Capital Structure Dynamics and Risks: Empirical Evidence

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To Those Who Love and Take Care of Me

Abstract

Despite ample research on corporate financing decisions, there is a growing interest in deepening our understanding of how firms structure their financing needs. In this dissertation, we build upon previous work on capital structure by examining the impact of firm-specific and macroeconomic risks on the capital structure of UK manufacturing firms. In particular, the dissertation consists of three separate, yet related essays. Each essay intends to serve a specific objective. The essays, in the order in which they appear, are entitled as follows:

Essay I: The Response of Firms' Leverage to Risks: Evidence from UK Public *versus* Non-Public Firms

Essay II: Capital Structure Adjustments: Do Macroeconomic and Business Risks Matter?

Essay III: Macroeconomic Dynamics, Idiosyncratic Risk, and Firms' Security Issuance Decisions: An Empirical Investigation of UK Manufacturing Firms

In the first essay, we empirically investigate whether the sensitivity of leverage to firm-specific (idiosyncratic) and macroeconomic risk differs across publicly listed and privately owned firms. We also study the implications of cash reserves-risk interactions for firms' leverage decisions. Using data from the Financial Analysis Made Easy (FAME) database, the analysis is carried out for a large panel of UK manufacturing firms over the period 1999-2008. The results provide significant evidence that UK manufacturing firms use less short-term debt in their capital structure during periods of high risk. This finding holds for both types of risk. The results on the differential effects of risk across public and non-public firms indicate that while the leverage of non-public firms is more sensitive to firm-specific risk in comparison to their public counterparts, the effects of macroeconomic risk on leverage are similar for both types of firms. The results of the indirect effects of risk show that firms with high levels of cash holdings are more (less) likely to reduce their leverage in periods when firm-specific (macroeconomic) is risk. On the whole, the results that we document in this essay provide strong evidence of the heterogenous sensitivities of leverage to risk across both types of firms and across different levels of firms' cash holdings.

Essay II examines how risk affects firms' leverage adjustment decisions. Specifically, in this essay, we study the impact of risk about firms' own business activity and macroeconomic conditions on the speed with which firms adjust their capital structure toward their specific leverage targets. In doing this, we use an annual panel data obtained from the WorldScope file via DataStream for a fairly large sample of quoted UK manufacturing, covering the period 1981-2009. The results suggest that the adjustment is asymmetric and it depends on the magnitude of risk, the type of risk, and whether firms' actual leverage is above or below the target. Further, we find that firms with financial surpluses and above-target leverage adjust their leverage faster when firm-specific risk is low and when macroeconomic risk is high. In contrast, firms with financial deficits and below-target leverage are more likely to align their leverage toward their target in periods when both types of risk are low. Taken as a whole, our results suggest that firms adjust their leverage toward the target very asymmetrically across different levels and types of risk. This finding holds true even when we take into account several firm characteristics known to affect firms' adjustment speeds.

The third essay analyzes how risk about firms' own business activity and macroeconomic conditions influences the security issuance decisions of listed UK manufacturing firms appeared on the WorldScope database during the period from 1981-2009. Estimating dynamic panel models using the system GMM estimator, we show that the issuance of new debt is significantly negatively related to idiosyncratic risk while both the issuance of new equity and the use of internally generated funds (retained earnings) are positively related to the risk. In contrast, we find that all these three sources of financing are significantly negatively associated with macroeconomic risk. Nevertheless, our results suggest that the aggregate dynamics of firms' target leverage are significantly negatively linked with these two types of risk. The results, from the debt-equity choice regression, indicate that the effect of both firm-specific and macroeconomic risk is significant and negative, implying that firms are likely to have low debt-equity ratio in periods when either type of risk is high.

JEL classification: C23; D81; E44; G32

Keywords: macroeconomic risk; idiosyncratic risk; firm-level uncertainty/volatility; firm leverage; cash holdings; capital structure rebalancing; the speed of adjustment; asymmetry in adjustment rates; deviations from target leverage ratios; financing deficits and surpluses, security issuance, retentions, public *versus* non-public firms; spillover effects; firm-level panel data; system GMM

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> *"Then do ye remember Me (by praying, glorifying); I will remember you. Be grateful to Me (for My countless Favors on you), and reject not Faith."*
>
> —*Surah al-Baqarah* (2: 152)

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Chapter 1

Introduction

1.1 Motivation

How do firms determine their capital structure? What factors affect capital structure choices? Do firms have specific target capital structures? How and when do firms adjust toward these targets? These are the fundamental questions in corporate finance that have extensively been explored in the literature. Traditional theories of firm capital structure suggest that firms determine their leverage by trading off the costs and benefits of debt versus equity financing. Empirical studies have successfully identified many firm-specific factors that are important to firms' financing decisions. In addition, despite little consensus on the speed of adjustments toward the target, several authors have recently provided convincing evidence on the leverage-targeting behavior of firms.

In explaining the capital structure of firms, most studies have mainly emphasized what and how firm-specific factors affect firms' financing decisions. While the firm-specific determinants of capital structure are immensely important for understanding corporate financing, it is also worth exploring how variations in macroeconomic conditions or firms' own business activity affect the capital structure decisions of firms. Our understanding of the role of firm-specific and macroeconomic risk in corporate financial policies is relatively imperfect. Although mostly neglected in the literature, the impact of risk on firms' financing strategies is an important aspect without which one cannot have a good understanding of firms' financing behavior. In this study, we conjecture that if various costs and benefits associated with firms' financing options (e.g., retentions, debt borrowing, and equity financing) are affected by risk, so does the optimal capital structure of firms.

1.2 What Does this Study Explore?

The main aim of the study is to empirically explore the effect of risk on the capital structure of UK manufacturing firms. Specifically, we analyze how risk about macroeconomic conditions and firms' own business activity affects firms' leverage targets, the rebalancing behavior of firms, the security issuance decisions of firms, and firms' choice between debt and equity financing. In doing this, we take several firm characteristics, such as cash holdings, cash flow imbalances, and the deviations of leverage from the target, into account in addition to the conventional determinants of corporate capital structure. Given that our empirical models have a dynamic panel data context, we use the robust two-step system dynamic panel data (DPD) estimator (system GMM approach). This estimator is also effective in mitigating potential endogeneity problems and controlling for heterogeneity across individual firms.

The second chapter of this dissertation aims at analyzing the effects of firm-specific and macroeconomic risk on the capital structure of UK public and non-public firms.[1] To carry out our investigation, we use a fairly large panel of UK manufacturing firms over the period 1999-2008. A unique aspect of our dataset is that we can differentiate the firms by their legal form. Non-public (aka private) firms significantly differ from public firms in terms of their access to external financing markets, size, and opaqueness. Further, non-public firms are more likely to suffer from the negative business shocks as compared to their public counterparts. Given a different financial and operating environment within which public and non-public firms operate, we expect the sensitivity of capital structure to risk to be different across public and non-public firms. To test this conjecture, we construct public and non-public firm dummies and interact our explanatory variables with these two dummies. This design allows us to properly test whether the sensitivity of leverage to risk varies across the two groups of firms.

Researchers have also documented evidence that risk not only affects firm behavior on its own but it also affects in conjunction with various other firm-specific factors. To take into account this possibility, we also examine the spillover effect of risk on public and non-public firms' leverage. Specifically, we augment our leverage specification by introducing the interactions between our risk measures and firms' cash holdings. This approach allows us to examine whether the effect of risk on leverage increases or decreases when firms build up their cash holdings.

The analysis of firm leverage adjustments has recently become the center of the empirical studies in the corporate finance literature. Several recent studies provide evidence that firms considerably adjust their capital structure toward their leverage targets, yet the speed with which firms move toward these targets is not a settled issue. The third chapter of this study therefore investigates the role of firm-specific and macroeconomic risk in capital structure adjustments. Specifically, we condition the adjustment speed of firms on the level and the type of risk. It should also be noted that some previous studies have explored the firm-specific source(s) of asymmetry in the speed of adjustment. However, we are the first to relate adjustments speeds with risk as well as firm characteristics. In particular, we estimate firms' adjustment speeds across different levels of risk after taking into account firms' financing needs and leverage deviations from the target. In other words, we squarely examine the implications of both risk-leverage deviations interactions

[1] Throughout this study, we use the terms risk and uncertainty, idiosyncratic risk and firm-specific risk, non-public firms and privately owned firms, publicly traded firms and public/listed firms, and cash flow imbalances and financing deficits/surpluses interchangeably.

and risk-financing needs interactions for firms' capital structure adjustments. We expect, as various costs and benefits of adjusting toward a leverage target vary with changes in the degree of risk that a firm experiences, so does the speed of adjustment. We examine this issue, using an extensive firm-level dataset for a fairly large panel of publicly quoted UK manufacturing firms over the period from 1981-2009.

While most of the empirical evidence on corporate financing comes either from studies that explore the determinants of firms' leverage decisions or from studies that analyze the choice of firms between debt and equity financing, there is a growing interest among researchers in exploring when and how firms issue securities. Recent work, such as Baker and Wurgler (2002), Welch (2004), Hovakimian (2006), Alti (2006), Huang and Ritter (2009), Hovakimian and Hutton (2010), and Almeida and Campello (2010), on the security issuance decisions of firms provide ample evidence, suggesting firm managers considerably take into account the relative cost of issuing different securities and market conditions when they issue securities. Only a few studies have investigated the interactions between security issuance and macroeconomic conditions, yet not focusing on the risk associated with the overall macroeconomic environment. These studies are Korajczyk and Levy (2003), Covas and Den Haan (2007), and Huang and Ritter (2009).

Although we have little empirical evidence, recent theoretical studies relate firms' financing choices to business-cycle risk more systematically. These studies argue that as higher macroeconomic risk increases discount rates (risk premia), deteriorates prospective future cash flows, and reduces the market value of equity, so it will affect the firms' preference for financing their capital needs. The empirical validity of these arguments would definitely enhance our understanding of firms' issuance decisions. The forth chapter of this study therefor studies the effects of firm-specific and macroeconomic risk on security issuance. We do so by examining how risk influences firms' ability to use internally generated funds (retentions), debt borrowing, and equity financing. Specifically, we decompose the aggregate change in leverage into three components, namely the net change in debt financing, the net change in equity financing, and the change in retained earnings. We then analyze how each of these components responds to firm-specific and macroeconomic risk.

By examining the effects of risk on the components of the change in leverage, we are also able to identify the channel(s) through which the effect of risk comes to leverage. In this chapter, we also study how risk affects the choice of firms between issuing debt and issuing equity. Examining the effect of risk on firms' debt-equity choice, we are likely to infer more explicitly whether firms prefer debt or equity financing in periods when firm-specific and macroeconomic risks are high. We use an unbalanced panel dataset for listed UK manufacturing firms, covering the period from 1981-2009.

1.3 Contribution

This dissertation contributes to the literature on capital structure on several grounds. We empirically examine the role of firm-specific and macroeconomic risk in determining the target (optimal) level of firms' leverage, the speed of adjustment toward the target, the issuing of financial securities, and firms' preference for debt versus equity financing. This potentially important dimension of corporate capital structure has not been highly explored previously in the literature. The dissertation's primary contributions are as follows.

First, we examine how risk affects firms' choice for optimal leverage ratios. Prior work on the risk-leverage relationship have mainly focused on publicly traded firms in the United States. Instead, we study the impact of risk on the financing behavior of both public and non-public firms in the United Kingdom as our data allow us to stratify the firms according to their legal form. By doing so, we provide an interesting comparison of the sensitivity of leverage to risk across public and non-public firms. This comparison not only provides new insights into the role of risk in determining the optimal capital structure of firms but it also improves our understanding of how publicly listed and privately owned firms design their financing policies differently when facing risks in their operations. Privately owned firms are generally small and medium in size and do not have excess to stock markets and thus mainly rely on bank-loans, whereas, public firms have excess to equity markets and can issue public equity to finance their financing needs. In this context, the analysis of the effects of risk on the leverage policies of publicly listed and privately owned firms would definitely enhance our knowledge about the importance of risks in the corporate financing decisions of firms with different characteristics.

Private owned firms are generally more opaque to outside investors, face higher asymmetric information problems, and have a limited access to external financing markets. Given this, private (non-public) firms, compared to their public counterparts, face more problems in acquiring the finance they need from external capital markets. That is, non-public firms are more likely to be financially constrained. In this context, our analysis also enables us to infer whether risk affects the leverage decisions of financially constrained and unconstrained firms differently. Thus, we not only contribute to the literature related to the determinants of leverage but also to the literature that relates firms' financing decisions to financial constraints. The impacts of risk on the financing decisions of financially constrained and unconstrained firms may provide new insights into the issue of how access to capital market plays a role in corporate financing decisions.

We also contribute to the literature of the indirect effect of risk on firm behavior by exploring the implications of the interactions of risk and the cash holdings of firms for firms' leverage decisions. Our results on the impact of risk on leverage through its effect on the cash-holding decisions of firms are new and so far have not been presented in the previous literature. The risk-cash-holding-leverage interactions are important as a firm' financing policy substantially depends on its investment opportunities and available reserves of cash. The investigation of the indirect effects of risk on the capital structure of public and private firms may improve our understanding of the role of the cash holdings of firms in their leverage policies. This investigation may also help us understand the nonlinearity in the risk-leverage linkage and thus, extend our understanding of the importance of risks in corporate financing policies.

Our third contribution to literature is that we study the effects of firm-specific and macroeconomic risk on the adjustment behavior of firms and therefore we relate the asymmetry of adjustment speed to risk that a firm experiences. Most studies on the asymmetry in capital structure adjustment across firms have mainly focused on firm characteristics. Going outside the box, we estimate the speed of adjustment conditional on the level and type of risk after controlling for the firm-specific factors that are known to affect firms' adjustment speeds. By systematically relating the speed with which firms adjust toward their leverage targets to the types and levels of risk, we provide a new avenue for research on capital structure adjustments. The investigation of the effects of risk on the rebalancing behaviour of firms provide further insight to understand the role of firm-specific and macroeconomic risk in the capital structure decisions of firms. Our results on the asymmetric adjustment speeds conditional on the level and type of risk provide some important understanding about how, when, and at what speed firms adjust their capital structure toward their leverage targets. The heterogeneity in the capital structure adjustments of firms across different levels and across different types of risk would definitely extend our knowledge about how firms' managers economize on the costs of issuing securities and deviating from or moving toward their target capital structure as well as optimize on the benefits of maintaining their leverage targets.

Our findings that firms adjust their leverage asymmetrically depending on the level and the type of risk are of interest because they suggest that the differences in the adjustment speeds are not fully explained by the imbalances of firms' cash nor by the deviations of firms' actual leverage from the target leverage as reported by previous studies but also they relate to the levels of firm-specific and macroeconomic risk. In that sense, our findings are useful to interpret earlier research which discusses why firms are not always responsive to changes in the market value of their equity (Welch (2004)) or gains and losses in their earnings (Hovakimian, Hovakimian, and Tehranian (2004)), and why they significantly time the debt and equity market conditions while financing external capital (Baker and Wurgler (2002) and Antoniou, Zhao, and Zhou (2009)).

The final contribution of the dissertation is that we examine the impact of both types of risk on net debt borrowing, the newly retained earnings, and net equity issues and contribute to the literature on the effects of macroeconomic conditions on corporate security issuance decisions. We also build upon previous work on the leverage-risk relationship by examining how the dynamics of firms' leverage ratios relate to unpredictable variations in firms' own business activities as well as the volatility of the overall macroeconomic environment. One should note that prior studies estimating the effect of risk on firms' capital structure have largely focused on relating the target leverage of firms to risk. And, therefore, the impacts of risks on leverage dynamics and the security issuance decisions of firms have not been squarely studied previously. Rather, here, our focus is to examine more explicitly how risk affects changes in leverage and the components of a change in leverage (i.e., net debt issues, net equity financing, and the newly retained earnings).

By examining the impacts of risk on different components of the change in leverage, we not only document the role of risk in the external financing decisions of firms (debt borrowing and equity financing) but we also provide evidence on how risk about firms' own business activity and macroeconomic conditions affects firms' use of internally generated funds (the newly retained earnings). The analysis of the impact of risk on these financing instruments also helps identify a channel through which risk affects the change in leverage. We also extend the literature by studying the impact of risk on a firm's choice of debt versus equity issuance. This provides us the opportunity to analyze more explicitly whether equity financing is preferred to debt borrowing or vice-versa when a firm experiences a high volatility in its own earnings and when macroeconomic conditions become more volatile.

1.4 Background

In spite of numerous papers, there is a continuing debate on corporate financing. Since Weston (1955), several ideas published in the field journals and theories have been proposed to understand firms' financing policy. These include the Modigliani-Miller theorem (Modigliani and Miller (1958)), the trade-off theory (Modigliani and Miller (1963)),[2] the agency theory of capital structure (Jensen and Meckling (1976)), the capital signalling theory (Ross (1977)), the target-adjustment behavior (Myers (1984)), the pecking order theory (Myers (1984) and Myers and Majluf (1984)), the free cash flow theory (Jensen (1986)), organizational behaviour (Myers (1993)), the market timing theory of capital structure (Baker and Wurgler (2002)), managerial overoptimism (Heaton (2002)), and the inertia theory (Welch (2004)).

[2] See Kraus and Litzenberger (1973) and Bradley, Jarrell, and Kim (1984) for the static trade-off theory, and Kane, Marcus, and McDonald (1984) and Fischer, Heinkel, and Zechner (1989) for the dynamic trade-off theory.

Despite these theoretical advances, several fundamental questions either remain unanswered or are not well answered on empirical grounds. Some examples of these questions follow. How do firms choose the optimal level of capital structure? Do firms have a target capital structure? Do firms adjust toward their targets when they deviate from those targets? If yes, at which speed? How does risk affect leverage adjustment decisions? Do firms time their security issues? What are the determinants of firms' choice between debt and equity financing? How does risk about macroeconomic conditions influence the financing decisions of firms? Does the financing policy of non-public firms differ from that of public firms? Do public and non-public firms respond to risks differently?

According to the trade-off theory of capital structure, the optimal level of firms' leverage reflects trade-offs between the tax benefits of debt financing and the costs of financial distress. Further, as in Myers (1984), firms that follow the trade-off theory have leverage targets. Thus, firms adjust their leverage toward these targets gradually when they deviate from those targets (à la trade-off theory). In contrast, the pecking order theory suggests that the adverse selection costs induce a strict financing hierarchy. Firms prefer internal financing over external financing to finance their financing needs. Debt borrowing is preferred to equity financing when firms need external financing. Only as a last resort, firms issue equity. In this context, one can say that the change in firms' debt ratio mainly depends on firms' need for external financing rather than firms intentionally change their debt ratio to reach any predetermined optimum leverage ratio. Likewise, the market timing and the inertia theory of capital structure indicate that firms do not quickly align their capital structure with changes in market equity values, suggesting firms do not appear to adjust capital structure quickly.

Reviewing empirical literature, we find that recent papers by Hovakimian, Opler, and Titman (2001), Ozkan (2001), Fama and French (2002), Hovakimian, Hovakimian, and Tehranian (2004), Leary and Roberts (2005), Flannery and Rangan (2006), Frank and Goyal (2009), Harford, Klasa, and Walcott (2009), Huang and Ritter (2009), and Goyal, Nova, and Zanetti (2011) provide convincing evidence of firms having their leverage targets. These studies indicate that the target (optimal) level of firms' leverage is mainly a function of firms' market-to-book value, the profitability of firms, firm size, the tangibility of assets, stock prices, and non-debt tax shields.

However, in the empirical literature, there is a lack of consensus on the speed of adjustment with which firms adjust their leverage toward these targets. On one hand, studies estimating adjustment speeds provide evidence of either a slow or negative speed of adjustment (see, for example, Fama and French (2002), Kayhan and Titman (2007), Brav (2009), and Iliev and Welch (2010)). Welch (2004) finds that about 60% of year-to-year fluctuations of firms' leverage are just the result of firms' issuance activity rather than of firms changing their leverage in order to achieve any specific leverage target. Baker and Wurgler (2002) show that the effects of historical market valuations on leverage are relatively long-lasting, suggesting firms do not adjust their capital structure actively. One the other hand, several studies, such as Ozkan (2001), Flannery and Rangan (2006), Lemmon, Roberts, and Zender (2008), Antoniou, Guney, and Paudyal (2008), Chang and Dasgupta (2009), Cook and Tang (2010), Elsas and Florysiak (2011), and Faulkender, Flannery, Hankins, and Smith (2011), have documented evidence of a relatively rapid adjustment toward the target.

Recent research suggests that the evidence of the passive attitude of firms toward leverage targets is generally imputed to mismeasurement of the speed of adjustment. Some researchers argue that the standard partial-adjustment models of leverage do not have enough power to separate the benefits of achieving targets from other motivations of financing (see, for example, Shyam-Sunder and Myers (1999) and Chang and Dasgupta (2009)). Others indicate that estimated leverage adjustment speeds in most previous studies are biased (see, for example, Flannery and Rangan (2006), Lemmon, Roberts, and Zender (2008), and Huang and Ritter (2009)).

In explaining the speed of adjustment toward the target, most of the previous studies assume the uniformity of adjustment speed across firms and estimate a standard partial adjustment model of leverage. However, as the costs and benefits of capital structure adjustments vary across firms, so does the speed at which firms do move toward the target. Asymmetry in estimated leverage adjustment speeds move researchers' attention toward a research for the determinant(s) of heterogeneity in adjustment speeds. In fact, diverging from the assumption of the homogenous speed of adjustment for all sample firms, several recent studies estimate a modified form of partial-adjustment model to take into account heterogeneity in adjustment speeds across firms. As a results, we find a handful of papers estimating the speed of adjustment of firms with a specific focus when and why firms adjust toward a leverage target with asymmetrical speeds. These papers include Flannery and Hankins (2007), Byoun (2008), Cook and Tang (2010), Elsas and Florysiak (2011), Faulkender, Flannery, Hankins, and Smith (2011), and Warr, Elliott, Koëter-Kant, and Öztekin (2011). Almost all of these papers successfully relate the asymmetry of adjustment speed to firm characteristics such as cash flow imbalances, equity market valuations, deviations from target leverage, and firm size.[3]

Another stream of capital structure literature focuses on firms' security issuance decisions and firms' choice of debt versus equity financing. A substantial part of this literature

[3]Cook and Tang (2010) is an exception, who examine the effect of macroeconomic conditions on US firms' rebalancing behavior. Similarly, another study by Haas and Peeters (2006) also relate the speed of adjustment to GDP growth and inflation for Central and Eastern European firms.

has been devoted to explore what and how firm characteristics affect firms' preference for financing instruments.[4] However, other studies, such as Baker and Wurgler (2002), Welch (2004), Hovakimian (2006), Alti (2006), and Hovakimian and Hutton (2010) have linked the security issuance decisions of firms to equity market valuations and stock prices. Baker and Wurgler (2002) document that firms with high equity market values relative to their book and past equity market values issue equity–rather than debt–to finance their external financing needs. They also show that firms have a greater tendency to purchase their equity in periods when their market value is low. Welch (2004) provides evidence of a significant and long-lasting effect of stock price on the issuance and repurchase decisions of firms. However, Hovakimian (2006) finds that while firms time their equity issues, the impacts of issuing equity on firms' leverage ratio are not large economically.

Alti (2006) and Chen and Zhao (2007) decompose the annual change in leverage ratio into new debt borrowing, new equity financing, and the newly retained earnings and examine how these components respond to firm-specific factors known to affect corporate financing. In a recent paper, Hovakimian and Hutton (2010) provide evidence of a positive relationship between first-year post-issue returns and follow-on debt and equity issuance. Further, they show that this relationship remains significant at least for the next 5 years.

To our knowledge, only a few studies in the literature have examined the impact of macroeconomic conditions on corporate security issuance decisions.[5] Korajczyk and Levy (2003) find that while macroeconomic conditions significantly affect the issuance decisions of financially unconstrained firms, the issue choice of financially constrained firms are not significantly related to macroeconomic conditions. Covas and Den Haan (2007) examine the behavior of firms' retained earnings, debt borrowing, and net-equity issuance over the business cycle and show that firms' leverage decisions are pro-cyclical.[6] Huang and Ritter (2009) show that the the likelihood of corporate security issuance is significantly positively related to the real GDP growth rate. They also document that in periods when the growth rate is high relatively, firms are more likely to issue debt vis-à-vis equity.

In spite of prior empirical studies have provided relatively rich evidence on how firm-specific factors affect firms' financing policy, these studies leave a great gap in our knowledge about the effect of firm-specific and macroeconomic risk on firms' financing decisions.

[4]Studies of this genre include, among many others, Marsh (1982), Hovakimian, Opler, and Titman (2001), Fama and French (2002), Frank and Goyal (2003), Hovakimian (2004), Hovakimian, Hovakimian, and Tehranian (2004), Fama and French (2005), Frank and Goyal (2008), Almeida and Campello (2010), and Bessler, Drobetz, and Grüninger (2011).

[5]It should be noted that the focus of these studies was to analyze the security issuance patterns of firms over the business cycle. Instead, the aim of our study is to examine how risk associated with macroeconomic conditions and firms' own business activity influences corporate financing.

[6]Korteweg (2010) also documents the empirical evidence on the pro-cyclicality of leverage. Likewise, recently Akhtar (2011) examines the relationship between firms' leverage and different phases of the business cycle and finds that all four business cycle phases are crucial in explaining the dynamics of capital structure of firms.

Notably, our understanding of the effects of risk on firms' leverage targets, the rebalancing behavior of firms, the security issuance decisions of firms, and firms' choice between debt borrowing and equity financing is relatively incomplete. In this study, we bridge this gap by exploring how firm-specific and macroeconomic risk affects corporate financing policies.

1.5 Importance of Risk

1.5.1 *Firm-Specific Risk*

> *"If projections indicate relatively stable earnings, debt financing is usually advantageous; if future earnings are unstable, the risk of debt may shift the decisions to equity financing."*
>
> —*Weston (1955)* (p. 135)

Fisher (1959) argues that the risk premium which firms pay is significantly associated with their earnings volatility. Likewise, Baxter (1967) documents that the variance of firms' earnings have a negative impact on firms' desirability to rely on debt financing. Brealey and Myers (1981) also argue that firms find financial distress to be costly regardless of the presence or absence of bankruptcy. Firms therefore generally have a tendency to repress their financial distress costs, implying that firms with relatively volatile potential future cash flow streams use less debt in their capital structure than the others. Consistent with these arguments, Taub (1975), Ferri and Jones (1979), and Marsh (1982) present empirical evidence of a negative and statistically significant relationship between the uncertainty of firms' earnings and firms' ability to "tolerate" leverage.

From a theoretical prospective, Castanias (1983) shows that with a given marginal tax rate and marginal default cost function, higher business risk compels firms to reduce their use of debt. In the manner of the static trade-off theory of corporate financing, Bradley, Jarrell, and Kim (1984) show that idiosyncratic risk specifically when it is relatively high negatively affects a firm's debt ratio. In contrast, Myers (1977) suggests that the relationship between idiosyncratic risk and the optimal level of firms' debt is positive. In this regard, Myers argues that a large amount of risk associated with firms' own business activity may tend to reduce the debt-related agency costs. These lower agency costs induce firms to use more debt in their capital structure.

In practice, banks and other lending institutions may avoid offer funding to risky firms or, at least, they require a higher risk premium (interest rate), making debt financing relatively costly. Because of this, firms with relatively unstable earnings reduce their use of debt, while they prefer to utilize internally generated funds (retained earnings). And if external financing is required, more volatile firms are more likely to issue equity. These firms do so for two reasons. First, they find that equity financing is cheaper than debt borrowing. Second, the issuance of equity minimizes their likelihood to go bankrupt, resulting in a reduction in their leverage (debt/assets) ratio.

In addition to the significance of firm-specific risk in determining firms' optimal (target) leverage ratio, the firm-level risk has also an important role to play in firms' capital structure adjustment decisions. Firms when making adjustments toward their leverage targets take into account variance in their potential future earnings along with other firm-specific factors known to affect the cost and benefit of adjusting. For instance, over-levered firms may adjust toward the target relatively quickly in periods when their earnings are relatively more volatile. These firms do so because large variations in earnings reduce their ability to rely heavily on debt financing by increasing debt-related costs (e.g., the probability of bankruptcy). However, when firms are under-levered and experience risk in their income streams, they are likely to adjust their leverage slowly because the variance of earnings makes adjusting procedure (i.e., debt issues or equity repurchases) relatively expensive for these firms.

1.5.2 *Macroeconomic Risk*

> *"If firms did not have to forgo the tax subsidy for debt, they would opt for a financial structure with greater insulation against aggregate risks."*
>
> –*Gertler and Hubbard (1993)* (p. 288)

Unlike the case of firm-specific risk, early studies of capital structure do not put much stress on how corporate financing policies respond to risk associated with the overall macroeconomic environment. Recent theoretical studies, such as Bhamra, Kuehn, and Strebulaev (2010) and Chen (2010), however, document that variations in macroeconomic conditions are significant for firms' financing choices. Specifically, these studies predict that firms are likely to choose lower optimal coupons in times of high macroeconomic risk in order to increase their financial flexibility. In particular, Chen (2010) predicts that higher macroeconomic risks increase discount rates (risk premia) and deteriorate future cash flows, which lessens the discounted value of expected tax benefits, which lowers the advantages related to the outstanding stock of debt. Hence, firms are likely to reduce their leverage ratios by reducing their outstanding amounts of debt in bad times.

Bhamra, Kuehn, and Strebulaev (2010) develop a dynamic capital structure model to examine how corporate financing policy responds to macroeconomic fluctuations. They show that unpredictable variations in macroeconomic conditions have a significant impact on firms' financing policies. Levy and Hennessy (2007) examine firms' financing choices in a general equilibrium framework and show that firms are more likely to reduce their outstanding debt in periods of poor macroeconomic conditions. Hackbarth, Miao, and

Morellec (2006) relating the cash flows of firms to both idiosyncratic risk and macroeconomic conditions predict that firms' borrowing capacity exhibits pro-cyclicity and that both the pace and the size of capital structure changes depend on macroeconomic conditions.

According to the market timing hypothesis, firms significantly time their security issues (Hovakimian, Opler, and Titman (2001) and Baker and Wurgler (2002)). That is, firms issue equity when their market values are high and they repurchase equity when their market values are low. Since risks about macroeconomic conditions affect the market value of equity, firms are less likely to issue equity when macroeconomic risk is high. Macroeconomic risks also affect the ability of firms to use internally generated funds. When macroeconomic conditions are uncertain, firms might become more cautious about financial distress costs. Thus, they prefer to keep cash on hand rather than investing it as they regard cash holdings as a buffer against any future insolvency.[7] Macroeconomic risk is also important for an adjustment toward a target capital structure. It is very likely that macroeconomic risk can affect the costs and benefits of adjusting toward the target, by affecting the risk premia that firms pay, deteriorating expected potential cash flow streams, and destroying the market value of equity. And thus, it affects the rate at which firms adjust their capital structure.

1.6 Datasets, Measuring Risk, and Estimation Methods

1.6.1 Data and Methodology

We analyze the role of risk in corporate financing decisions using two different datasets. To examine the impact of firm-specific and macroeconomic risk on the capital structure of publicly listed and privately owned firms, we use a fairly large panel of manufacturing firms in the United Kingdom. In particular, we construct an annual panel dataset covering the period from 1999 to 2008 using the Financial Analysis Made Easy (FAME) dataset. The data on macroeconomic variables which we use to generate risk measures are extracted from the International Financial Statistics (IFS), an International Monetary Fund (IMF) database.

The FAME database is made available for commercial use by Jordans Bureau van Dijk (BvD) Electronic Publishing. FAME contains data for both non-public (privately owned) and public limited companies and over 99% of the companies in the database are small and not traded on the stock exchange. Hence, our dataset gives us a unique opportunity to investigate the behavior of non-public *versus* public limited companies.

[7] A number of papers, such as Opler, Pinkowitz, Stulz, and Williamson (1999), Almeida, Campello, and Weisbach (2004), Han and Qiu (2007), Acharya, Almeida, and Campello (2007), Riddick and Whited (2009), and Bates, Kahle, and Stulz (2009), relate the cash holding behavior of firms to their precautionary motives.

The FAME database provides information on both active and inactive public/non-public limited liability companies in the UK up to a maximum of a 10-year period. The data coverage may vary in terms of the number of observations for a given company as there may be entry or exit from the dataset. The main advantage of the FAME database is that it includes both balance-sheet and off-balance sheet information, such as income statements, cash flows statements, profit and loss accounts, and ownership information.[8]

To study the effect of firm-specific and macroeconomic risk on the speed of adjustments toward target capital structure and firms' security issuance decisions, we use data on a large sample of publicly listed UK firms over a relatively longer time period, spanning a 29-year period. We focus only on manufacturing firms quoted on the London Stock Exchange at any point over the period 1981-2009. The data are drawn from the WorldScope database via DataStream. To compute macroeconomic risk, seasonally adjusted quarterly data spanning 1975Q1-2009Q4 on UK real GDP are taken from the Office for National Statistics (ONS) database.

The main estimator that we use in this study is a robust two-step system dynamic panel data (DPD) estimator–also known as "system GMM" estimator–proposed by Blundell and Bond (1998). In contrast to the conventional ordinary least square (OLS), Within-Groups and first-difference GMM estimators, the system GMM estimator not only mitigates potential endogeneity problems, controls for heterogeneity across individual firms, and removes unobserved firm-specific fixed effects, but it also allows researchers to make use of different instruments with different lag structure for both the levels and the first-differenced equations (Blundell and Bond (1998, 2000) and Bond (2002)). Further, the Blundell and Bond (1998) system GMM estimator utilizes all available moment conditions by combing moment conditions for the model in first differences and moment conditions for the model in levels. Finally, this estimator improves the estimation over others GMM estimators, such as first differenced estimator, particularly in the case when the underlying series are moderately persistent (Blundell and Bond (2000) and Bond, Nauges, and Windmeijer (2005)).

Since there is no well-established process that assists a prior to choose the optimal instrument set for the system GMM estimation, the blind use of instruments may lead to the problem of "many instruments". As in Roodman (2009a,b), this problem would be even more severe if the sample size has a relatively short-horizon. Therefore, the Hansen (1982) test for overidentifying restrictions and the Arellano and Bond (1991) test for autocorrelation are applied to ensure the validity of the instruments that we use in our estimations.

[8] Further details on the FAME database are given in Section 3 , Chapter 2.

1.6.2 Measuring Risk

To study the effect of risk on the capital structure of firms, we consider two types of risk: firm-specific (idiosyncratic) risk and macroeconomic risk. Researchers generally use the moving standard deviation, state space models, ARCH/GARCH models, stochastic volatility models, the intra-annual variation approach, and survey-based methods to generate proxy for risk.

Although these methods are appropriate when the focus is on large publicly traded firms, they may introduce a bias into the constructed measure of risk for relatively small firms. Since our focus, in Chapter 2, is on the response of public *versus* non-public firms to risk, and since non-public firms are generally small in size, we pay careful attention to selection of methods for generating risk proxies. Specifically, the methods we use for generating proxies for firm-level risk are time-variant and suitable even for small firms. Our first method is similar to that of Morgan, Rime, and Strahan (2004). Specifically, we regress the firms' net sales-to-total assets ratio on firm and year fixed-effects. We then use the absolute value of the residuals obtained from this regression as a proxy for firm-specific risk.

To construct a second measure of risk, we follow Bo (2002) and estimate an AR(1) model for net sales normalized by total assets. Using the one-period-ahead residuals, we compute the cumulative-variance for each underlying firm in the sample over the examined period. The square root of estimated cumulative variance is then used as a proxy for firm-specific risk. Both of these methods enable us to generate risk using the unpredictable components of the movement of the underlying variable rather than the variability of the variable per se. Further, unlike the conventional measures of firm-specific uncertainty, these methods yield a time-varying measure of firm-specific risk and are suitable even for relatively small firms.

To generate a time-varying proxy for macroeconomic risk, we estimate an ARCH for quarterly real UK GDP and GARCH models for both Treasury bills (T-bills) rates and Consumer Prices Index (CPI) over the period under investigation. The obtained conditional variance series are then annualized by averaging over four quarters for GDP series and over twelve months in the case of T-bills rate and CPI series to match the frequency of the firm-level panel data.

1.7 Structure of the Thesis

The thesis is organized into five chapters. Chapter 2 examines the impact of risk on the capital structure of publicly listed and privately owned UK manufacturing firms. Specifically, this chapter begins the investigation by analyzing the role of firm-specific and macroeconomic risk in firms' leverage decisions for a sample of public and non-public firms. This chapter also studies whether the effects of risk on leverage differ across public and non-public firms. Finally, the chapter explores the implications of firms' cash holdings in the leverage-risk relationship.

Chapter 3 examines how risk about firms' own activity and macroeconomic conditions affects the speed of adjustment of firms toward the target capital structure. In particular, the chapter starts with a brief review of recent work on the capital structure adjustments and describes our hypotheses regarding the interactions between risk and firms' leverage adjustment decisions. The chapter next presents the estimates of the speed of adjustment toward the target from estimating the partial-adjustment model of capital structure. Finally, this chapter discusses the effect of risk on firms' rebalancing behavior when we allow asymmetries in adjustments speeds across firms.

Chapter 4 explores the role of both types of risk in corporate security issuance decisions. First, this chapter examines how the dynamics of leverage respond to risk. Second, the chapter looks for the associations between risk and the components of the change in leverage, namely, the net change in debt issues, the net change in equity issues, and the newly retained earnings. Finally, we conclude the chapter by examining the effects of firm-specific and macroeconomic risk on firms' choice between debt and equity financing.

Chapter 5 concludes the dissertation. Specifically, this chapter begins by presenting thesis background. Next, the chapter presents a summary of the empirical findings of the dissertation and discusses the policy implications of the findings. In this chapter, we also discuss the limitations of our study. Finally, we end with an eye toward highlighting fruitful areas for future research on risk-capital structure interlinkages.

Chapter 2

The Response of Firms' Leverage to Risks: Evidence from UK Public *versus* Non-Public Firms

2.1 Key Findings

This chapter empirically investigates the effects of macroeconomic and firm-specific risk on firms' leverage. The analysis is carried out for a large panel of public and non-public UK manufacturing firms over the period 1999-2008. Our investigation provides evidence that UK firms use less short-term debt in their capital structure during periods of high firm-specific and macroeconomic risk. However, the leverage of non-public firms is more sensitive to firm-specific risk in comparison to their public counterparts while macroeconomic risk affects the leverage decisions of both types of firms similarly.[9]

2.2 Introduction

Since the seminal work of Modigliani and Miller (1958), researchers proposed several theories to understand the factors that affect firms' financing decisions. While these theories help us to understand the role of firm-specific factors such as profitability, the effective tax rate, firm growth, tangible assets, firm size, stock returns, and non-debt tax shields in the determination of firms' leverage, there is comparatively less research that examines the role of firm-specific and macroeconomic risk on leverage.[10] For instance, studies that investigate the role of macroeconomic conditions on firms' borrowing behavior show that managers, in consideration of the financial strength of the firm, design the capital structure of the firm in alignment with the state of the economy to minimize the adverse effects of business cycles but they do not necessarily examine the effects of macroeconomic risk on firms' capital structure.[11] To our knowledge, only Baum, Stephan, and Talavera (2009) and Hatzinikolaou, Katsimbris, and Noulas (2002) empirically examine the impact

[9]A paper based on the findings presented in this chapter has been published as a working paper in Sheffield Economics Research Papers Series, the Department of Economics, University of Sheffield, and submitted for publication under the title: Caglayan, M. and Rashid, A. (2011), The Response of Firms' Leverage to Risks: Evidence from UK Public *versus* Non-Public Firms.

[10]See, for instance, among others, Hovakimian, Opler, and Titman (2001), Fama and French (2002), and Hennessy and Whited (2005) on the empirical validity of these factors. Also see Kolasinski (2009) and Graham and Leary (2011) for an excellent survey of the empirical literature on capital structure. Several early studies, such as Marsh (1982), Bennett and Donnelly (1993), Lasfer (1995), Walsh and Ryan (1997), and Ozkan (2001) have also examined the empirical determinants of capital structure using firm-level data from the UK. Ozkan (2001) provides an excellent review of evidence in studies of UK firms.

[11]See, for instance, among others, Levy and Hennessy (2007), Hackbarth, Miao, and Morellec (2006), Korajczyk and Levy (2003), Suarez and Sussman (1999), and Gertler and Hubbard (1993).

of macroeconomic risk on public firms' leverage and show that an increase in macroeconomic risk would lead to a decrease in borrowing.[12] In contrast, studies that focus on the impact of firm-specific (idiosyncratic) risk on firms' capital structure arrive at conflicting results: while some studies provide evidence that idiosyncratic risk exerts a negative impact on leverage, others suggest that the effect is positive.

One major gap in the literature is the lack of information about the behavior of privately owned (non-public) firms under risk as researchers mainly focus on publicly traded companies. However, there are important differences between public and non-public firms regarding ownership structure, the level of information asymmetry between insiders and outsiders, bargaining power, secondary market trading, governance, management, compensation structure, future performance, and ability to absorb negative business shocks. As a result, both groups of firms are likely to face different market frictions when visiting external capital markets.

The most important difference between privately owned and publicly traded firms is the differences in their ownership structure. Publicly traded firms are owned by a large number of atomistic equityholders and they do not have any virtual control over the firm. Rather, professional managers and boards of directors run public firms. They clearly state corporate objectives and design strategies to achieve these objectives with an aim to maximize equityholders' wealth. By contrast, privately owned firms are generally held by a small number of shareholders. Each of these shareholders has significant control over the firm. As compared to public firms, private firms may have a narrow objectives to economize various costs and benefits associated with different financing choices or maintain relationships with key suppliers and customers.

A higher concentration of ownership in privately owned firms leads to agency-related issues. Specifically, the fear of losing control of the business makes private firms' equityholders reluctant to issue new external equity (see, for example, Stulz (1988) and Amihud, Lev, and Travlos (1990)). Since the issuance of equity reduces the control of existing shareholders, the costs of equity issuance is higher for privately owned firms than their publicly traded counterparts. On the other hand, since there is separation between public firm ownership and management, public firms' managers may observe rational to lessen the control of any single equityholders. As as result, they may find the issuance of equity attractive and less costly as compared to private firms (Morellec (2004)).

Another reason of the higher relative equity issuing costs of private firms is the differences in the quality of their disclosures and protections to minority shareholders as compared with publicly traded firms. As a result, minority investors are likely to be reluctant to purchase private equity, thereby making private equity relatively costly (Brav

[12]However, one should note that both studies focus solely on publicly traded US firms.

(2009)).

Another notable distinction between privately owned and publicly traded firms is the differences in the level of opacity at the time when raising external capital. In general, private firms are relatively more opaque to outside lenders/investors as compared with public firms. Therefore, the level of extent of information asymmetry between private firm management and outsiders is higher in private firms than public firms. We expect, due to the presence of the greater information asymmetry at privately owned firms, private firms are more likely to suffer from adverse selection problems than their publicly listed counterparts. Hence, the relative costs of issuing equity to debt financing are expected to be larger for privately owed firms than for publicly traded firms. This is because the value of equity as compared to debt is likely to be relatively more sensitive to private information as equity is generally considered junior to debt (Myers and Majluf (1984) and Noe (1988)).[13]

Another important difference between privately owned and publicly traded firms is the differences in their ability to raise capital from the general public. Public firms have an unrestricted access to stock markets and thus, they can raise capital by issuing public equity or debentures, whereas, privately owned firms do not have access to stock markets and thus, they can not issue shares to the general public and mainly rely on bank-loans.[14] Frank and Goyal (2008) show empirically that non-public firms exhibit a greater reliance on retained earnings and bank borrowing than do public firms. However, private firms are generally small and medium-sized firms (Brav (2009) and Goyal, Nova, and Zanetti (2011)), and thus, they have even limited access to debt markets due to lack of the collateral necessary back up their loans (Whited (1992)). Further, private firms have less bargaining power as compared with their lenders. Private firms also significantly differ from their publicly traded counterparts in terms of their future investment opportunities. As a result, the relative borrowing costs of private firms is higher as lenders may anticipate these difference and demand higher spreads (Saunders and Steffen (2011)).

It is also well accepted in the literature that private firms have less potential to absorb the negative shocks (Gertler and Gilchrist (1994)). Given all these characteristics, privately owned firms have to overcome more hurdles to access outside sources of finance.[15] As a consequence, privately owned firms are expected to have more constrained access to external funds including bank borrowing. We expect private firms face these constraints

[13]See Klein, O'Brien, and Peters (2002), who provide an excellent review of previous empirical studies that have focused on the relationship between information asymmetry and debt-equity choice.

[14]Section 81 of Companies Act, 1985.

[15]Goyal, Nova, and Zanetti (2011) further point out that privately owned firms are significantly younger, exhibit lower sales growth, and have higher leverage ratios than their publicly listed counterparts. Likewise, Brav (2009) documents evidence that privately owned firms build up their cash hoards in good times and appear to dilute their cash reserves in times when they face risks. See, Ball and Shivakumar (2005), Brav (2009), and Goyal, Nova, and Zanetti (2011) for more on how private firms differ from public firms.

with a relatively greater extent during periods of high risk when they experience shortfalls in their potential cash between existing shareholders and new shareholders flows.

In this chapter, we hypothesize that given a different structure of the environment within which public and non-public firms operate and different characteristics of both types of firms, the sensitivity of a non-public firm's leverage decisions to risks associated with the firm's own business activities or macroeconomic conditions should differ from the sensitivity of a public firm's leverage decisions to risks. To achieve our goal we use a large panel of UK manufacturing as our dataset allows us to differentiate the firms by their legal form. The data on public and non-public UK manufacturing firms are extracted from the FAME database and cover the period 1999-2008. An initial inspection of the data shows that non-public firms are relatively small in size, appears to rely more on short-term debt than on long-term debt, and they significantly differ from their public counterparts in the context of their access to the capital markets. These observations are broadly speaking consistent with those of Goyal, Nova, and Zanetti (2011), who do a comparison between private and public firms in 18 European countries.

Research has also shown that risk not only affects firm behavior on its own but also in conjunction with various firm-specific variables. For instance, as Baum, Caglayan, and Talavera (2010) suggest, when risk varies over time, lenders may fail to evaluate the creditworthiness of a firm and render the firm credit constrained by raising the liquidity premium required to provide funds. In such circumstances, firm managers will be more dependent on firms' retained earnings or liquid assets to overcome the difficulties that the firm has to go through. In their investigation, Baum, Caglayan, and Talavera (2010) show that the impact of risk on a firm's fixed capital investment can also be gauged through its effects on the firm's cash holdings (spillover effects) in addition to the own (direct) effects of risk. Therefore, in this paper, we additionally explore whether risk has spillover effects on leverage in addition to its direct effects, an issue that has not been examined earlier in the literature.

We begin our analysis by separately estimating the effects of macroeconomic and idiosyncratic risk on the target leverage of public and non-public manufacturing firms. Once we establish the role of each type of risk on firms' leverage, we introduce an interaction term between our measures of risk and the cash stock of the firm to examine how the impact of risk on leverage changes as the cash holdings of the firm vary over time — the spillover effect. In our empirical investigation we use several risk measures to capture the impact of both firm-specific and macroeconomic risk on public *versus* non-public firms' leverage while controlling for firm-specific variables to gauge the robustness of our findings.

Our findings can be summarized as follows. Using the System-GMM estimator we find that the effects of firm-specific variables, namely the investment-to-total assets ratio, the sales-to-total assets ratio, and the cash-to-total assets ratio, on leverage are generally similar to earlier empirical findings.[16] Therefore, throughout the discussion of our findings we do not place too much emphasis on the role of firm-specific determinants on leverage. Instead, we mainly focus on the impact of time-varying idiosyncratic and macroeconomic risk on firms' leverage, whether the leverage of public *versus* non-public firms behaves differently in response to either sources of risk, and whether firms' cash holdings affect the marginal impact of risk on firms' leverage.

We find that an increase in idiosyncratic risk has a negative impact on firms' leverage. This observation that we gather for the UK data supports the findings of Titman and Wessels (1988), MacKie-Mason (1990), and Baum, Stephan, and Talavera (2009), all of whom using data on US publicly-traded firms show that a firm's leverage is significantly negatively correlated with its earnings volatility.[17] We also find that the leverage of non-public firms exhibits a greater sensitivity to idiosyncratic risk as compared to their public counterparts. This finding is consistent with the view that the financing policy of non-public firms depends more on their in-house performance as their ability to tap into external finance is expected to diminish during periods of volatility due to the presence of frictions. When we turn to investigate the effects of macroeconomic risk, we observe that an increase in macroeconomic risk also leads to both public and non-public firms to use less short-term debt in their capital structure. Yet we find no evidence that the impact is statistically different across each category. This indicates that during periods of macroeconomic turmoil debt becomes an unattractive source of finance for either type of firm.[18]

Last, but not least, we examine the spillover effects of risk on leverage through firms' cash holdings. We show that both types of risk have significant spillover effects on public firms' leverage, but we find no such significant effects for non-public firms. We close our investigation considering the joint impacts of direct and spillover effects of risk and show that although the full impact of idiosyncratic risk on leverage is negative, this negative effect becomes stronger as the firm holds more cash stocks. In other words, we show that during periods of higher idiosyncratic risk, firms with higher levels of cash holdings have a larger propensity to reduce their leverage relative to those firms that hold lower levels of cash stocks. In the case of macroeconomic risk, we observe that the adverse effects of macroeconomic risk on leverage is stronger when firms' cash holding is low than when firms

[16] See, for instance, Titman and Wessels (1988), Fama and French (2002), and Brav (2009).

[17] Myers (1977), in contrast, argues that large business risk may reduce the agency cost of debt leading to an increase in the firm's debt.

[18] The closest study to our work is that of Baum, Stephan, and Talavera (2009). In particular, they examine the effect of risk on the short-term debt to total assets ratio of listed firms in the United States. Regarding the effects of risk on the leverage of firms, Baum, Stephan, and Talavera (2009) present similar evidence as we do here.

hold relatively high levels of cash. Furthermore, the negative effect of macroeconomic risk on leverage becomes weaker and, in fact, insignificant statistically as firms accumulate a stockpile of cash. Our these findings, on the whole, suggest that the level of cash holdings plays an important role in establishing the relationship between the risk that a firm experiences and the optimal level of the firm's leverage.

The remainder of the study proceeds as follows. Section 2 lays out the effects of macroeconomic and idiosyncratic risk on a firm's financing behavior. Section 3 provides a description of the dataset we use for our empirical investigation, explains the construction of variables, and gives the basic summary statistics. Section 4 discusses the empirical models. Section 5 presents the empirical results. Section 6 concludes the study.

2.3 The Link between Risk and Leverage

In what follows below, we provide a brief discussion on the role of macroeconomic and firm-specific risk in determining a firm's leverage.

2.3.1 Macroeconomic Risk and Firm Leverage

There is an extensive empirical literature which investigates how macroeconomic volatility affects firms' behavior. Several researchers, including Leahy and Whited (1996), Ghosal and Loungani (1996), Baum, Caglayan, and Talavera (2010), and Rashid (2011) indicate that firms significantly reduce their fixed investment expenditures during periods of high risk.[19] Bartram (2002) presents evidence that the measures of firm liquidity is significantly associated with interest rate exposure. Studies, among others, Almeida, Campello, and Weisbach (2004) and Baum, Caglayan, Stephan, and Talavera (2008), find that firms increase their demand for liquid assets in response to an increase in macroeconomic uncertainty. Collectively, these empirical findings indicate that managers fine tune the fixed investment behavior and liquid assets of the firms to shield the firm against the adverse effects of risk associated with the aggregate economic activities. Theoretically, the effects of macroeconomic disturbance on firms' financing decisions can be explained through the financial propagation mechanism. That is, the volatility of macroeconomic conditions influences the borrowers' collateralizeable net worth (net financial assets, tangible physical assets, and unencumbered potential earnings), and therefore affects the premium for external funds. The countercyclical movements of the premium required for external financing in turn influences the borrowers' ability to borrow funds from external sources (Bernanke and Gertler (1989), Calomiris and Hubbard (1990), Gertler (1992), Greenwald and Stiglitz (1993), Gertler and Gilchrist (1993), and Kiyotaki and Moore (1997)).

[19] Also see Aizenman and Marion (1999), Beaudry, Caglayan, and Schiantarelli (2001), and Bloom, Bond, and Reenen (2007), who present evidence on the adverse effects of risk on fixed investment.

Interestingly, there is not much empirical research that investigates the impact of macroeconomic risk on firms' debt structure. Gertler and Hubbard (1993) discuss how firms face both idiosyncratic and macroeconomic risk in their production and financial decisions. According to them, although firms can mitigate the effect of the first one, they are not able to manipulate the effects of macroeconomic risk. Therefore, firms opt for equity rather than debt to shift (at least some of) the business-cycle risk to their lenders during periods of higher macroeconomic risk. In this context, the effect of macroeconomic volatility on leverage is expected to be negative. Despite its significance to firms, to our knowledge, only two studies empirically examine the link between leverage and macroeconomic risk. Baum, Stephan, and Talavera (2009) show for a set of large US nonfinancial firms drawn from COMPUSTAT that an increase in macroeconomic risk leads to a significant decrease in firms' optimal short-term leverage. Hatzinikolaou, Katsimbris, and Noulas (2002) examine the impact of inflation risk on firms' debt-equity ratios for the firms included in the Dow Jones Industrial Index and they find that inflation risk has a significant negative effect on a firm's debt-equity ratio.[20]

Given the lack of empirical research, it is of particular interest to investigate to what extent macroeconomic risk affects the target leverage of firms. It must also be noted that this issue is not only relevant for public companies but more so for non-public companies whose main source of financing is bank debt as these firms are severely constrained due to the presence of asymmetric information when it comes to raising funds to finance their daily activities as well as their capital investment projects.[21] All together, our investigation would help us to understand the linkages between macroeconomic risk and leverage for public and non-public firms.

2.3.2 Firm-Specific Risk and Firm Leverage

When we review the literature we find that while some researchers report a negative impact of idiosyncratic risk on leverage, others find no or positive effects. The trade-off theory of capital structure predicts an inverse link between firm-specific risk and firms' optimal debt levels. The rationale for this prediction is that higher business risk as measured by an increase in the volatility of cash flows heightens the probability of bankruptcy. Therefore, due to the presence of positive bankruptcy costs, firms use less debt in their capital structure when there is a large variation in their earnings. To that end, Bradley, Jarrell, and Kim (1984) present a single period corporate capital structure model and show that

[20]Despite giving very little attention to empirically examine the role of macroeconomic risk in firm financing strategies in the literature, several empirical papers, such as Choe, Masulis, and Nanda (1993), Gertler and Gilchrist (1994), Korajczyk and Levy (2003), Amdur (2009), Cook and Tang (2010), and Akhtar (2011) provide evidence of significant relations between business cycles and capital structure dynamics.

[21]See, for instance, Whited (1992), who points out that small firms have limited access to debt markets due to the lack of the collateral necessary to back up their loans.

there is a negative association between firm volatility and its optimal debt. Subsequently, Titman and Wessels (1988) report a negative association between earnings volatility and leverage. Baum, Stephan, and Talavera (2009) report a significant and negative impact of idiosyncratic risk on the optimal short-term leverage for US non-financial public firms.[22] Wald (1999) investigates how earnings volatility affects the target leverage by examining the determinants of capital structure in France, Germany, Japan, the US and the UK. They find a significant negative effect of firm-level risk on the debt-to-assets ratio for firms established in the US and Germany. For the remaining countries, however, they do not find any significant association between firms' business risk and their leverage.[23] Overall similar findings are reported in Baxter (1967), Ferri and Jones (1979), Friend and Lang (1988), and MacKie-Mason (1990), indicating the presence of a significant and negative impact of firm-level risk on leverage.[24]

In contrast, Myers (1977) predicts a positive relationship between a firms risk and its level of debt. He argues that large business risk may reduce the agency cost of debt and thus firms use more debt in their capital structure. Jaffe and Westerfield (1987) also derive a positive association between risk and the optimal debt level. Several other empirical studies, including Kim and Sorensen (1986) and Chu, Wu, and Chiou (1992), report a significant and positive impact of firm-level risk on leverage. Earlier, Toy, Stonehill, Remmers, and Wright (1974) report the presence of a significant and positive effect of earnings volatility on the debt ratio of manufacturing firms in Japan, Norway and the US. Kale, Noe, and Ramirez (1991) examine the impact of business risk on the optimal debt level by developing a model similar to DeAngelo and Masulis (1980). They show that an increase in business risk initially leads to a decline in debt. However, once the debt of a firm exceeds a certain limit, the firm uses more debt in its capital structure as business risk increases.

Overall, we observe that prior research leads to conflicting conclusions on the association between idiosyncratic risk and leverage. In the case of theoretical models, results are related to the underlying assumptions and in the case of empirical studies, results differ based on the sample and measure of risk used in the investigation. In addition, none of the studies cited above examines this relationship for non-public companies. Since non-public firms' financing options significantly differ from that of public firms, as they are not

[22]In addition, they show that highly leveraged firms and small firms are more sensitive to firm-specific risk as compared to relatively low leveraged or large firms.

[23]Flath and Knoeber (1980) also show that the firm's earning volatility does not have any significant impact on leverage in 38 major industries over the period 1957-1972 using a dataset drawn form the IRS Statistics of Income, Corporate Income Tax Returns database.

[24]Graham and Harvey (2001b) conducting a survey of U.S. Chief Financial Officers (CFOs) find that firm managers take earnings volatility into account considerably when making debt decisions. The surveys of European firms' CFOs also reveal similar evidence (see, for example, Bancel and Mittoo (2004) and Brounen, De Jong, and Koedijk (2004)).

legally allowed to issue debt instruments, it is important to investigate how non-public firms' leverage evolves under risk. In this paper, we therefore investigate the impact of firm-specific risk on public and non-public firms' leverage using UK firm-level data.

2.4 Data, Variable Construction, and Measuring Risk

To carry out our investigation we construct an annual panel dataset for public and non-public manufacturing firms using the FAME database which is made available by Bureau van Dijk (BvD) Electronic Publishing. The data on macroeconomic variables which we use to generate risk measures are extracted from the International Financial Statistics (IFS), an International Monetary Fund (IMF) database. The dataset covers a ten-year period from 1999 to 2008.

2.4.1 Public and Non-Public Company Data Collection

Under the UK Companies Act, all limited liability companies register themselves with the Companies House as either public or non-public companies. Companies House is basically an executive agency of the United Kingdom Department for Business, Innovation and Skills (BIS). The fundamental functions of the Companies House are to incorporate and dissolve limited liability companies, accumulate and scrutinize company information and make this information available to the public.[25]

According to the Companies Act of 1967, in the United Kingdom, all public and non-public companies must submit their annual financial statements to the Register of Companies House. However, the Companies Act of 1981 which modified the 1967 Act, allows small firms to file an abbreviated balance sheet without a profit and loss statement and medium sized companies to submit an abbreviated financial statement.[26] Currently, both public and non-public companies must file their financial statements within a period of ten and seven months respectively of their accounting year-end date.

It should be noted that all accounting statements are compiled according to the UK accounting standards. Both non-public and public companies' financial statements must be audited by a professional and a qualified auditing firm if the company's annual turnover is more than one million pounds. However, public firms should provide some additional information to the general public to be listed on the London Stock Exchange. Hence, this source provides compatible and consistent information across public and non-public firms.

[25] For more information about Companies House, see http://www.companieshouse.gov.uk/.

[26] According to the Companies Act, a company to be classified into "medium" ("small") category based on execution of any two of the following criteria for at least two consecutive years: (i) annual sales should not be more than 11.2 (2.8) million pounds, (ii) the book value of total assets should not be more than 5.6 (1.4) million pounds, and (iii) the number of workers should not be more than 250 (50).

2.4.2 The FAME Database

As mentioned earlier, according to the UK Companies Act, all limited liability companies must submit their annual financial statements to Companies House during a specific period of time from the year-end date. Once a company files its accounting statements, Companies House carefully investigates and checks this information and makes it available to the general public. Jordans, one of the leading providers of legal information in the UK, collects this data from Companies House. Finally, BvD collects the data from Jordans and makes it available for commercial uses through the FAME database.

The FAME database provides information on both active and inactive public/non-public limited liability companies in the UK up to a maximum of a 10-year period. The data coverage may vary in terms of the number of observations for a given company as there may be entry or exit from the dataset. The main advantage of the FAME database is that it includes both balance-sheet and off-balance sheet information, such as income statements, cash flows statements, profit and loss accounts, and ownership information.

Firms in the database operate in a wide range of industrial sectors including agriculture, forestry and mining, manufacturing, construction, retail and wholesale, hotels and restaurants, the financial sector, the public sector, and the regulated utility industry. FAME contains data for both non-public and public limited companies and over 99% of the companies in the database are small and not traded on the stock exchange. Hence, our dataset gives us a unique opportunity to investigate the behavior of non-public *versus* public limited companies.

The FAME database reports two sorts of variables in the form of static and annual observations. An annual variable is a variable whose values are reported for each end of accounting year. Whereas, in the case of a static variable (a "header" variable), such as ownership information, company type (public or non-public, listed or unlisted, etc), date of incorporation, registration number, and SIC primary and secondary codes, only the previous year's reported value exists. The FAME database that we use for this study contained information for 1999-2008 on both static variables and annual financial statements for approximately 4 million public and non-public companies in the UK from all sectors. All incorporated entities are classified by the 2003 Standard Industrial Classification (SIC) codes.

2.4.3 Sample Selection Criteria, Initial Screening, and Variable Construction

In this paper, we only focus on the manufacturing firms and exclude companies that have changed the date of their accounting year-end by more than a few weeks. The dataset refers to 12-month accounting periods for all companies. As an initial screening, we exclude companies that have less than 3 years of consecutive data on debt, investment, cash and equivalence, or sales. Second, we set all negative values for all variables (except cash flows) in the sample as missing. After the initial screening, our dataset contains a total of 120,337 firm-year observations over a ten-year period from 1999 to 2008. The dataset has an unbalanced panel structure where each firm contributes between 3 to 10 years of observations. We flag each firm as either public or non-public based on their "Company Type" as provided by FAME.

We construct leverage as the book value of the short-term debt to total assets ratio as we aim to understand the behavior of public and non-public firms' short-term debt as risk evolves over time.[27] We should note that Titman and Wessels (1988) also use the ratio of short-term debt to total assets as one of the proxies for firm leverage while several other researchers including Marsh (1982), Fama and French (2002), Rajan and Zingales (1995), and Leary and Roberts (2005), define leverage as a ratio of the book value of debt to total assets.

Following the previous empirical studies, we include a number of firm-specific control variables in our empirical model. We define investment as expenditure by the firm on the purchase of fixed tangible assets during a year. Cash is set equal to cash and equivalents. Sales are defined as the total turnover of the company during an accounting year period. To control for the potential influence of outliers in our empirical analysis, all variables that enter into our model in ratios are winsorized at the lower and upper one-percentile to purge the impact of outliers and reporting errors on the data.[28] Further details on the variables are given in Table 2-A of Appendix A.

2.4.4 Generating Firm-Specific Risk

Researchers implement different methods to generate a proxy for firm-specific risk. For instance, Huizinga (1993) uses the conditional variance obtained from a GARCH-type specification on wage and materials cost. Pindyck and Solimano (1993) and Caballero and Pindyck (1996) use a geometric Brownian model to derive the variance of the marginal revenue product of capital. Ghosal and Loungani (2000) measure the firm-level risk by the standard deviation of the firm's unpredictable profit. Bo (2002) constructs an AR(1) model for sales and then uses the cumulative standard deviation of the residuals obtained from the model for each year as a measure of firm-specific risk. Bo and Lensink (2005) use stock price volatility as well as the volatility of the number of employees to measure firm-level uncertainty. They compute stock price volatility as the difference between the highest and lowest stock price for each underlying firm normalized by the lowest price.

[27] It should be noted that the market value of debt is not available for non-public firms.

[28] See, for instance, Brav (2009), who have applied similar screening methods.

To construct volatility based on employees, they use the coefficient of variance over a seven-year period. Baum, Stephan, and Talavera (2009) estimate idiosyncratic risk by calculating the standard deviation of the closing price of the firm's shares.[29] Likewise, Ozkan and Ozkan (2004) also simply use the standard deviation of cash flows normalized by average total assets as a proxy for idiosyncratic risk in their analysis of the empirical determinants of cash holdings of UK firms.

Most of the measures described above are well suited for cases where the focus is on large publicly traded firms as these methods may introduce a bias into the constructed measure of risk for small firms.[30] Given that the focus of our paper is on the behavior of public *versus* non-public firms, and non-public firms are much smaller than the public firms, we follow Morgan, Rime, and Strahan (2004) to compute time-varying measures of firm-specific risk. Their approach requires us to estimate a model on firm sales scaled by total assets (S_{it}) using firm (f_i) and year fixed-effects (f_t). Specifically, we estimate the following specification:

$$S_{it} = f_i + f_t + \psi_{it} \tag{2.1}$$

where i and t denote firm and year, respectively and ψ_{it} is the white-noise error term. The absolute value of these residuals, $\sigma_{it}^{level} = |\psi_{it}|$, is then used as a proxy for firm-specific risk.

To construct a second measure of risk, we estimate an AR(1) model for sales normalized by total assets. Using the one-period-ahead residuals obtained from this model, we compute the cumulative-volatility in sales, $\sigma_{it}^{cumulative}$. Specifically, the risk proxy for 2000 is constructed by calculating the standard deviation of the residuals obtained from the AR(1) model of sales that uses data for 2000 and 1999. Similarly, the risk measure for 2001 is constructed calculating the standard deviation of the residuals obtained from the same model using the data for 2001, 2000, and 1999. The process is repeated similarly. The downside of this approach is the loss of one observation per firm.

2.4.5 Computing Macroeconomic Risk

Similar to the case of generating firm-specific risk, researchers use different methodologies to construct measures of macroeconomic risk. For instance, Aizenman and Marion (1999) use conditional variances obtained from government expenditures as a share of GDP, nominal money growth, and the real exchange rate to proxy for macroeconomic risk. Driver, Temple, and Urga (2005) construct a proxy for macroeconomic risk from the

[29] Campbell, Lettau, Malkiel, and Xu (2001) also estimate the market, industry and firm-level volatility for listed U.S. firms by using firm-level return data.

[30] For more details on this issue, see Comin and Philippon (2005).

conditional variance of manufacturing output obtained from a GARCH model. Baum, Stephan, and Talavera (2009) fit a generalized ARCH model to derive the conditional variance of the index of leading macroeconomic indicators as a proxy for the macro-level uncertainty.

In contrast to the researchers above, Ghosal and Loungani (2000) use the moving standard deviation of energy prices and the Federal Funds Rate (FFR) to proxy for macroeconomic fluctuations. Korajczyk and Levy (2003) use two-year aggregate domestic nonfinancial corporate profit growth and two-year equity market returns to proxy macroeconomic conditions. Several other researchers, including Kaufmann, Mehrez, and Schmukler (2005) and Graham and Harvey (2001a), utilize survey-based methods based on the dispersion of forecasts, which are collected from firm or bank managers, as a measure of macroeconomic risk.

In our investigation, we use the ARCH/GARCH methodology to measure macroeconomic risk. To generate macroeconomic risk, given that companies tend to consider their production as well as financing decisions, we use monthly T-bills rate and quarterly GDP series for the period between 1996 and 2008. Once the conditional variances for each series are obtained, we annualize these series by taking average across four quarters and across twelve months for GDP and T-bills rate series, respectively, to match the frequency of the firm-level panel data. Table 2-B in Appendix B presents the estimated ARCH/GARCH specifications. As the table reveals, the estimates on diagnostic tests provide evidence that our models are well-specified and there is no remaining ARCH effect in the residuals.

2.4.6 Preview: Summary Statistics and Correlations

Table 2.1 provides the descriptive statistics for the full sample as well as public and non-public firms. We apply nonparametric equality tests to examine if the means, medians, and standard deviations of those variables that we employ in our models differ across public and non-public firms.

We observe that the mean leverage for non-public firms is significantly higher than their public counterparts over the sample period. In particular, the average short-term debt to total assets of non-public firms is 19.8% compared with 13.8% for their public counterparts. This difference implies that the non-public firms in our dataset depend more on short-term debt to finance their activities in comparison to the public firms. This observation makes sense as debt financing is one of the major means for non-public firms to raise funds. This observation is also in line with that of Brav (2009) who shows that non-public firms use relatively more debt to finance their fixed capital investments than public firms. Recently, Goyal, Nova, and Zanetti (2011) examining the differences in financing policies of public and private firms in 18 European countries also document

Table 2.1: Descriptive Statistics of Firm-Specific Variables for Public *versus* Non-Public Firms

Variables	Firms	Statistics			
		Obs.	Mean	Median	Std. Dev.
Leverage ratio	Full Sample	120337	0.196	0.116	0.223
	Public	5361	0.138	0.067	0.183
	Non-public	114976	0.198	0.119	0.225
	Difference		0.060*	0.052*	0.042*
Sales-to-total assets ratio	Full Sample	105006	1.575	1.443	0.892
	Public	5060	1.085	1.019	0.631
	Non-public	99946	1.600	1.469	0.869
	Difference		0.515*	0.450*	0.238*
Cash & equivalent-to-assets ratio	Full Sample	140544	0.121	0.057	0.555
	Public	5477	0.111	0.054	0.146
	Non-public	135067	0.122	0.057	0.156
	Difference		0.011	0.003	0.010
Investment-to-total assets ratio	Full Sample	57991	0.155	0.028	0.265
	Public	4292	0.184	0.041	0.283
	Non-public	53699	0.152	0.026	0.263
	Difference		- 0.032*	-0.015*	-0.020*

Notes: The difference between the means, medians, and standard deviation (Std.Dev.) of public and non-public firms are reported in brackets. * denotes statistical significance at the 1% level of significance.

similar evidence. We also observe that the leverage of non-public firms is more volatile as compared to that of public firms. Similarly, there is a significant difference between non-public and public firms' sales-to-total assets ratios. The mean value of the sales-to-total assets ratio is 1.60 for non-public firms, whereas, it is 1.08 for the public firms. This ratio is also significantly more volatile for the non-public firms as compared to that of public firms.

The statistics on cash and equivalent do not show any significant difference between the two groups. Non-public firms have a cash and equivalent-to-total assets ratio of 12.2%, on average, whereas, this figure is 11.1% for public firms. We should also note that, on average, public firms have higher investment normalized by total assets as compared to their non-public counterparts. The mean value of the investment to asset ratio is 15% and 18% for non-public firms and public firms, respectively. This differential is statistically significant for both the mean and median values. The size of the standard deviation for this variable provides evidence that public firms' investment rates are slightly more variable than that of non-public firms over the period under consideration.

Table 2.2 presents summary statistics of our macroeconomic and idiosyncratic risk measures. The table reports the means, standard deviations, as well as the 25^{th}, 50^{th} and 75^{th} percentiles of these proxies. There are considerable differences within each group of risk measure. The mean and the standard deviation of firm-specific risk measure based on absolute errors (σ^{level}) is much smaller than that of cumulative ($\sigma^{cumulative}$) risk measure. A similar observation is valid for macroeconomic risk based on T-bills and GDP. To investigate whether the risk proxies gauge similar movements in the business and macroeconomic environment, we compute their correlations. Table 2.3 shows that the correlation coefficients are very low and they are not statistically significant at any reasonable level of significance. Hence, we conclude that each of our measures captures a different aspect of the risk within which firms operate.

Table 2.2: Summary Statistics of Proxies for Risk

The table presents summary statistics of the risk measures. We construct two time-varying proxies for firm-specific risk which are based on sales, σ_{it}^{level} and $\sigma_{it}^{cumulative}$. Note that $\sigma_{it}^{cumulative}$ is cumulative volatility in the level of sales. Similarly, we compute two time-varying proxies for macroeconomic risk based on the conditional variance of T-bills rates (σ_t^{T-bill}) and GPD (σ_t^{GDP}).

Statistics	Firm-Specific Risk		Macroeconomic Risk	
	σ_{it}^{level}	$\sigma_{it}^{cumulative}$	σ_t^{T-bill}	σ_t^{GDP}
Mean	0.240	0.500	0.033	4.475
Std. Deviation	2.023	7.707	0.046	3.142
P25	0.033	0.007	0.011	1.988
P50	0.069	0.024	0.015	2.202
P75	0.185	0.087	0.026	8.017

Table 2.3: Correlations of Idiosyncratic and Macroeconomic Risk Proxies

The table presents the coefficients of correlation for macroeconomic and idiosyncratic risk measures. We construct two time-varying proxies for firm-specific uncertainties which are based on sales, σ_{it}^{level} and $\sigma_{it}^{cumulative}$. Note that $\sigma_{it}^{cumulative}$ is cumulative volatility in the level of sales. Similarly, we compute two time-varying proxies for macroeconomic risk based on the conditional variance of T-bills rates (σ_t^{T-bill}) and GPD (σ_t^{GDP}).

		Firm-Specific Risk	
		σ_{it}^{level}	$\sigma_{it}^{cumulative}$
Macroeconomic Risk	σ_t^{GDP}	0.024	0.001
	σ_t^{T-bill}	0.022	0.011

In Table 2.4, we report simple correlation coefficients between our main variables and leverage for non-public and public firms. For both types of firms (public and non-public), leverage has a negative correlation with the sales to total asset ratio. However, this association is statistically insignificant in the case of public firms, reflecting that the optimal leverage may be more sensitive to sales for non-public firms as compared to public firms. The cash and equivalent to total assets ratio is significantly and negatively correlated with leverage for both non-public and public firms. This correlation suggests that cash rich firms borrow less.

Table 2.4 also shows that the correlation between the ratio of investment to total assets and firms' leverage is statistically significant and positive for both groups of firms. The intensity of this relationship is considerably higher for public firms as the magnitude of

Table 2.4: Correlation of Risk and Firm-Specific Variables with Leverage

The table presents correlations between firm leverage and the remaining variables in the model. The sample covers the period from 1999 to 2008. We categorize a firm as public if it is listed in the stock exchange and as non-public if it is not. The leverage is defined as the ratio of the short-term debt to total assets. The method of measuring volatility and definitions of the firm-specific independent variables are given in Table 2-A, Appendix A. ** denotes statistical significance at the 5% level.

Variables	Leverage	
	Non-public	Public
Sales-to-total assets ratio	-0.007**	-0.015
Cash & equivalent-to-total assets ratio	-0.117**	-0.182**
Investment-to-total assets ratio	0.172**	0.446**
Volatility in levels of sales	-0.008**	-0.035**
Cumulative-volatility in levels of sales	-0.025**	-0.021**
T-bills rate volatility	-0.012**	-0.002**
GDP volatility	-0.009**	0.037**

the correlation coefficient is 0.45, while, for non-public firms the correlation coefficient is only 0.17. This evidence suggests that public firms use relatively more short-term debt to finance their investment opportunities than the non-public firms do.

Regarding the correlation between risk and leverage, Table 2.4 provides a *prima facia* evidence for the presence of a significant and negative association between leverage and all measures of risk. Furthermore, the table shows that this observation holds for both public and non-public firms. However, to properly examine the causal effects of both types of risk on firms' leverage decisions, we need to have a well-specified model which incorporates the relevant firm-specific variables while considering the dynamics.

2.5 Econometric Framework

2.5.1 Specification of the Baseline Empirical Model

To examine the association between risk and leverage, we estimate several models for public and non-public firms. Our baseline model incorporates risk measures to a standard model allowing us to examine the linkages between leverage and risk. Among others, similar to Brav (2009), Baum, Stephan, and Talavera (2009) and Auerbach (1985), our model contains the lagged leverage (lagged dependent variable) to control for the persistence in debt holdings. Specifically, we express the model as follows:

$$Lev_{it} = \lambda_0+\lambda_1 Lev_{it-1}+\lambda_2 Sales_{it}+\lambda_3 Cash_{it}+\lambda_4 Invt_{it}+\lambda_5\sigma^{firm}_{it-1}+\lambda_6\sigma^{macro}_{t-1}+f_i+\varepsilon_{it} \quad (2.2)$$

where subscript i and t denote firms and years, respectively. Lev_{it} is the leverage in year t for firm i and is defined as the ratio of short-term debt to total assets. $Sales_{it}$, $Cash_{it}$, and $Invt_{it}$ denote sales, cash and equivalents, and fixed investment, correspondingly, and each variable is normalized by total assets to remove scale effects. In our model, the risk measure enters the model with a lag, where σ^{firm}_{it-1} is one of our time-varying firm-specific risk measures for firm i in year t and σ^{macro}_{t-1} denotes one of our time-varying macroeconomic risk measures. f_i denotes firm-specific fixed effects and ε_{it} is the error term. All estimations are carried out for the period 1999-2008. The key coefficients of interest are λ_5 and λ_6 which capture the effects of firm-specific and macroeconomic risk on firms' leverage, respectively. Particularly, we are interested to see if these coefficients attain a negative or a positive sign so that we can determine the effect of risk on the leverage of manufacturing firms in the UK.

2.5.2 Differential Effects of Risk

Whilst estimating the effects of risk on the firm's short-term leverage, equation (2.2) does not enable us to test whether the impact of risk on public firms is statistically different from that of non-public firms. To scrutinize this issue, we extend our basic model so that all variables of interest in equation (2.2) assume a different coefficient across public and non-public firms within the same framework. To achieve our goal, we generate two sets of dummies that allow us to separate public firms from non-public firms and interact them with all variables in the model. Specifically, we generate a public-firm dummy (D_i^{public}) which is equal to one if the firm is categorized as a public firm and zero otherwise. We then generate a dummy for non-public firms ($D_i^{nonpublic}$) which is equal to $(1 - D_i^{public})$. The extended model takes the following form:

$$\begin{aligned} Lev_{it} = {} & \phi_1 Lev_{it-1} D_i^{public} + \phi_2 Lev_{it-1} D_i^{nonpublic} + \phi_3 Sales_{it} D_i^{public} + \phi_4 Sales_{it} D_i^{nonpublic} \\ & + \phi_5 Cash_{it} D_i^{public} + \phi_6 Cash_{it} D_i^{nonpublic} + \phi_7 Invt_{it} D_i^{public} + \phi_8 Invt_{it} D_i^{nonpublic} \\ & + \phi_9 \sigma_{it-1}^{firm} D_i^{public} + \phi_{10} \sigma_{it-1}^{firm} D_i^{nonpublic} + \phi_{11} \sigma_{t-1}^{macro} D_i^{public} \\ & + \phi_{12} \sigma_{t-1}^{macro} D_i^{nonpublic} + \phi_0 + f_i + \varepsilon_{it} \end{aligned} \tag{2.3}$$

We prefer this approach over estimating leverage models on separate sub-samples of public and non-public firms owing to the following two reasons. First, our approach allows us to work with higher degrees of freedom. Second, our approach allows us to properly test the differential effects of risk on leverage for both groups of firms.[31] More specifically, we test the following two hypotheses:

H_0^1 : The impact of σ_{it-1}^{firm} on Lev_{it} is the same for public and non-public firms. ($\phi_9 = \phi_{10}$)

H_0^2 : The impact of σ_{t-1}^{macro} on Lev_{it} is the same for public and non-public firms. ($\phi_{11} = \phi_{12}$)

2.5.3 Spillover Effects of Risk

Baum, Caglayan, Stephan, and Talavera (2008) develop a partial equilibrium model of precautionary demand for liquid assets to examine how macroeconomic risk and idiosyncratic

[31] This approach also allows one to test the differential effects of the remaining variables across public *versus* non-public firms. Nevertheless, we leave this step to the reader to save space as we concentrate on the effects of risk on firms' leverage.

uncertainty affect firms' cash holdings. Their empirical results indicate that risk has a significant impact on the non-financial U.S. firms' optimal liquidity and firms increase their demand for liquid assets in response to an increase in either macroeconomic risk or firm-specific risk. Almeida, Campello, and Weisbach (2004) also show that macroeconomic conditions have a significant impact on financially constrained firms' cash holdings.[32] Since a firm's financing policy markedly depends on the firm's investment opportunities and availability of internal funds, risk is likely to have indirect (spillover) effects, possibly through its impact on cash holdings, as well while directly affecting firms' capital investment or borrowing behavior.

In fact, Baum, Caglayan, and Talavera (2010) provide evidence that risk affects firms' capital investments on its own (the direct effect of uncertainty) and through its impact on those firms' cash holdings (the indirect effect of uncertainty). To see whether the effects of risk spill over to firms' leverage behavior through its effects on firms' cash holdings, we augment our basic specification by incorporating cash-holding-risk interactions. In particular, we estimate the following augmented model:

$$\begin{aligned} Lev_{it} = {} & \beta_1 Lev_{it-1} D_i^{public} + \beta_2 Lev_{it-1} D_i^{nonpublic} + \beta_3 Sales_{it} D_i^{public} + \beta_4 Sales_{it} D_i^{nonpublic} \\ & + \beta_5 Cash_{it} D_i^{public} + \beta_6 Cash_{it} D_i^{nonpublic} + \beta_7 Invt_{it} D_i^{public} + \beta_8 Invt_{it} D_i^{nonpublic} \\ & + \beta_9 \sigma_{it-1}^{firm} D_i^{public} + \beta_{10} \sigma_{it-1}^{firm} D_i^{nonpublic} + \beta_{11} \sigma_{t-1}^{macro} D_i^{public} + \beta_{12} \sigma_{t-1}^{macro} D_i^{nonpublic} \\ & + \beta_{13} Cash_{it} \sigma_{it-1}^{firm} D_i^{public} + \beta_{14} Cash_{it} \sigma_{it-1}^{firm} D_i^{nonpublic} + \beta_{15} Cash_{it} \sigma_{t-1}^{macro} D_i^{public} \\ & + \beta_{16} Cash_{it} \sigma_{t-1}^{macro} D_i^{nonpublic} \\ & + \beta_0 + f_i + \varepsilon_{it} \end{aligned} \tag{2.4}$$

We assess the spillover effects of idiosyncratic risk on the firm's leverage by investigating the significance of β_{13} and β_{14} in equation (2.4):

$H_0^1 : \beta_{13} = 0$, for public firms.

$H_0^2 : \beta_{14} = 0$, for non-public firms.

To examine the spillover impact of macroeconomic risk on leverage, we test the significance of β_{15} and β_{16} in equation (2.4):

$H_0^3 : \beta_{15} = 0$, for public firms.

$H_0^4 : \beta_{16} = 0$, for non-public firms.

The rejection of the null hypotheses suggest that idiosyncratic volatility as well as macroeconomic volatility affect leverage in conjunction with movements in firms' cash holdings.

[32]Several other papers including Kim and Sorensen (1986), Kim, Mauer, and Sherman (1998), Opler, Pinkowitz, Stulz, and Williamson (1999), Pinkowitz and Williamson (2001), Ozkan and Ozkan (2004), Han and Qiu (2007), Acharya, Almeida, and Campello (2007), Riddick and Whited (2009), and Bates, Kahle, and Stulz (2009) also provide evidence on the relationship between the cash structure of the firms and idiosyncratic risk.

2.5.4 Estimation Procedure

To estimate the models discussed above, one must use an instrumental variable (IV) approach due to endogeneity problem. Here, we use a robust two-step system dynamic panel data (DPD) estimator (system GMM approach) developed by Blundell and Bond (1998). This methodology allows us to remove fixed effects by design as we can estimate the model in first-differences. Specifically, this estimation procedure combines equations in differences of the variables with equations in levels and controls for possible endogeneity problems by using the lagged values of the regressors as instruments. Finally, this approach is quite flexible and allows the researcher to make use of different instruments with different lag structure for both the levels and the first-differenced equations. To test for the validity of the instruments, we use the *J-statistic* of Hansen (1982). This statistic is asymptotically distributed as χ^2 with degrees of freedom equal to the number of overidentifying restrictions (i.e., the number of instruments less the number of estimated parameters). Under the null hypothesis, the instruments are orthogonal to the errors.

To examine the presence of serial correlation in the error terms, we employ the Arellano and Bond (1991) test for autocorrelation. Under the null of no serial correlation, the test asymptotically follows a standard normal distribution. It also provides a further check on the correct specification of the System-GMM process. In a dynamic panel data context, the first-order serial correlation is likely to be present, but the residuals should not exhibit the second-order serial correlation if the instruments are strictly exogenous.

The estimates from the J test are reported in each table that we present below. These estimates indicate that the instruments used in the System GMM estimations are appropriate and satisfy the orthogonality conditions. The Arellano-Bond AR(2) tests do not provide any evidence for the presence of second-order serial correlation in the residuals. This indicates that the instruments that we use in our estimation are appropriate. For the purpose of consistency and brevity, we do not make any further comments on these aspects of the estimated models when we discuss our results.

2.6 Empirical Findings

We commence our empirical analysis by estimating equation (2.2) to pin down the effects of idiosyncratic and macroeconomic risk on firms' leverage, using two different measures for each type of risk. We next investigate whether risk has a differential impact on the leverage of non-public *versus* public firms as equation (2.3) depicts. Finally, we estimate equation (2.4) to examine whether the effects of risk spill over to leverage through its impact on the cash holdings of firms and to discuss the total impact of risk on firms' leverage.

2.6.1 The Impact of Risk on Leverage

The results for equation (2.2) that relates the leverage of firms to risk as well as several firm-specific variables are given in Table 2.5. The first two columns, indicated as the first and second models, use risk measures based on GDP in conjunction with the volatility in the level of sales and the cumulative volatility in sales, correspondingly. The third and fourth models use the risk measure based on T-bill rates while firm-specific risks are same as before. Recalling the correlations depicted in Table 2.3 , we believe that each measure captures a different aspect of risk in the environment within which firms operate. Furthermore, given the simple correlations in Table 2.4, we expect to find an inverse association between risk and leverage.

Before we examine the effects of risk on leverage, let us observe the role of the lagged dependent variable and the other firm-specific variables on leverage. Table 2.5 shows that the lagged leverage attains a positive sign providing evidence on the persistence of leverage: firms that borrowed in the previous period continue to use debt financing. As expected, the coefficients of $Sales$ and $Cash$ to total asset ratios are significant and negative implying that an improvement in sales and cash holdings enables firms to borrow less funds. The coefficient of investment rate is positive suggesting that increases in capital investment lead to an increase in the use of short-term debt as a means of external finance. Our findings for the firm-specific variables are generally consistent with the previous empirical work including that of Titman and Wessels (1988), Fama and French (2002), Rajan and Zingales (1995), Brav (2009), and Goyal, Nova, and Zanetti (2011).

The key finding emerging from Table 2.5 is that both types of risk exert a significant and negative effect on leverage. Specifically, for each model depicted in the table, we observe that idiosyncratic risk attains a significant and negative coefficient. The negative effect of idiosyncratic risk on firms' leverage is consistent with Titman and Wessels (1988), MacKie-Mason (1990), Wald (1999), and Baum, Stephan, and Talavera (2009), who also show empirically that firm-level risk has a negative and significant impact on leverage.[33] Table 2.5 also presents evidence that macroeconomic risk has a significant and negative impact on firms' leverage in all models, although the intensity of the estimated impact of macroeconomic risk on leverage depends on the risk measure used. Our observations are consistent with the findings of Hatzinikolaou, Katsimbris, and Noulas (2002) and Baum, Stephan, and Talavera (2009), who report a negative association between macroeconomic risk and the leverage of US non-financial firms.

The results in Table 2.5 provide evidence that the effects of risk on leverage are not only

[33] Our finding on the negative effect of firm-specific risk on a firm's leverage is, however, in contrast to the findings of Campello and Giambona (2010), who find a negative but statistically insignificant effect of earnings volatility on the choice of leverage of firms.

Table 2.5: Robust Two-step System-GMM Estimates for the Effects of Risk on Leverage

Panel A of the table reports the estimates obtained from robust two-step System-GMM estimations for combined effects of macroeconomic risk and firm-specific risk on firms' leverage. The figures given in parentheses are standard errors which are asymptotically robust to the presence of heteroskedasticity and serial correlation within panels. The dependent variable is leverage, defined as the ratio of short-term debt to total assets. The analysis covers the period 1999-2008 for panel of UK public and non-public firms. Model 1 estimates the joint impact of volatility in GDP and volatility in the level of sales on leverage. Model 2 estimates the joint impact of volatility in GDP and accumulative volatility in firms' sales on leverage. Model 3 estimates the joint impact of volatility in T-bills rates and volatility in the level of sales on firm's leverage. Model 4 estimates the joint impact of volatility in T-bills rates and cumulative volatility in sales on leverage. In all four models, the one period lagged values of the first difference of the right-hand side variables are used as instruments for the equations in levels. The instruments for differenced equations are the first and second lags for Model 1, 2, and 3. For Model 4, the second to fourth lags of the right-hand variables are used as instruments for first differenced equations. The method of measuring volatility and definitions of the remaining independent variables are given in Table 2-A, Appendix A. Panel C of the table reports the J statistics, which is a test of the over identifying restrictions and distributed as chi-squared under the null of instrument validity and the Arellano-Bond, AR(2), test of second-order autocorrelation in the first-differenced residuals. *** denotes statistical significance at the 1% level of significance. ** indicates statistical significance at the 5% level. * indicates statistical significance at the 10% level.

Panel A: Estimation results				
Regressors	**Model 1**	**Model 2**	**Model 3**	**Model 4**
	Coeff. Std. Error	Coeff. Std. Error	Coeff. Std. Error	Coeff. Std. Error
Lev_{it-1}	0.358 (0.134)***	0.316 (0.156)***	0.339 (0.127)***	0.439 (0.148)***
$Sales_{it}$	-0.015 (0.002)***	-0.014 (0.002)***	-0.016 (0.002)***	-0.017 (0.003)***
$Cash_{it}$	-0.113 (0.041)***	-0.116 (0.041)***	-0.126 (0.042)***	-0.127 (0.042)***
$Invt_{it}$	0.044 (0.020)**	0.049 (0.021)**	0.045 (0.020)**	0.043 (0.025)*
σ^{GDP}_{t-1}	-0.010 (0.002)***	-0.010 (0.002)***		
σ^{T-bill}_{t-1}			-0.453 (0.159)***	-0.844 (0.233)***
σ^{level}_{it-1}	-0.022 (0.008)***		-0.023 (0.009)***	
$\sigma^{cumulative}_{it-1}$		-0.029 (0.012)**		-0.069 (0.002)***
Constant	0.153 (0.026)***	0.157 (0.029)***	0.164 (0.025)***	0.156 (0.031)***
Panel B: Diagnostic tests				
Firm-years	23487	21001	23487	21001
Firm	5436	5301	5436	5301
AR(2)	-1.010	-1.011	-1.140	-0.14
p-value	0.310	0.311	0.254	0.889
J-statistic	12.77	10.86	12.29	9.04
p-value	0.850	0.828	0.583	0.433

similar across different measures of risk but they are robust when we implement different pairs of idiosyncratic and macroeconomic risk. Our findings so far provide support to the claim that manufacturing firms in the UK use less short-term debt in their capital structure when there is an increase in either macroeconomic or firm-specific risk. These results hold for each proxy that we use for either types of risk. Nevertheless, these results are too general and do not allow us to comment on whether risk affects public *versus* non-public firms differently. This is an important question as there are significant differences between the two types of firms. In particular, non-public firms are relatively small in size and they differ in terms of their ability to access the capital markets. Furthermore, they have generally less potential to absorb negative business shocks which render banks to act more cautiously towards non-public firms. Last, but not least, non-public firms exhibit relatively a high leverage ratio. We therefore continue our investigation to examine if risk affects leverage across public and non-public firms differently.

2.6.2 The Differential Impact of Risk across Public and Non-Public Firms

In this section, we seek to find out if risk has differential effects across public and non-public firms. To test for the possibility that risk exerts differential effects on public *versus* non-public firms, we estimate equation (2.3) where all firm-specific variables and risk measures are interacted with *Public* and *Non-public* dummies. The *Public* dummy is set to one if the firm is public and zero otherwise. The *Non-public* dummy is equal to $(1 - Public)$.

We estimate four dynamic models. Similar to Table 2.5, Models 1 and 2 use the volatility measure based on GDP to capture macroeconomic risks and that based on the level of sales and the cumulative-volatility measure to capture idiosyncratic risks, respectively. Models 3 and 4, use risk proxies based on Treasury bill rates along with the above two types of firm-specific volatility measures. Table 2.6, Panel A, reports the results. In all four cases, lagged leverage attains a positive and significant sign for both types of firms. However, the size of the coefficient for non-public firms is significantly larger than that of public firms showing that non-public firms' leverage has a greater persistence than that of public firms. This is expected as non-public firms generally depend on short-term debt to carry out their daily business activities while public firms have a wider choice to finance theirs. Sales and cash to total assets ratios also exhibit significant and negative effects on leverage. This effect is significantly greater in absolute value for public firms, once more signalling the fact that non-public firms cannot reduce their dependence on short-term borrowing as much as public firms when their sales and cash holdings improve.

We also find that the effect of investment on leverage is insignificant for non-public firms and significant for public firms. It is possible that the insignificance of the investment ratio for non-public firms is due to the fact that they have on average significantly less expenditure on capital investment as compared to their public counterparts (see Table 2.1). All of these variables in the remaining models in the table attain the same signs as in Model 1 and we therefore do not make further comments on them.[34] Overall, our results regarding firm-specific variables are in line with the earlier findings.[35]

When we turn to inspect the role of risk on leverage, we see from Table 2.6 that both

[34] To our knowledge, the impact of firm-specific variables on leverage, which we provide here for public *versus* non-public firms, has not been studied in the literature with the exception of Brav (2009) and Goyal, Nova, and Zanetti (2011).

[35] See, for example, Rajan and Zingales (1995), Fama and French (2002), Lemmon, Roberts, and Zender (2008), Baum, Stephan, and Talavera (2009), Brav (2009), Hovakimian and Li (2010a), and Goyal, Nova, and Zanetti (2011), among many others.

Table 2.6: Robust Two-step System-GMM Estimates for the Differential Effects of Risk on the Leverage of Public and Non-Public Firms

Panel A reports the estimates obtained from robust two-step System-GMM estimations for the effects of macroeconomic and firm-specific risk on firms' leverage, separately for non-public and public firms. The figures given in parentheses are standard errors which are asymptotically robust to the presence of heteroskedasticity and serial correlation within panels. To examine the differential impact of risk across both groups of firms, we construct $D_i^{nonpublic}$.X (D_i^{public}.X) as the explanatory variable X interacted with a dummy equal to one (zero) if the firm is non-public and zero (one) if the firm is public. The dependent variable is leverage, defined as the short-term debt scaled by total assets. The analysis covers the period 1999-2008 for a panel of UK non-public and public firms. Model 1 estimates the joint impact of volatility in GDP and volatility in the level of sales on leverage. Model 2 estimates the joint impact of volatility in GDP and cumulative volatility in firms' sales on leverage. Model 3 estimates the joint impact of volatility in T-bills rates and volatility in the level of sales on firm's leverage. Model 4 estimates the joint impact of volatility in T-bills rates and cumulative volatility in sales on leverage. The method of measuring volatility and definitions of the remaining independent variables are given in Table 2-A, Appendix A. Panel B of the table reports the test statistics along with its p-values for testing a differential effect of uncertainty. Panel C reports the J statistics, which is a test of the over identifying restrictions and distributed as chi-squared under the null of instrument validity and the Arellano-Bond, AR(2), test of second-order autocorrelation in the first-differenced residuals. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

Panel A: Estimation results				
Regressors	Model 1	Model 2	Model 3	Model 4
	Coeff. Std. Error	Coeff. Std. Error	Coeff. Std. Error	Coeff. Std. Error
$D_i^{nonpublic}.Lev_{it-1}$	0.759 (0.026)***	0.761 (0.031)***	0.775 (0.026)***	0.768 (0.033)***
$D_i^{public}.Lev_{it-1}$	0.528 (0.162)*	0.639 (0.184)*	0.340 (0.138)***	0.395 (0.135)*
$D_i^{nonpublic}.Sales_{it}$	-0.015 (0.002)***	-0.014 (0.002)***	-0.016 (0.001)***	-0.015 (0.002)***
$D_i^{public}.Sales_{it}$	-0.019 (0.007)***	-0.025 (0.009)***	-0.027 (0.010)***	-0.012 (0.006)*
$D_i^{nonpublic}.Cash_{it}$	-0.054 (0.009)***	-0.061 (0.011)***	-0.056 (0.009)***	-0.061 (0.012)***
$D_i^{public}.Cash_{it}$	-0.090 (0.028)***	-0.081 (0.027)***	-0.076 (0.035)***	-0.058 (0.028)***
$D_i^{nonpublic}.Invt_{it}$	0.001 (0.009)	0.002 (0.011)	0.003 (0.010)	0.001 (0.011)
$D_i^{public}.Invt_{it}$	0.111 (0.061)*	0.117 (0.058)**	0.146 (0.059)**	0.136 (0.059)***
$D_i^{nonpublic}.\sigma_{t-1}^{GDP}$	-0.009 (0.003)***	-0.007 (0.003)**		
$D_i^{public}.\sigma_{t-1}^{GDP}$	-0.016 (0.007)**	-0.015 (0.008)*		
$D_i^{nonpublic}.\sigma_{t-1}^{T-bill}$			-0.621 (0.294)**	-0.926 (0.328)***
$D_i^{public}.\sigma_{t-1}^{T-bill}$			-0.922 (0.418)**	-1.093 (0.461)**
$D_i^{nonpublic}.\sigma_{it-1}^{level}$	-0.025 (0.005)***		-0.027 (0.005)***	
$D_i^{public}.\sigma_{it-1}^{level}$	-0.004 (0.002)**		-0.005 (0.002)**	
$D_i^{nonpublic}.\sigma_{it-1}^{cumulative}$		-0.050 (0.013)***		-0.056 (0.013)***
$D_i^{public}.\sigma_{it-1}^{cumulative}$		-0.004 (0.002)**		-0.007 (0.002)***
Constant	0.078 (0.006)***	0.074 (0.007)***	0.085 (0.008)***	0.086 (0.008)***
Panel B: Tests for differential effects of risk				
$\sigma_{firm}^{public} = \sigma_{firm}^{nonpublic}$	15.410	11.010	16.290	13.170
p-value	0.000	0.000	0.000	0.000
$\sigma_{macro}^{public} = \sigma_{macro}^{nonpublic}$	0.530	0.580	0.330	0.090
p-value	0.467	0.445	0.565	0.760
Panel C: Diagnostic tests				
Firm-years	23,487	21,001	23,487	21,001
Firm	5,436	5,301	5,436	5,301
AR(2)	0.210	-0.003	0.170	-0.160
p-value	0.837	0.998	0.869	0.873
J-statistic	39.210	42.370	40.080	28.640
p-value	0.211	0.127	0.113	0.156

idiosyncratic and macroeconomic risk exert a significant and negative impact on leverage. However, the impact of idiosyncratic risk on non-public firms is significantly stronger than that on public firms as equality test results in Panel B of the table shows. Equality test results indicate that the equality of coefficients is strongly rejected in all four models for idiosyncratic risk. As expected, this confirms that non-public firms' leverage is more sensitive to idiosyncratic risk as compared to public firms. In contrast, the magnitude of the estimates on macroeconomic risk is larger for public firms in comparison to that of non-public firms, yet they are not statistically different from that of non-public firms. This suggests that both groups of firms experience negative effects due to macroeconomic risk of similar intensity.

In summary, the results presented in Table 2.6 indicate that both groups of firms exhibit a negative sensitivity to idiosyncratic and macroeconomic risk. Our results also suggest that the leverage of non-public firms is relatively more sensitive to idiosyncratic risk than that of public firms. The greater sensitivity of non-public firms to idiosyncratic risk is sensible as non-public firms are more informationally opaque to their external financiers, and since banks are likely to be more cautious about adverse selection and moral hazard problems in an environment where business risk is high, non-public firms will be unable to attract external financing in periods of heightened risk. As a result, they use less debt in their capital structure as reflected in reductions of their leverage ratio.

2.6.3 The Spillover Effects of Risk: Does Risk Affect Firm's Leverage through Cash Holdings?

Having established the impacts of both types of risk on leverage and the differential effects of risk across public *versus* non-public firms' leverage, we next turn to investigate whether risk affects firms' leverage through the cash holdings of firms as shown in equation (2.4). In other words, we would like to find out whether the effect of risk on a firm's leverage changes as the amount of the cash holdings of the firm evolves over time. We therefore introduce an interaction term between our measures of risk and firms' cash holding levels. This term captures the 'spillover effect' of risk on leverage through firms' cash holdings and in turn tests whether the sensitivity of the leverage of firms to risks intensified when firms hold high levels of cash. Table 2.7 presents the results for three models which make use of risk measures based on sales level and that based on GDP as depicted by σ^{level} and σ^{GDP}, respectively.[36] Models 1 and 2 respectively quantify the spillover effects of idiosyncratic risk and macroeconomic risk separately and Model 3 presents our results when both types of risk are simultaneously present in the environment. We should note prior to discussing the interaction terms that the own effects of risk in this set of regressions are similar to those reported earlier. The only difference is that the coefficient of firm-specific risk is statistically insignificant for public firms for Models 1 and 3. However, this finding does not necessarily mean that firm-specific risk in not operational for the case of public firms, which we will come back to later when we discuss the interaction terms.

Table 2.7 shows that the coefficient on the idiosyncratic risk-cash holdings interaction

[36] The results from other combinations are qualitatively similar to those in Table 2.7 and are available from the authors on request.

Table 2.7: Robust Two-step System-GMM Estimates for the Spillover Effects of Risk on the Leverage of Public and Non-Public Firms

Panel A reports the estimates obtained from robust two-step System-GMM estimations, separately as well as jointly, for the spillover effects of macroeconomic and firm-specific risk on firms' leverage, separately for non-public and public firms. The figures given in parentheses are standard errors which are asymptotically robust to the presence of heteroskedasticity and serial correlation within panels. To examine the differential impact of risk across non-public and public firms, we construct $D_i^{nonpublic}$.X (D_i^{public}.X) as the explanatory variable X interacted with a dummy equal to one (zero) if the firm is non-public and zero (one) if the firm is public. The dependent variable is leverage, defined as the ratio of short-term debt to total assets. The analysis covers the period 1999-2008 for a panel of UK non-public and public firms. Model 1 estimates the spillover effect of firm-specific risk on firms' leverage. Model 2 estimates the spillover effect of macroeconomic risk on firms' leverage and Model 3 estimates the spillover effects of both macroeconomic and firm-specific risk on firm leverage jointly. The method of measuring volatility and definitions of the remaining independent variables are given in Table 2-A, Appendix A. Panel B of the table reports the J statistics, which is a test of the over identifying restrictions and distributed as chi-squared under the null of instrument validity and the Arellano-Bond, AR(2), test of second-order autocorrelation in the first-differenced residuals. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

	Panel A: Estimation results		
Regressors	**Model 1**	**Model 2**	**Model 3**
	Coeff. Std. Error	Coeff. Std. Error	Coeff. Std. Error
$D_i^{nonpublic}.Lev_{it-1}$	0.636 (0.049)***	0.584 (0.032)***	0.588 (0.032)***
$D_i^{public}.Lev_{it-1}$	0.348 (0.184)*	0.418 (0.132)***	0.420 (0.132)***
$D_i^{nonpublic}.Sales_{it}$	-0.016 (0.001)***	-0.015 (0.001)***	-0.015 (0.002)***
$D_i^{public}.Sales_{it}$	-0.024 (0.009)***	-0.031 (0.007)***	-0.030 (0.007)***
$D_i^{nonpublic}.Cash_{it}$	-0.076 (0.012)***	-0.099 (0.014)***	-0.098 (0.015)***
$D_i^{public}.Cash_{it}$	-0.096 (0.040)***	-0.167 (0.046)***	-0.156 (0.046)***
$D_i^{nonpublic}.Invt_{it}$	0.007 (0.012)	0.014 (0.012)	0.015 (0.012)
$D_i^{public}.Invt_{it}$	0.155 (0.069)**	0.121 (0.059)**	0.122 (0.059)**
$D_i^{nonpublic}.\sigma_{t-1}^{GDP}$	-0.009 (0.003)***	-0.011 (0.003)***	-0.012 (0.003)***
$D_i^{public}.\sigma_{t-1}^{GDP}$	-0.017 (0.008)**	-0.029 (0.010)***	-0.029 (0.010)***
$D_i^{nonpublic}.\sigma_{it-1}^{level}$	-0.032 (0.009)***	-0.038 (0.007)***	-0.035 (0.009)***
$D_i^{public}.\sigma_{it-1}^{level}$	-0.002 (0.002)	-0.006 (0.002)**	-0.001 (0.002)
$D_i^{nonpublic}.Cash_{it}.\sigma_{it-1}^{level}$	-0.037 (0.093)		-0.056 (0.099)
$D_i^{public}.Cash_{it}.\sigma_{it-1}^{level}$	-0.164 (0.075)**		-0.165 (0.078)**
$D_i^{nonpublic}.Cash_{it}.\sigma_{t-1}^{GDP}$		0.033 (0.025)	0.034 (0.025)
$D_i^{public}.Cash_{it}.\sigma_{t-1}^{GDP}$		0.119 (0.069)*	0.117 (0.069)*
Constant	0.106 (0.011)***	0.115 (0.007)***	0.114 (0.008)***
	Panel B: Diagnostic tests		
Firm-years	23,487	23,487	23,487
Firm	5,436	5,436	5,436
AR(2)	-0.060	-0.180	-0.170
p-value	0.954	0.858	0.869
J-statistic	52.360	65.960	87.500
p-value	0.309	0.195	0.118

is negative for both public and non-public firms. However, the interaction is statistically meaningful only for the public firms. This implies that when (public) firms experience idiosyncratic risk, an increase in cash holdings will lead firms to further reduce their debt holdings.[37] In contrast, the estimates on the interaction of macroeconomic risk and

[37]This finding is in line with the findings of Ozkan and Ozkan (2004) that indicate that those UK firms

cash holdings are positive for both groups of firms while this interaction is statistically meaningful only for the public firms. The positive coefficient on the interaction term suggests that an increase in cash holdings will motivate the manager to increase the firms' leverage in times of high macroeconomic risk: in times of macroeconomic risk the manager of the (public) firm can convince the lenders to extend more credit in the short run, given that the firm's cash stocks are high. That is, the fact that higher macroeconomic risks would not prevent a firm rich in cash holdings to borrow more funds in the short run. An alternative rationale is that during uncertain states of the economy, firms are more likely to face volatility in their retained earnings. As a result, they would prefer to use short-term debt to finance their operations rather than depleting their internal funds.

2.6.4 The Full Impact of Risk on Leverage

To gauge the full impact of risk at a particular level of cash holdings, we must compute the total derivative of leverage with respect to idiosyncratic and macroeconomic risk as shown in the following equations:

$$\frac{\partial Lev}{\partial \sigma_{firm}} = \hat{\Psi}_{\sigma_{firm}} + \hat{\Psi}_{\sigma_{firmCash}} \times Cash^{*} \tag{2.5}$$

$$\frac{\partial Lev}{\partial \sigma_{macro}} = \hat{\Psi}_{\sigma_{macro}} + \hat{\Psi}_{\sigma_{macroCash}} \times Cash^{*} \tag{2.6}$$

where $\hat{\Psi}_{\sigma_{firm}}$, $\hat{\Psi}_{\sigma_{firmCash}}$ refer to the estimated coefficients associated with the idiosyncratic risk and the idiosyncratic risk—cash holdings interaction, respectively. Similarly, $\hat{\Psi}_{\sigma_{macro}}$ and $\hat{\Psi}_{\sigma_{macroCash}}$ denote the coefficients associated with macroeconomic risk and the macroeconomic risk—cash holdings interaction. $Cash^{*}$ refers to a particular level of cash holdings which we compute at the 10^{th}, 25^{th}, 50^{th}, 75^{th}, 80^{th} and 90^{th} percentiles. The results of these total derivatives are reported in Tables 2.8 and 2.9 for public and non-public firms separately while we plot these estimates in Figures 2.1–2.4 along with the 95% confidence interval.

Panel A of Table 2.8 gives the total derivatives with respect to idiosyncratic risk for public firms. These values are negative and significantly different from zero at all levels of cash holdings apart from when cash holding is very low. For those firms that that operate with very low cash holdings (around or less than the 10^{th} percentile), idiosyncratic risks do not affect the public firms' leverage. However, as cash stocks of the firm increase, idiosyncratic risk begins to adversely affect public firms' leverage. These estimates provide evidence that the total effect of risk on leverage is substantially related to cash holdings of the company. In Panel B of the same table, we present the estimates of total derivatives

that have higher levels of cash holdings appear to have lower levels of leverage and bank debt.

Table 2.8: Sensitivity of Public Firms' Leverage to Risk and Cash Holdings

Panel A reports the percentiles of the cash-to-total assets ratio, estimates of the total derivatives of leverage (*Lev*) with respective to idiosyncratic risk (σ_{firm}) at particular levels of cash holdings, standard errors and p-values associated with the test of the significance of the estimates. Panel B reports the percentiles of the cash-to-total assets ratio, estimates of the total derivatives of leverage (*Lev*) with respective to macroeconomic risk (σ_{macro}) at particular levels of cash holdings, standard errors and p-values associated with the test of the significance of the estimates.

Panel A: Idiosyncratic Risk Effects and Cash/Assets Holdings						
	P10	**P25**	**P50**	**P75**	**P80**	**P90**
Cash/assets	2.1E-03	1.6E-02	5.4E-02	1.5E-01	1.8E-01	3.1E-01
$\frac{\partial Lev}{\partial \sigma_{firm}}$	-0.002	-0.004	-0.010	-0.025	-0.031	-0.051
Std. Error	0.003	0.002	0.003	0.010	0.013	0.020
p-value	0.508	0.069	0.004	0.013	0.016	0.022
Panel B: Macroeconomic Risk Effects and Cash/Assets Holdings						
Cash/assets	2.1E-03	1.6E-02	5.4E-02	1.5E-01	1.8E-01	3.1E-01
$\frac{\partial Lev}{\partial \sigma_{macro}}$	-0.029	-0.027	-0.023	-0.012	-0.008	0.007
Std. Error	0.010	0.009	0.008	0.007	0.009	0.016
p-value	0.004	0.003	0.003	0.102	0.331	0.673

of leverage with respect to macroeconomic risk. Although the total effect is significantly negative at lower levels cash holdings, it becomes insignificant as public firms accumulate higher levels (at around or more than 75th percentile) of cash.[38] This suggests that those firms which hold low levels of cash during uncertain states of the economy tend to reduce their leverage more than those that hold higher levels of cash. In fact macroeconomic risk does not affect the capital structure of the firm when it holds high levels of cash. This finding is the opposite to that for the case of idiosyncratic risk.

Next we calculate the same set of derivatives for non-public firms and report these estimates in Table 2.9. Panel A of the table shows that the aggregate effect of idiosyncratic risk is negative and significant at all levels of cash holdings. Indeed, this effect increases monotonically as firms accumulate more cash implying that in response to higher business-risk, firms with big cash hoards tend to reduce their leverage by a greater amount as compared to those firms which have relatively lower levels of cash holdings. Looking at Panel B of Table 2.9, we see that the total derivative of leverage with respective to macroeconomic risk is negative and significant unless firms' cash holdings exceed the 75th percentile level. That is, firms that hold high levels of cash do not change their leverage in response to macroeconomic risk. These observations are similar to that of public firms but are more pronounced.

Figures 2.1 to 2.4 plot the estimates and the corresponding 95% confidence intervals given in Tables 2.8 and 2.9 helping us to visually compare the effects of both types of risk for public and non-public firms. Figures 2.1 and 2.3 show that the effect of risk on leverage

[38] The total derivative with respect to macroeconomic risk becomes insignificant and positive at or above the 90^{th} percentile of cash holdings.

Table 2.9: Sensitivity of Non-Public Firms' Leverage to Risk and Cash Holdings

Panel A reports the percentiles of the cash-to-total assets ratio, estimates of the total derivatives of leverage (Lev) with respective to idiosyncratic risk (σ_{firm}) at particular levels of cash holdings, standard errors and p-values associated with the test of the significance of the estimates. Panel B reports the percentiles of the cash-to-total assets ratio, estimates of the derivatives of leverage (Lev) with respective to macroeconomic risk (σ_{macro}) at particular levels of cash holdings, standard errors and p-values associated with the test of the significance of the estimates.

Panel A: Idiosyncratic Risk Effects and Cash/Assets Holdings						
	P10	**P25**	**P50**	**P75**	**P80**	**P90**
Cash/assets	4.3E-04	9.2E-03	5.7E-02	1.7E-01	2.2E-01	3.5E-01
$\frac{\partial Lev}{\partial \sigma_{firm}}$	-0.034	-0.035	-0.038	-0.044	-0.047	-0.054
Std. Error	0.009	0.008	0.007	0.013	0.017	0.029
p-value	0.000	0.000	0.000	0.001	0.008	0.069
Panel B: Macroeconomic Risk Effects and Cash/Assets Holdings						
Cash/assets	4.3E-04	9.2E-03	5.7E-02	1.7E-01	2.2E-01	3.5E-01
$\frac{\partial Lev}{\partial \sigma_{macro}}$	-0.012	-0.011	-0.009	-0.005	-0.004	0.000
Std. Error	0.004	0.003	0.003	0.004	0.004	0.007
p-value	0.003	0.003	0.002	0.114	0.325	0.967

for both type of firms is negative and relates to the amount of firms' cash holdings. In particular, we see that the adverse effect of idiosyncratic risk strengthens as firms' cash holdings increase. We also see that non-public firms are affected worse than public firms. At low levels of cash, public firms do not respond to idiosyncratic risk. Perhaps this is due to the fact that public firms have a track record and they can borrow easily despite the fact that they are going through a rough period. However, non-public firms do not have such a luxury; in periods of high idiosyncratic risk they can only borrow less due to financial frictions. Interestingly, when both types of firm carry very high levels of cash, the effect of risk on leverage is almost the same across the two types of firms. This is perhaps due to firm managers trying to avoid high risk premiums demanded by the lenders in periods of internal unrest.

When we compare Figures 2.2 and 2.4, we see that the impact of macroeconomic risk on both types of firms is almost the same except for the impact size: the effect of macroeconomic risk on both types of firms is negative but the impact is much higher for public firms. The figure also clearly shows that the adverse effect of macroeconomic risk for both types of firms becomes insignificant as firms' cash stocks exceed the 70th percentile. One possibility why public firms are more affected in times of higher macroeconomic risk than non-public firms is that public firms can afford to reduce their short-term borrowing in comparison to non-public firms as they can rely on raising funds from nonbank sources of finance such as equity financing and commercial paper (see Kashyap, Stein, and Wilcox (1993)). Whereas non-public firms cannot do so and are constrained to borrow from banks. Once banks start to contract their loans in periods of macroeconomic turmoil, non-public

Figure 2.1

Marginal Effects of Idiosyncratic Uncertainty on Public Firms' Leverage

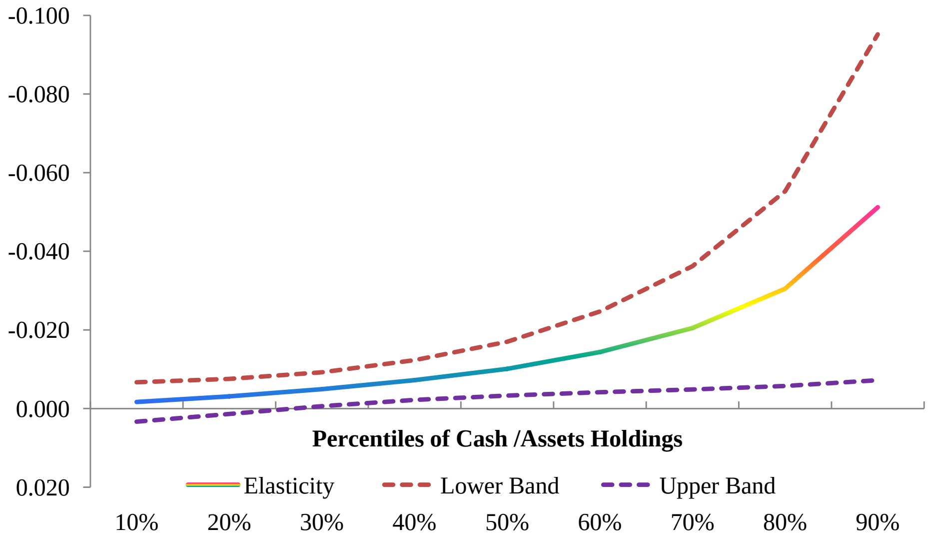
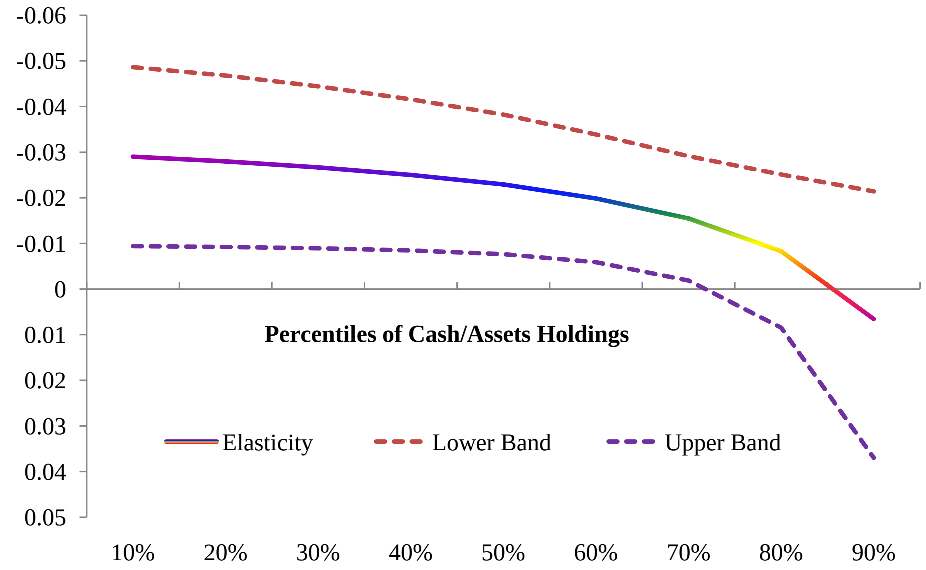


Figure 2.2

Marginal Effects of Macroeconomic Uncertainty on Public Firms' Leverage



firms cannot borrow as much as despite their willingness to pay high risk premiums. As the figure shows, it is only when cash holdings of companies improve the overall impact of macroeconomic risk on leverage disappears. We conjecture that companies rich in cash can borrow at better terms as they are considered to be less likely to default in periods of high macroeconomic risk.

The analysis above suggests that a firm with high levels of cash holdings tend to reduce short-term debt financing by a larger amount relative to a firm with low levels of cash holdings in response to an increase in idiosyncratic risk. In contrast the leverage of a firm that holds high levels of cash is not necessarily affected from an increase in macroeconomic

Figure 2.3
Marginal Effects of Idiosyncratic Uncertainty on Non-Public Firms' Leverage

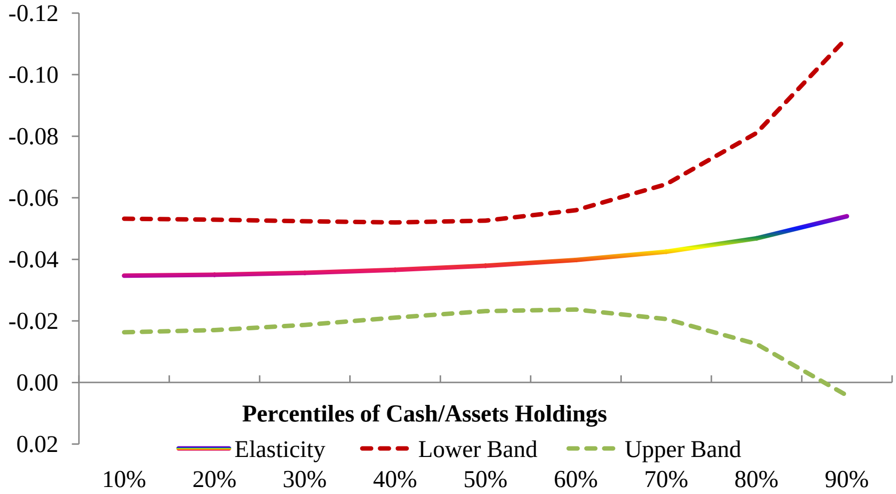
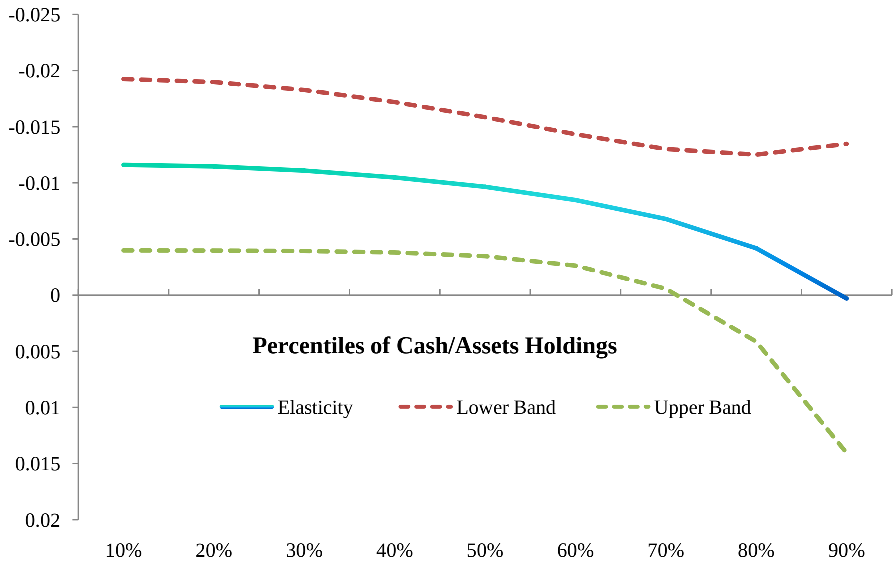


Figure 2.4
Marginal Effects of Macroeconomic Uncertainty on Public Firms' Leverage



risk in comparison to those firms which has less cash holdings. This observation indicates that models that do not take into account the interaction between risk and firms' cash holdings are likely to yield inaccurate conclusions regarding the effect of risk on leverage. Overall, our results indicate that i) there are (significant) differences on the size of the impact of risk on firms' leverage across public and non-public companies; ii) the effect of risk on leverage depends on the type of risk and the extent of cash holdings that each firm holds.

2.7 Robustness Tests

In our analysis, we examine the effects of idiosyncratic and macroeconomic risk on firms' leverage by incorporating both types of risk in the same model as we assume that these measures of risks are jointly operational. However, it is possible that the macroeconomic risk may drive the effect of idiosyncratic risk on firms' leverage, and vise versa. Therefore, in order to ensure that the effect of one source of risk is not driven by the other source of risk, we re-estimate our models separately to examine separately the effect of macroeconomic and idiosyncratic risk on the target leverage of public and non-public firms. It is also possible that the (negative) effects of risk on firms' target leverage are driven by a specific measure of risk. To guard ourself from this possibility, we re-estimate our models using an alternative measure of risk for each source of risk.

The measure of firm-specific risk is constricted by estimating a model on the growth of firm sale (ΔlnS_{it}) using firm fixed-effects ($\acute{f_i}$) and year fixed-effects ($\acute{f_t}$). More specifically, we estimate the model: $\Delta lnS_{it} = \acute{f_i} + \acute{f_t} + \acute{\psi}_{it}$, where $\acute{\psi}_{it}$ is the error term with zero mean and finite variance. In particular, the absolute value of the residual obtained from this model, $\sigma_{it}^{growth} = |\psi_{it}^{'}|$, represents the fluctuations with respect to both the cross-firm and the cross-year average growth of sales which we use as a proxy for idiosyncratic risk. This measure is earlier used by Morgan, Rime, and Strahan (2004) and Kalemli-Ozcan, Sørensen, and Volosovych (2010). To proxy macroeconomic risk, we compute the equal weighted conditional variance index (σ_t^{Index}) using the conditional variance of gross domestic product, Treasury bills rates, and the Consumer Price Index (CPI) obtained from GARCH models.

Tables 2.10 and 2.11 present the results on the impact of idiosyncratic and macroeconomic risk on firms' leverage, respectively. In particular, Table 2.10 displays the impact of three different measures of firm-specific risk on leverage. Model 1 consider the impact of risk based on the level of sales. Model 2 implements the impact of cumulative volatility in the level of sales and Model 3 estimates the impact of volatility constricted based on the growth sales. Table 2.11 provides the estimates of a model similar to Table 2.10 except that we now concentrate on the effects of macroeconomic risk on firms' leverage. In particular, Models 1 and 2 use risk measures based on gross domestic product, and Treasury bill rates, respectively. Model 3 uses a weighted index based on gross domestic product, Treasury bill rates and the consumer price index. Observing the coefficient of the uncertainty measures in both tables, we see that the coefficient is negative and statistically significant in each model. These findings provide evidence that our results are not only similar across different measures of risk but they are also robust when we estimate the effect of idiosyncratic and macroeconomic risk on firms' leverage separately. The results

Table 2.10: Robustness: Robust Two-step System-GMM Estimates for Firm-Specific Risk Effects on Leverage

Panel A of the table reports the estimates obtained from robust two-step System-GMM estimations for firm-specific risk effects on firms' leverage decisions. The figures given in parentheses are standard errors and they are asymptotically robust to heteroskedasticity. The dependent variable is leverage, defined as the short-term debt scaled by total assets. The analysis covers the period 1999-2008 for a panel of UK public and non-public firms. Model 1 estimates the impact of volatility in the level of sales on a firm's leverage. Model 2 estimates the impact of cumulative volatility in level of sales on a firm's leverage and Model 3 estimates the impact of volatility in growth of sales on leverage. In all three models, the one period lagged values of the first difference of the right-hand side variables are used as instruments for the equations in levels. The instruments for differenced equations are the second to fourth lags, the second to sixth lags and the first to sixth lags of the right-hand side variables for Model 1, 2, and 3, respectively. The method of measuring volatility and definitions of the remaining independent variables are given in Table 2-A, Appendix A. Panel B reports the J statistics, which is a test of the over identifying restrictions and distributed as chi-squared under the null of instrument validity and the Arellano-Bond, AR(2), test of second-order autocorrelation in the first-differenced residuals. *** denotes statistical significance at the 1% level of significance. ** indicates statistical significance at the 5% level. * indicates statistical significance at the 10% level.

Panel A: Estimation results						
Regressors	**Model 1**		**Model 2**		**Model 3**	
	Coeff.	Std. Error	Coeff.	Std. Error	Coeff.	Std. Error
Lev_{it-1}	0.338	(0.098)***	0.437	(0.112)***	0.361	(0.100)***
$Sales_{it}$	-0.014	(0.002)***	-0.012	(0.002)***	-0.015	(0.002)***
$Cash_{it}$	-0.062	(0.025)***	-0.107	(0.039)***	-0.087	(0.035)***
$Invt_{it}$	0.053	(0.017)***	0.041	(0.018)**	0.057	(0.018)***
σ_{it-1}^{level}	-0.021	(0.007)***				
$\sigma_{it-1}^{cumulative}$			-0.012	0.003)***		
σ_{it-1}^{growth}					-0.047	(0.026)**
Constant	0.146	(0.018)***	0.127	(0.021)***	0.153	(0.020)***
Panel B: Diagnostic tests						
Firm-years	23,487		21,001		19,741	
Firm	5,436		5,301		4,944	
AR(2)	-1.202		-0.558		-1.034	
p-value	0.229		0.576		0.301	
J-statistic	37.470		32.030		48.290	
p-value	0.164		0.778		0.173	

related to firm-specific variables reveal that the effects of firms-specific factors hold true regardless of whether we incorporate both idiosyncratic and macroeconomic risk into our model separately or jointly.

We also examine the robustness of the differential effects of idiosyncratic and macroeconomic risk across public and non-public firms by estimating the the differential effects of both types of risk separately and using alternative risk measures for each source of risk. The results are presents in Tables 2.12 and 2.13. In both tables, our results regrading firm-specific variables for both public and non-public firms are similar to that in Panel A of Table 2.6. The results provide evidence that the effect of firm-specific risk on leverage is significant and negative for both public and non-public firms. Equality test results, shown in Panel B of Table 2.12 , indicate that the equality of coefficients is strongly rejected in

Table 2.11: Robustness: Robust Two-step System-GMM Estimates for Macroeconomic Risk Effects on Leverage

Panel A of the table reports the estimates obtained from robust two-step System-GMM estimations for macroeconomic uncertainty effects on firms' leverage decisions. The figures given in parentheses are standard errors which are asymptotically robust to the presence of heteroskedasticity and serial correlation within panels. The dependent variable is leverage, defined as the short-term debt scaled by total assets. The analysis covers the span 1999-2008 for a panel of UK public and non-public firms. Model 1 estimates the impact of volatility in GDP on leverage. Model 2 estimates the impact of volatility in T-bills rates on leverage and Model 3 estimates the impact of equal weighed volatility index on firm's leverage. In all three models, the one period lagged values of first difference of the right-hand side variables are used as instruments for the equations in levels. The instruments for differenced equations are the second and third lags of the right-hand side variables for all three models. The method of measuring volatility and definitions of the remaining independent variables are given in Table 2-A, Appendix A. Panel B of the table reports the J statistics, which is a test of the over identifying restrictions and distributed as chi-squared under the null of instrument validity and the Arellano-Bond, AR(2), test of second-order autocorrelation in the first-differenced residuals. *** denotes statistical significance at the 1% level of significance. ** indicates statistical significance at the 5% level. * indicates statistical significance at the 10% level.

Regressors	Model 1		Model 2		Model 3	
	Coeff.	Std. Error	Coeff.	Std. Error	Coeff.	Std. Error
Panel A: Estimation results						
Lev_{it-1}	0.318	(0.127)**	0.327	(0.128)***	0.317	(0.127)**
$Sales_{it}$	-0.014	(0.002)***	-0.015	(0.002)***	-0.014	(0.001)***
$Cash_{it}$	-0.115	(0.041)***	-0.123	(0.041)***	-0.116	(0.041)***
$Invt_{it}$	0.047	(0.019)**	0.044	(0.019)**	0.047	(0.020)**
σ_{t-1}^{GDP}	-0.010	(0.003)***				
σ_{t-1}^{T-bill}			-0.460	(0.159)***		
σ_{t-1}^{Index}					-0.040	(0.010)***
Constant	0.157	(0.024)***	0.162	(0.025)***	0.156	(0.024)***
Panel B: Diagnostic tests						
Firm-years	24394		24394		24394	
Firm	5713		5713		5713	
AR(2)	-1.129		-1.066		-1.130	
p-value	0.259		0.286		0.258	
J-statistic	14.080		12.550		14.130	
p-value	0.779		0.562		0.776	

all three models. This confirms that our finding that non-public firms' leverage decisions are more sensitive to idiosyncratic risk than public firms' leverage decisions are robust not only to an alternative measure of firm-specific risk but they are also robust when only firm-specific risk is incorporated in the model.

The results in Table 2.13 confirm the robustness of the finding that the leverage decisions of both public and non-public firms are negatively (and significantly) affected by macroeconomic risk. Further, equality tests provide evidence that macroeconomic risks have a similar impact on both public and non-public firms' leverage decisions. Overall, the results from robustness tests suggest that our earlier findings are robust and confirm that both idiosyncratic and macroeconomic risk have significant negative effects on the capital structure decisions of firms. The tests of robustness also confirm that non-public firms' leverage exhibits a greater sensitivity to idiosyncratic risk as compared to public firms while the sensitivity of leverage to macroeconomic uncertainty is similar for public and non-public firms.

We also use an alternative definition of leverage in order to examine the robustness of the effects of risk on the leverage decisions of firms. Specifically, we examine the sensitive of leverage to firm-specific and macroeconomic risk across publicly listed and privately owned firms and the differential impacts of both types of risk on leverage across different levels of firms' cash holdings by re-estimating the models with the total debt (short-term debt + long-term debt) to total assets ratio. We consider this measure of leverage to ensure that the effects of risk that we reported earlier are not driven by a specific measure of leverage.

Table 2.14 presents the results from regressions of total debt to total assets ratio on both firm-specific and macroeconomic risks as well as firm-specific control variables. In particular, we re-estimate two models. Model 1 estimates the effects of volatility in real GDP and volatility in the level of firms' net sales normalized by total assets on the leverage decisions of publicly listed and private owned firms, while Model 2 estimates the effects of volatility in real GDP and cumulative volatility in firms' net sales normalized by total assets on the leverage of both groups of firms. Other specifications are similar to those reported in Table 2.6 except that the dependent variable in these models is the ratio of the total debt (short-term debt + long-term debt) to total assets ratio.

Regarding the impacts of both types of risk on the leverage of public and private firms, the results from these models are generally similar to those reported in Table 2.6 in terms of their sign and statistical significance. Specifically, as one can see from the table, the coefficient estimates of both types of risk are negative and statistically significant. This suggests that firms appear to reduce their use of total debt in their capital structure when they face higher risks in their own business activities and when macroeconomic conditions become relatively more volatile.

The coefficient estimates on other firm-specific variables are also similar to those reported earlier. As before, the results suggest that privately owned firms exhibit greater leverage persistence than that public firms do. The leverage of a firm decrease with the firm's net sales to total assets ratio regardless of the type of the firm. Likewise, leverage is negatively related to the cash holdings of firms for both publicly listed and privately owned firms. However, while the impact of firms' investment spending is positive both categories of firms, it is statistically significant for only public firms. This finding is also similar to our earlier findings. The results from Model 2 suggest that the effects of both types of risk on the leverage decisions of publicly listed and privately owned firms are robust to different measures of firm-specific risk.

Table 2.15 presents from the regression where we include the interactions between our measures of risk and the cash holdings of firms. Specifically, we study how firm-specific and macroeconomic risk affect the leverage policies of publicly listed and private owned firms differently as firms stockpile their cash reserves. The model specification is similar to those we use in Table 2.7. The only difference is that we now consider leverage as the ratio of total debt (short-term debt + long-term debt) to total assets instead of the ratio of short-term debt to total assets. Overall, the results presented in Table 2.15 are similar to our earlier results presented in Table 2.7.

Consistent with the findings discussed above, the leverage of public and private firms is negatively related with risk regardless of the type of risk. This suggest that firms appear to reduce their outstanding amounts of debt when they go through periods of either internal or external unrest. As we find earlier, the estimated coefficient on the interaction term between firm-specific risk and the cash holdings of firms is negative for both public and private firms. However, it appears statistically significant only for the publicly listed firms. In combination with the direct impact of firm-specific risk on leverage, this negative indirect impact suggests that public firms are likely to reduce their leverage by a relatively greater amount in result of increases in firm-specific risk when they have higher levels of cash holdings than when they have relatively lower levels of cash holdings.

The results on the impact of macroeconomic risk via the cash holding decisions of firms are also similar to those presented in Table 2.7–it is positive for both publicly listed and privately owned firms but it is statistically meaningful only for the former one. Taken together with the direct of impact of macroeconomic risk on leverage decisions, these results suggest that public firms are less likely to reduce their leverage ratios in response to a rise in the volatility of macroeconomic conditions when they are rich in their cash holdings. The results on other firm-specific variables in Table 2.15 are similar to those in Tables 2.6 and 2.14. The only exception is the results on sales-to-asset ratio, which now appears statistically significant only for privately owned firms. Taken as a whole, the results presented in Tables 2.14 and 2.15 suggest that both direct and indirect effects of firm-specific and macroeconomic risk are robust to alternative measures of leverage.

So far we show that the negative effects of firm-specific and macroeconomic risk on the leverage decisions of private and public firms are robust to different proxies for firm-specific and macroeconomic risk, alternative measures of firm leverage, and when only firm-specific or macroeconomic risk is included into the leverage regression. The specifications of our baseline leverage regression are similar to those in Baum, Stephan, and Talavera (2009). Specifically, based on the firm value optimization problem, Baum, Stephan, and Talavera (2009) propose a theoretical model which establishes the link between firm leverage and firm-specific and macroeconomic risk. In particular, the model proposed by Baum, Stephan, and Talavera (2009) is a generalization of the standard Q models of investment proposed by Whited (1992) and Hubbard and Kashyap (1992).

As in Baum, Stephan, and Talavera (2009), we use the ratio of sales to total assets, the ratio of investment to total assets, the ratio of cash to total assets, and the one-period lagged of dependent variable (leverage) as firm-specific control variables when estimating the impact of risks of leverage. However, one may argue that not controlling for firm-specific factors that are commonly used in capital structure studies (e.g., Rajan and Zingales (1995), Baker and Wurgler (2002), and Hovakimian (2006)) can affect our finding that leverage is negatively related to risks. Therefore, we re-estimate the effects of risk on the leverage decisions of private and public firms by using the profitability of firm, firm size, tangibility, firm growth, and cash to total assets as control variables.[39] The results are presented in Table 2.17. Specifically, we estimate two models. Model 1 only estimates the direct impact of risks on firm leverage decisions. The specifications of Model 2 are similar to those in Model 1 except it includes the interactions between risk measures and the cash holdings of firms.

The results on the direct and indirect impact of firm-specific and macroeconomic risk are qualitatively similar to those in Tables 2.6 and 2.7. Specifically, the results in Table 2.17 indicate that the leverage decisions of both private and public firms are negatively and statistically significantly related to firm-specific and macroeconomic risk. These findings confirm that the effects of risk on firm leverage that we reported earlier are robust, even after controlling for firm-specific factors commonly used in the literature. From Model 1, the coefficient estimates on these firm-specific variables indicate that consistent with the findings of Brav (2009) and Goyal, Nova, and Zanetti (2011), leverage increases with firm size, while it decreases with the profitability of firm for both private and public firms. The leverage decisions of both private and public firms are negatively affected by past sales growth. However, leverage is positively and statistically significantly related to tangibility only for private firms.

As we discussed earlier, privately owned firms are generally smaller on average than publicly traded firms and thus, they could have different investment and financing policies. Although we report above that the results on the impact of risks on firm leverage decisions are unaffected, both in terms of sign and statistical significance, by controlling for firm size, the differences in firm size may nonlinearly affect the estimated coefficient. In other words, the differences in size between public and private firms may cause the sample selection bias problem. To insure that our findings are not suffered from the the sample selection bias problem, we also study the effects of risk on leverage for a sub-sample of privately owned and publicly traded firms matched on the basis of size, industry and the year-end.

[39] For this exercise, firm leverage is defined as the ratio of total debt (short-term debt + long-term debt) to total assets.

The results are presented in Table 2.18.[40]

For each privately owned firm and in each year, we select, without and with replacement, a size-matched firm from the sample of publicly traded firms with the same industry and year. The chosen public firms are the closest in size measured based on total assets to the privately owned firms, the maximum difference is not more than 5%. The results from this matched sample indicate that the coefficient on both firm-specific and macroeconomic risk are consistent, in terms of their signs and statistical significance, with the full sample results presented in Table 2.17. These results confirm that our earlier findings are not driven by the greater percentage of privately owned firms compared to that of publicly traded firms in the sample.

2.8 Conclusions

Implementing a dynamic panel data methodology, we investigate the impact of idiosyncratic and macroeconomic risk on non-public and public manufacturing firms' short-term leverage in the United Kingdom. We hypothesize that given a different structure of the environment within which public and non-public firms operate, risks associated with a firm's own business activities or macroeconomic conditions affect non-public firms' leverage differently than public firms' leverage. Our dataset is collected from the FAME database and covers the period between 1999-2008. To quantify the effects of risk, we employ two different proxies for both firm-specific and macroeconomic risk while we control for several firm-specific factors whose effects on leverage are similar to those reported in earlier research including Titman and Wessels (1988), Fama and French (2002), Rajan and Zingales (1995), and Brav (2009).

Our findings can be summarized as follows. First, we show that there is a significant negative association between idiosyncratic risk and the leverage of firms. However, non-public firms' leverage exhibits a greater sensitivity to idiosyncratic risk as compared to their public counterparts. This observation is in line with the view that an increase in business risk leads to non-public firms depend more on their in-house performance as external finance is restricted due to the presence of financial frictions. Second, we show that both types of firms exhibit a negative and significant sensitivity to macroeconomic risk while the sensitivity of each type of firm is similar. It appears that firms in each category become cautious about the cost of financial distress during periods of macroeconomic instability, and thus carry less short-term debt. These results hold true for different proxies that we use for either type of underlying risk.

We next investigate the presence of spillover (indirect) effects of risk on leverage

[40] We also study the effects of firms-specific and macroeconomic risk on firm leverage decisions separately for the sample of privately owned and publicly listed firms. The results are presented in Table 2.16.

through firms' cash holdings. An investigation of the full impact of risk on leverage provides evidence that the effects of risk on leverage change as the amount of the cash holdings of a company evolves over time. In particular, it turns out that during periods of high idiosyncratic (macroeconomic) risk, firms reduce their leverage more (less) if they hold higher levels of cash balances. This is an interesting finding and provides evidence that the total effect of risk on leverage varies with respect to its source and the size of liquid assets that each firm holds.

Our findings suggest that researchers should consider the effects of both macroeconomic and idiosyncratic sources of risk while studying firms' optimal leverage over and above the other factors that have been investigated in the literature. While doing this, the possibility of spillover effects should also be considered.

Table 2.12: Robustness: Robust Two-step System-GMM Estimates for a Differential Effect of Firm-Specific Risk on the Leverage of Public and Non-Public Firms

Panel A reports the estimates obtained from robust two-step System-GMM estimations. The figures given in parentheses are standard errors which are asymptotically robust to the presence of heteroskedasticity and serial correlation within panels. To examine the differential impact of uncertainty across both non-public and public firms, we construct $D_i^{nonpublic}$.X (D_i^{public}.X) as the explanatory variable X interacted with a dummy equal to one (zero) if the firm is non-public and zero (one) if the firm is public. The dependent variable is leverage, defined as the ratio of short-term debt to total assets. The analysis covers the period 1999-2008 for a panel of UK non-public and public firms. Model 1 estimates the impact of volatility in the level of firms' sales on firms' leverage. Model 2 estimates the impact of cumulative volatility in the level of firms' sales on firms' leverage. Model 3 estimates the impact of volatility in growth of sales on firms' leverage. In all three models, the one period lagged values of the first difference of the right-hand side variables are used as instruments for the equations in levels. The instruments for differenced equations are the second to fourth lags of the right-hand side variables for all models. The method of measuring volatility and definitions of the remaining independent variables are given in Table 2-A, Appendix A. Panel B of the table reports the test statistics along with its p-values for testing a differential effect of idiosyncratic uncertainty. Panel C reports the J statistics, which is a test of the over identifying restrictions and distributed as chi-squared under the null of instrument validity and the Arellano-Bond, AR(2), test of second-order autocorrelation in the first-differenced residuals. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

Panel A: Estimation results			
Regressors	**Model 1**	**Model 2**	**Model 3**
	Coeff. Std. Error	Coeff. Std. Error	Coeff. Std. Error
$D_i^{nonpublic}.Lev_{it-1}$	0.624 (0.048)***	0.629 (0.052)***	0.694 (0.050)***
$D_i^{public}.Lev_{it-1}$	0.338 (0.181)**	0.348 (0.189)*	0.393 (0.188)**
$D_i^{nonpublic}.Sales_{it}$	-0.015 (0.001)***	-0.015 (0.002)***	-0.017 (0.002)***
$D_i^{public}.Sales_{it}$	-0.027 (0.010)***	-0.027 (0.010)***	-0.026 (0.010)***
$D_i^{nonpublic}.Cash_{it}$	-0.076 (0.012)***	-0.079 (0.013)***	-0.066 (0.012)***
$D_i^{public}.Cash_{it}$	-0.119 (0.037)***	-0.108 (0.039)***	-0.091 (0.040)**
$D_i^{nonpublic}.Invt_{it}$	0.010 (0.011)	0.011 (0.012)	0.012 (0.012)
$D_i^{public}.Invt_{it}$	0.127 (0.074)*	0.126 (0.075)*	0.158 (0.087)*
$D_i^{nonpublic}.\sigma_{it-1}^{level}$	-0.035 (0.007)***		
$D_i^{public}.\sigma_{it-1}^{level}$	-0.006 (0.002)**		
$D_i^{nonpublic}.\sigma_{it-1}^{cumulative}$		-0.076 (0.016)***	
$D_i^{public}.\sigma_{it-1}^{cumulative}$		-0.007 (0.003)**	
$D_i^{nonpublic}.\sigma_{it-1}^{growth}$			-0.048 (0.014)***
$D_i^{public}.\sigma_{it-1}^{growth}$			-0.044 (0.023)*
Constant	0.104 (0.010)***	0.099 (0.011)***	0.097 (0.012)***
Panel B: Tests for differential effects of uncertainty			
$\sigma_{firm}^{public} = \sigma_{firm}^{nonpublic}$	14.370	18.070	10.030
p-value	0.000	0.000	0.013
Panel C: Diagnostic tests			
Firm-years	23,487	21,001	19,741
Firm	5,436	5,301	4,944
AR(2)	-0.080	-0.220	-0.300
p-value	0.936	0.826	0.766
J-statistic	22.560	15.060	28.990
p-value	0.546	0.591	0.220

Table 2.13: Robustness: Robust Two-step System-GMM Estimates for a Differential Effect of Macroeconomic Risk on the Leverage of Public and Non-public Firms

Panel A of the table reports the estimates obtained from robust two-step System-GMM estimations for the effects of macroeconomic uncertainty on firms' leverage, separately for non-public and public firms. The figures given in parentheses are standard errors which are asymptotically robust to the presence of heteroskedasticity and serial correlation within panels. To examine the differential impact of uncertainty across non-public and public firms, we construct $D_i^{nonpublic}$.X (D_i^{public}.X) as the explanatory variable X interacted with a dummy equal to one (zero) if the firm is non-public and zero (one) if the firm is public. The dependent variable is leverage, defined as the ratio of short-term debt to total assets. The analysis covers the period 1999-2008 for a panel of UK non-public and public firms. Model 1 estimates the impact of volatility in GDP on leverage. Model 2 estimates the impact of volatility in T-bills rates on leverage and Model 3 estimates the impact of equal weighed volatility index on firm's leverage. In all three models, the one period lagged values of the first difference of the right-hand side variables are used as instruments for the equations in levels. The instruments for differenced equations are the second and the third lags of the right-hand side variables for Model 1 and 2. For Model 3, the third and fourth lags of the right-hand side variables (excluding uncertainty) are used as instruments in first differenced equations. The method of measuring volatility and definitions of the remaining independent variables are given in Table 2-A, Appendix A. Panel B of the table reports the test statistics along with its p-values for testing a differential effect of macroeconomic uncertainty. Panel C of the table reports the J statistics, which is a test of the over identifying restrictions and distributed as chi-squared under the null of instrument validity and the Arellano-Bond, AR(2), test of second-order autocorrelation in the first-differenced residuals. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

Panel A: Estimation results			
Regressors	**Model 1**	**Model 2**	**Model 3**
	Coeff. Std. Error	Coeff. Std. Error	Coeff. Std. Error
$D_i^{nonpublic}.Lev_{it-1}$	0.617 (0.048)***	0.675 (0.064)***	0.617 (0.048)***
$D_i^{public}.Lev_{it-1}$	0.409 (0.192)**	0.242 (0.136)*	0.413 (0.192)**
$D_i^{nonpublic}.Sales_{it}$	-0.015 (0.002)***	-0.016 (0.001)***	-0.014 (0.001)***
$D_i^{public}.Sales_{it}$	-0.029 (0.009)***	-0.014 (0.008)*	-0.029 (0.009)***
$D_i^{nonpublic}.Cash_{it}$	-0.076 (0.012)***	-0.071 (0.013)***	-0.077 (0.012)***
$D_i^{public}.Cash_{it}$	-0.113 (0.030)***	-0.090 (0.038)**	-0.112 (0.036)***
$D_i^{nonpublic}.Invt_{it}$	0.011 (0.012)	0.003 (0.011)	0.011 (0.013)
$D_i^{public}.Invt_{it}$	0.123 (0.064)*	0.151 (0.059)**	0.122 (0.064)*
$D_i^{nonpublic}.\sigma_{t-1}^{GDP}$	-0.010 (0.002)***		
$D_i^{public}.\sigma_{t-1}^{GDP}$	-0.021 (0.008)***		
$D_i^{nonpublic}.\sigma_{t-1}^{T-bill}$		-0.596 (0.278)**	
$D_i^{public}.\sigma_{t-1}^{T-bill}$		-0.992 (0.383)***	
$D_i^{nonpublic}.\sigma_{t-1}^{Index}$			-0.029 (0.008)***
$D_i^{public}.\sigma_{t-1}^{Index}$			-0.067 (0.025)***
Constant	0.105 (0.010)***	0.102 (0.014)***	0.105 (0.011)***
Panel B: Tests for differential effects of uncertainty			
$\sigma_{macro}^{public} = \sigma_{macro}^{nonpublic}$	1.670	0.680	1.820
p-value	0.195	0.414	0.177
Panel C: Diagnostic tests			
Firm-years	24,394	24,394	24,394
Firm	5,713	5,713	5,713
AR(2)	0.120	0.200	0.120
p-value	0.904	0.840	0.903
J-statistic	25.680	35.010	25.670
p-value	0.370	0.170	0.370

Table 2.14: Robustness: An Alternative Definition of Leverage

Panel A of the table reports the estimates obtained from robust two-step System-GMM estimations for the effects of macroeconomic uncertainty on firms' leverage, separately for non-public and public firms. Here, the leverage is the ratio of total debt (short-term debt + long-term debt) to total assets. The figures given in parentheses are standard errors which are asymptotically robust to the presence of heteroskedasticity and serial correlation within panels. To examine the differential impact of uncertainty across both non-public and public firms, we construct $D_i^{nonpublic}$.X (D_i^{public}.X) as the explanatory variable X interacted with a dummy equal to one (zero) if the firm is non-public and zero (one) if the firm is public. The dependent variable is leverage, defined as the ratio of short-term debt to total assets. The analysis covers the period 1999-2008 for a panel of UK non-public and public firms. Model 1 estimates the joint impact of volatility in GDP and volatility in the level of firms' sales on firm leverage. Model 2 estimates the joint impact of volatility in GDP and cumulative volatility in firms' sales on firm leverage. The method of measuring volatility and definitions of the remaining independent variables are given in Table 2-A, Appendix A. Panel B of the table reports the J statistics, which is a test of the over identifying restrictions and distributed as chi-squared under the null of instrument validity and the Arellano-Bond, AR(2), test of second-order autocorrelation in the first-differenced residuals. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

Panel A: Estimation Results; Dependent Variable: Leverage				
	Model 1		Model 2	
	Coefficient	Std. Error	Coefficient	Std. Error
$D_i^{nonpublic}.Lev_{it-1}$	0.642	(0.055)***	0.652	(0.055)***
$D_i^{public}.Lev_{it-1}$	0.514	(0.078)***	0.517	(0.079)***
$D_i^{nonpublic}.Sales_{it}$	-0.031	(0.003)***	-0.029	(0.003)***
$D_i^{public}.Sales_{it}$	-0.029	(0.010)***	-0.024	(0.011)**
$D_i^{nonpublic}.Cash_{it}$	-0.105	(0.029)***	-0.104	(0.030)***
$D_i^{public}.Cash_{it}$	-0.238	(0.055)***	-0.230	(0.055)***
$D_i^{nonpublic}.Invt_{it}$	0.009	(0.019)	0.002	(0.018)
$D_i^{public}.Invt_{it}$	0.087	(0.040)**	0.092	(0.045)**
$D_i^{nonpublic}.\sigma_{t-1}^{GDP}$	-0.002	(0.000)***	-0.001	(0.000)***
$D_i^{public}.\sigma_{t-1}^{GDP}$	-0.004	(0.001)***	-0.003	(0.001)***
$D_i^{nonpublic}.\sigma_{it-1}^{level}$	-0.014	(0.007)**		
$D_i^{public}.\sigma_{it-1}^{level}$	-0.005	(0.001)***		
$D_i^{nonpublic}.\sigma_{it-1}^{cumulative}$			-0.028	(0.001)***
$D_i^{public}.\sigma_{it-1}^{cumulative}$			-0.012	(0.003)***
Constant	0.178	(0.022)***	0.175	(0.022)***
Panel B: Diagnostic tests				
Firm-years	23,487		21,001	
Firm	5,436		5,301	
AR(2)	1.430		1.420	
p-value	0.152		0.155	
J-statistic	74.570		71.390	
p-value	0.131		0.194	

Table 2.15: Robustness: The Spillover Effects of Risk on Leverage with An Alternative Definition of Leverage

Panel A of the table reports the estimates obtained from robust two-step System-GMM estimations for the effects of macroeconomic uncertainty on firms' leverage, separately for non-public and public firms. Here, the leverage is the ratio of total debt (short-term debt + long-term debt) to total assets. The figures given in parentheses are standard errors which are asymptotically robust to the presence of heteroskedasticity and serial correlation within panels. To examine the differential impact of uncertainty across both non-public and public firms, we construct $D_i^{nonpublic}$.X (D_i^{public}.X) as the explanatory variable X interacted with a dummy equal to one (zero) if the firm is non-public and zero (one) if the firm is public. The dependent variable is leverage, defined as the ratio of short-term debt to total assets. The analysis covers the period 1999-2008 for a panel of UK non-public and public firms. The method of measuring volatility and definitions of the remaining independent variables are given in Table 2-A, Appendix A. Panel B of the table reports the J statistics, which is a test of the over identifying restrictions and distributed as chi-squared under the null of instrument validity and the Arellano-Bond, AR(2), test of second-order autocorrelation in the first-differenced residuals. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

Panel A: Estimation Results; Dependent Variable: Leverage		
	Coefficient	**Std. Error**
$D_i^{nonpublic}.Lev_{it-1}$	0.649	(0.040)***
$D_i^{public}.Lev_{it-1}$	0.451	(0.053)***
$D_i^{nonpublic}.Sales_{it}$	-0.029	(0.003)***
$D_i^{public}.Sales_{it}$	-0.004	(0.011)
$D_i^{nonpublic}.Cash_{it}$	-0.176	(0.079)**
$D_i^{public}.Cash_{it}$	-0.389	(0.080)***
$D_i^{nonpublic}.Invt_{it}$	0.014	(0.020)
$D_i^{public}.Invt_{it}$	0.120	(0.041)***
$D_i^{nonpublic}.\sigma_{t-1}^{GDP}$	-0.003	(0.001)***
$D_i^{public}.\sigma_{t-1}^{GDP}$	-0.005	(0.001)***
$D_i^{nonpublic}.\sigma_{it-1}^{level}$	-0.012	(0.000)***
$D_i^{public}.\sigma_{it-1}^{level}$	-0.002	(0.001)**
$D_i^{nonpublic}.Cash_{it}.\sigma_{it-1}^{level}$	-0.003	(0.070)
$D_i^{public}.Cash_{it}.\sigma_{it-1}^{level}$	-0.082	(0.003)***
$D_i^{nonpublic}.Cash_{it}.\sigma_{t-1}^{GDP}$	0.008	(0.013)
$D_i^{public}.Cash_{it}.\sigma_{t-1}^{GDP}$	0.035	(0.012)***
Constant	0.181	(0.016)***
Panel B: Diagnostic tests		
Firm-years	23,487	
Firm	5,436	
AR(2)	1.180	
p-value	0.236	
J-statistic	114.970	
p-value	0.329	

Table 2.16: Robustness: The Effect of Risks on Leverage for the Sample of Public and Private Firms

2.16 Panel A of the table reports the estimates obtained from robust two-step System-GMM estimations for the effects of macroeconomic uncertainty on firms' leverage separately for the sample of public and non-public firms. Here, the leverage is the ratio of total debt (short-term debt + long-term debt) to total assets. The figures given in parentheses are standard errors which are asymptotically robust to the presence of heteroskedasticity and serial correlation within panels. The dependent variable is leverage, defined as the ratio of short-term debt to total assets. The analysis covers the period 1999-2008 for a panel of UK non-public and public firms. Model 1 estimates the joint impact of volatility in GDP and volatility in the level of firms' sales on firm leverage. Model 2 estimates the joint impact of volatility in GDP and cumulative volatility in firms' sales on firm leverage. The method of measuring volatility and definitions of the remaining independent variables are given in Table 2-A, Appendix A. Panel B of the table reports the J statistics, which is a test of the over identifying restrictions and distributed as chi-squared under the null of instrument validity and the Arellano-Bond, AR(2), test of second-order autocorrelation in the first-differenced residuals. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

Panel A: Estimation Results; Dependent Variable: Leverage				
	Public Firms		**Private Firms**	
	Coefficient	**Std. Error**	**Coefficient**	**Std. Error**
Lev_{it-1}	0.525	(0.081)***	0.794	(0.037)***
$Sales_{it}$	-0.030	(0.008)***	-0.023	(0.003)***
$Cash_{it}$	-0.416	(0.066)***	-0.068	(0.026)***
$Invt_{it}$	0.114	(0.040)***	-0.017	(0.019)
σ^{GDP}_{t-1}	-0.002	(0.000)**	-0.001	(0.000)***
σ^{level}_{it-1}	-0.006	(0.001)***	-0.014	(0.005)***
Constant	0.188	(0.029)***	0.116	(0.016)***
Panel B: Diagnostic tests				
Firm-years	2,216		21,271	
Firm	554		4,882	
AR(2)	0.740		1.390	
p-value	0.456		0.166	
J-statistic	44.680		37.900	
p-value	0.245		0.651	

Table 2.17: Robustness: The Impact of Risks on Leverage while Controlling for Firm Size, Profitability, Tangibility, and Growth

Panel A of the table reports the estimates obtained from robust two-step System-GMM estimations for the effects of macroeconomic uncertainty on firms' leverage, separately for non-public and public firms. Here, the leverage is the ratio of total debt (short-term debt + long-term debt) to total assets. The figures given in parentheses are standard errors which are asymptotically robust to the presence of heteroskedasticity and serial correlation within panels. To examine the differential impact of uncertainty across both non-public and public firms, we construct $D_i^{nonpublic}$.X (D_i^{public}.X) as the explanatory variable X interacted with a dummy equal to one (zero) if the firm is non-public and zero (one) if the firm is public. The dependent variable is leverage, defined as the ratio of short-term debt to total assets. The analysis covers the period 1999-2008 for a panel of UK non-public and public firms. Model 1 estimates the joint impact of volatility in GDP and volatility in the level of firms' sales on firm leverage. Model 2 estimates the joint impact of volatility in GDP and cumulative volatility in firms' sales on firm leverage. The method of measuring volatility and definitions of the remaining independent variables are given in Table 2-A, Appendix A. Size is the natural log of total assets. Tangibility is the ratio of tangible assets to total assets. Profitability is the ratio of earnings before interest and taxes to total assets. Growth is defined as the difference of the log of net sales normalized by consumer price index. Panel B of the table reports the J statistics, which is a test of the over identifying restrictions and distributed as chi-squared under the null of instrument validity and the Arellano-Bond, AR(2), test of second-order autocorrelation in the first-differenced residuals. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

Panel A: Estimation Results; Dependent Variable: Leverage				
	Model 1		Model 2	
	Coefficient	Std. Error	Coefficient	Std. Error
$D_i^{nonpublic}.Lev_{it-1}$	0.717	(0.036)***	0.834	(0.017)***
$D_i^{public}.Lev_{it-1}$	0.517	(0.083)***	0.723	(0.027)***
$D_i^{nonpublic}.Cash_{it}$	-0.038	(0.018)**	-0.085	(0.028)***
$D_i^{public}.Cash_{it}$	-0.243	(0.063)***	-0.192	(0.070)***
$D_i^{nonpublic}.Profitability_{it}$	-0.190	(0.028)**	-0.177	(0.042)***
$D_i^{public}.Profitability_{it}$	-0.269	(0.093)***	-0.123	(0.022)***
$D_i^{nonpublic}.Tangibility_{it}$	0.033	(0.008)***	0.035	(0.007)***
$D_i^{public}.Tangibility_{it}$	-0.011	(0.033)	0.031	(0.016)**
$D_i^{nonpublic}.Size_{it}$	0.030	(0.007)***	0.014	(0.002)***
$D_i^{public}.Size_{it}$	0.036	(0.005)***	0.016	(0.003)***
$D_i^{nonpublic}.Growth_{it}$	-0.035	(0.008)***	-0.046	(0.018)***
$D_i^{public}.Growth_{it}$	-0.095	(0.048)**	0.009	(0.011)
$D_i^{nonpublic}.\sigma_{t-1}^{GDP}$	-0.001	(0.000)**	-0.001	(0.000)***
$D_i^{public}.\sigma_{t-1}^{GDP}$	-0.002	(0.000)**	-0.002	(0.001)**
$D_i^{nonpublic}.\sigma_{it-1}^{level}$	-0.024	(0.006)***	-0.081	(0.003)**
$D_i^{public}.\sigma_{it-1}^{level}$	-0.003	(0.000)***	-0.009	(0.004)**
$D_i^{nonpublic}.Cash_{it}.\sigma_{it-1}^{level}$			-0.032	(0.039)
$D_i^{public}.Cash_{it}.\sigma_{it-1}^{level}$			-0.028	(0.008)***
$D_i^{nonpublic}.Cash_{it}.\sigma_{t-1}^{GDP}$			0.008	(0.004)**
$D_i^{public}.Cash_{it}.\sigma_{t-1}^{GDP}$			0.006	(0.001)***
Constant	-0.194	(0.068)***	-0.075	(0.027)***
Panel B: Diagnostic tests				
Firm-years	22,375		22,375	
Firm	5,254		5,254	
AR(2)	1.340		1.260	
p-value	0.179		0.208	
J-statistic	68.030		138.41	
p-value	0.250		0.826	

Table 2.18: Robustness: The Impact of Risks on Leverage when Private and Public Firm Samples Matched on Size, Industry, and Fiscal Year-End

Panel A of the table reports the estimates obtained from robust two-step System-GMM estimations for the effects of macroeconomic uncertainty on firms' leverage, separately for non-public and public firms. Here, the leverage is the ratio of total debt (short-term debt + long-term debt) to total assets. The figures given in parentheses are standard errors which are asymptotically robust to the presence of heteroskedasticity and serial correlation within panels. To examine the differential impact of uncertainty across both non-public and public firms, we construct $D_i^{nonpublic}$.X (D_i^{public}.X) as the explanatory variable X interacted with a dummy equal to one (zero) if the firm is non-public and zero (one) if the firm is public. The dependent variable is leverage, defined as the ratio of short-term debt to total assets. The analysis covers the period 1999-2008 for a panel of UK non-public and public firms. Model 1 estimates the joint impact of volatility in GDP and volatility in the level of firms' sales on firm leverage. Model 2 estimates the joint impact of volatility in GDP and cumulative volatility in firms' sales on firm leverage. The method of measuring volatility and definitions of the remaining independent variables are given in Table 2-A, Appendix A. Size is the natural log of total assets. Tangibility is the ratio of tangible assets to total assets. Profitability is the ratio of earnings before interest and taxes to total assets. Growth is defined as the difference of the log of net sales normalized by consumer price index. Panel B of the table reports the J statistics, which is a test of the over identifying restrictions and distributed as chi-squared under the null of instrument validity and the Arellano-Bond, AR(2), test of second-order autocorrelation in the first-differenced residuals. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

Panel A: Estimation Results; Dependent Variable: Leverage				
	Without Replacement		**With Replacement**	
	Coefficient	**Std. Error**	**Coefficient**	**Std. Error**
$D_i^{nonpublic}.Lev_{it-1}$	0.877	(0.041)***	0.846	(0.044)***
$D_i^{public}.Lev_{it-1}$	0.565	(0.037)***	0.573	(0.037)***
$D_i^{nonpublic}.Cash_{it}$	-0.011	(0.042)	-0.028	(0.044)
$D_i^{public}.Cash_{it}$	-0.202	(0.035)***	-0.181	(0.035)***
$D_i^{nonpublic}.Profitability_{it}$	-0.266	(0.044)***	-0.293	(0.043)***
$D_i^{public}.Profitability_{it}$	-0.162	(0.028)***	-0.176	(0.029)***
$D_i^{nonpublic}.Tangibility_{it}$	0.005	(0.021)	0.009	(0.025)
$D_i^{public}.Tangibility_{it}$	-0.002	(0.018)	-0.005	(0.018)
$D_i^{nonpublic}.Size_{it}$	0.015	(0.005)***	0.021	(0.005)***
$D_i^{public}.Size_{it}$	0.017	(0.004)***	0.022	(0.004)***
$D_i^{nonpublic}.Growth_{it}$	-0.025	(0.012)**	-0.032	(0.017)*
$D_i^{public}.Growth_{it}$	-0.013	(0.007)*	-0.011	(0.006)*
$D_i^{nonpublic}.\sigma_{t-1}^{GDP}$	-0.002	(0.001)**	-0.002	(0.001)***
$D_i^{public}.\sigma_{t-1}^{GDP}$	-0.003	(0.000)**	-0.003	(0.000)**
$D_i^{nonpublic}.\sigma_{it-1}^{level}$	-0.037	(0.003)***	-0.025	(0.007)***
$D_i^{public}.\sigma_{it-1}^{level}$	-0.002	(0.000)***	-0.001	(0.000)***
Constant	-0.074	(0.058)	-0.139	(0.058)***
Panel B: Diagnostic tests				
Firm-years	2,199		1,992	
Firm	1,145		1,022	
AR(2)	0.640		0.490	
p-value	0.524		0.623	
J-statistic	100.170		83.560	
p-value	0.338		0.793	

Appendix A: Definitions of Variables

Table 2-A: Symbol and Definition of Variables

Variable abbreviation	Variable description	Variable Contraction
Lev_{it}	Sort-term debt/total assets	Short-term debt at the end of the year divided by total assets
	Total debt/total assets	The sum of short-term and long-term debt at the end of the year divided by total assets
$Sales_{it}$	Sales/total assets	Total turnover during a year divided by total assets
$Invt_{it}$	Investment/total assets	Aggregate investment divided by total assets
$Cash_{it}$	Cash/ total assets	Cash and equivalent divided by total assets
$D_i^{nonpublic}$	Non-public dummy	Non-public is a dummy equal to one if the firm is non-public and zero if the firm is public
D_i^{public}	Public dummy	Public is a dummy equal to one if the firm is public and zero if the firm is non-public
σ_{it}^{level}	Volatility in the level of sales as proxy for firm-specific risk	It is the size of the deviation from average sales of the firm over the period from 1999 to 2008 and from average sales for all firms in a given year.
$\sigma_{it}^{cumulative}$	Cumulative-volatility in firm-level sales as proxy for firm-specific risk	To measure the cumulative-volatility in sales for the year 2000, we compute the standard deviation of the residuals obtained from the state space model of sales for years 2000, 1999; similarly for year 2001, the residuals in 2001, 2000, and 1999 are used.
σ_{it}^{growth}	Volatility in the growth of firms' sales as proxy for firm-specific risk	For a given firm-year, it is measured by the size of the deviation from average growth of sales of the firm over the period 1999 to 2008 and from average growth for all firms in that year.
σ_t^{GDP}	Conditional variance for gross domestic product (GDP)	ARCH/GARCH specifications are used for GDP to obtain the conditional variance as proxy for macroeconomic uncertainty.
$\sigma_t^{T-bills}$	Conditional variance for Treasury bills rates (T-bills rates)	ARCH/GARCH models are estimated for T-bills rates to proxy for macroeconomic uncertainty.
σ_t^{Index}	Conditional variance index	We compute an equal weighted index using the conditional variance obtained from ARCH/GARCH specifications for GDP, T-bills rates, and Consumer Price Index (CPI).

Appendix B: Measuring Macroeconomic Risk

Table 2-B: ARCH/GARCH Estimates for Macroeconomic Risk

This table reports the estimates obtained by estimating a generalized ARCH (GARCH) model for Treasury bill rates (TBR) and gross domestic product (GDP). X denotes the dependent variable in ARCH/GARCH specifications. The figures given in parentheses are standard errors. The estimates on the log-likelihood, Lagrange multiplier (ARCH LM) test, and Q-statistics to test for the remaining ARCH/GACRH effects in the model are given in the lower panel. Quarterly data on GDP and monthly data on Treasury bills rates and Consumer Price Index are obtained from the International Financial Statistics (IFS) file, an International Monetary Fund (IMF) database. The data covers the period from 1999 to 2008. We average the conditional variance of GDP (T-bills rates and CPI) across four quarters (twelve months) to obtain a yearly measure of the risk of macroeconomic conditions. Statistical significance at the 1%, 5%, and 10% level is indicated by three, two, and one asterisks, correspondingly.

Regressors	**ΔTBR**		**ΔCPI**		**ΔGDP**	
	Coeff.	Std.Error	Coeff.	Std.Error	Coeff.	Std.Error
ΔX_{t-1}	-0.120	(0.271)	-0.724	(0.112)**	0.232	(0.112)**
ΔX_{t-2}	0.353	(0.187)*	0.129	(0.124)	-0.001	(0.147)
Constant	0.013	(0.006)**	0.400	(0.096)***	2.789	(0.917)***
MA(1)	0.577	(0.274)**	0.958	(0.049)***		
ARCH(1)	0.724	(0.164)***	0.259	(0.146)*	0.859	(0.368)**
GARCH(1)	0.271	(0.128)**	0.512	(0.269)*		
Constant	0.005	(0.001)***	0.031	(0.012)***	1.281	(0.420)***

Diagnostic tests for remaining GARCH effects

	ΔTBR	ΔCPI	ΔGDP
Log-likelihood	92.569	-52.868	-103.101
Observations	148.000	148.000	51.000
LM-test(4)	0.140	2.010	2.510
P-value	0.997	0.733	0.643
Q(8)	3.274	4.936	11.225
P-value	0.916	0.764	0.189
Q(15)	3.865	18.999	16.009
P-value	0.998	0.213	0.381

Chapter 3

Capital Structure Adjustments: Do Macroeconomic and Business Risks Matter?

3.1 Key Findings

This chapter empirically examines the role of risk in firms' capital structure adjustments. The dataset used here consists of all available publicly traded UK manufacturing firms from the WorldScope files for the period of 1981 to 2009. We find strong evidence of asymmetry in firm leverage adjustments, depending on the magnitude and the type of risk as well as whether firms' actual leverage is above or below the target. We also find that firms with a financial surplus and above-target leverage adjust their leverage faster when firm-specific risk is low and when macroeconomic risk is high. In contrast, firms with financial deficits and below-target leverage are more likely to align their leverage toward their target in periods when both types of risk are low.

Overall, this chapter systematically relates firms' capital structure rebalancing activities to risk using a large panel of listed UK manufacturing firms and contributes to the literature in two major aspects. First, we show that risks exert a negative impact on firms' target leverage and provide evidence that both firm-specific and macroeconomic risks play a substantial role in the determination of firms' capital structure adjustment process toward a target. Second, we lay out how the interlinkages between risks, the imbalances in a firm's cash flows, and the level of a firm's actual leverage relative to its target leverage affect the firm in achieving its target capital structure. We also think that our findings would be useful to understand the movements in firms' target leverage, the managers' effort to time equity and debt markets as well as their lack of desire for a quick capital structure adjustment.

3.2 Introduction

Financial economists have devoted considerable attention to explain the capital structure of firms. Nevertheless, still it is hard to fully explain the documented time-series or cross sectional patterns referring to a specific theoretical reasoning. Perhaps managers strive to adjust firms' capital structure to achieve an optimal target leverage, but they cannot do so because of adverse selection problems (Myers and Majluf (1984)), the presence of relative time-varying costs of issuing debt to equity (Baker and Wurgler (2002)) or the trade-offs between the costs and benefits of debt vis-à-vis equity financing (Myers (1984)). In fact, one would expect that the capital structure adjustment process is related to several factors and that firm managers carefully consider the state of the firm's financial status when making adjustments in firms' capital structure.[41]

Besides examining the factors that affect the capital structure of firms, another important issue is the speed with which firms adjust their capital structure toward their target leverage. In an environment without frictions, firms should achieve their target level rather quickly. However, it may take firms several years to adjust to their desired leverage ratio due to the presence of adjustment costs. Indeed, prior empirical research has shown that the adjustment process takes several periods: while some studies suggest that the speed of adjustment is in the range of 7-18% per year (Fama and French (2002)), some others estimate it as high as 35% per year (Flannery and Rangan (2006)). Along the same lines, recently, Byoun (2008) suggests that the capital structure adjustment process is asymmetric with respect to the firm's financial status. He argues that typical partial adjustment models cannot capture the dynamics of capital structure adjustments and shows that the adjustment speed is faster (about 33%) when firms have a financial surplus with above-target debt but it drops substantially to single digit figures when firms have a financial deficit with above-target debt or when they have a financial surplus with below-target debt.

In this chapter, different from the earlier research on the speed of adjustment of firms' capital structure, we condition adjustment speeds on risks about macroeconomic conditions and firms' own business activity. Specifically, we examine firms' speed of adjustments toward target capital structure with a focus on asymmetry in adjustments speeds across different types of risk as well as across different levels of risk. To take asymmetry into account, we estimate speeds of adjustment at low, medium, and high levels of risk in general, as well as conditional on both firms' cash flow imbalances (financing deficits *versus* surpluses) and deviations (positive *versus* negative) of firms' actual leverage from the target.

We hypothesize that if the optimal debt level varies by firm, the risk structure of the environment within which the firm operates should affect the cost and benefit of adjusting the leverage ratio toward the target.[42] Given that the adjustment costs and benefits would change as risk varies over time, so will the speed of adjustment. Particularly, it is well accepted that risks associated with the state of the economy or the firm affect

[41]For more along these lines, see, for instance, Hovakimian, Opler, and Titman (2001), Baker and Wurgler (2002), Welch (2004), Hovakimian, Hovakimian, and Tehranian (2004), Huang and Ritter (2009), and Elsas and Florysiak (2011).

[42]In theory, firms' capital structure adjustment decisions reflect the trade-off between the benefits of maintaining the target, such as the expected value of tax shields and the potential costs of distress, and the cost of achieving the target, such as the relative costs of external financing, equity valuations, and financial constraints (Hovakimian, Opler, and Titman (2001), Korajczyk and Levy (2003), Leary and Roberts (2005), Flannery and Hankins (2007), Elsas and Florysiak (2011), and Faulkender, Flannery, Hankins, and Smith (2011)). We expect that as these costs and benefits of rebalancing the capital structure vary with variations in risk, so does the speed with which firms adjust their leverage toward their targets.

adverse selection problems, the relative cost of raising funds from equity or debt markets, and the state of the firm's retained earnings which directly impacting the firm's capital structure. However, the existing empirical studies on the adjustment speed of capital structure toward the target have largely ignored the impact of risk on adjustment speeds. Although mostly neglected in the literature, the impact of risk on the capital adjustment process is an important aspect without which one cannot have a good understanding of the adjustment process.[43]

In our investigation, we examine the effects of risk on the adjustment process of capital structure using a large panel of UK manufacturing firms which spans the period 1981-2009. We take into consideration the level of debt as well as the imbalances in cash flows while we study the impact of both business and macroeconomic risks on leverage adjustments within a dynamic framework. In our study, we also control for various firm-specific factors. We predict that the capital adjustment speed will be asymmetric with respect to the level and the type of risk that a firm experiences. This prediction can be rationalized realizing that the costs and benefits of adjusting toward a target leverage are related to both the source and the severity of risks.[44]

We begin our investigation by quantifying the impact of both firm-specific and macroeconomic risk on target leverage as we control for various firm-specific factors. We show that both types of risk exert a negative impact on firms' target leverage. That is, all else remains unchanged, the higher the level of risk, the lower the level of firms' leverage. When we analyze speed of adjustments toward the target leverage ratio, we find asymmetry in adjustment speeds across different levels of risks. Further, we observe that asymmetries in leverage adjustments are also related to the type of risk. Specifically, estimating the modified dynamic partial-adjustment model of capital structure, we show that the speed of adjustment is highest when the firm enjoys low firm-specific risk, but the adjustment slows down as macroeconomic risks rise.

Next, we estimate the speed of adjustment of firms at different levels of risks when the actual leverage of firms is above or below the target leverage. To allow differential leverage adjustment speeds across positive and negative leverage deviations, we modify the standard leverage adjustment model by interacting our risk measures with indicators of above- and below-target leverage. We provide strong evidence that both over-levered and under-levered firms respond to risk very differently when adjusting their capital structure toward their leverage target. In particular, we find that firms having leverage above the

[43] Empirical research has mainly focused on the effects of risk on leverage. See, for instance, Titman and Wessels (1988), MacKie-Mason (1990), Wald (1999), Hatzinikolaou, Katsimbris, and Noulas (2002), Baum, Stephan, and Talavera (2009), and Caglayan and Rashid (2010).

[44] See Fischer, Heinkel, and Zechner (1989) and Flannery and Hankins (2007), who argue that firms with differing adjustment costs tend to make asymmetric adjustments in their capital structure.

target adjust their capital structure faster toward the target when firm-specific risk is high and when macroeconomic risk is low. On the contrary, firms with below-target leverage are likely to adjust their capital structure quickly toward their targets in times of low firm-specific risk and high macroeconomic risk.

The last-and most important-model we examine allows the firm to face imbalances in cash flows and its actual leverage to differ relative to the target leverage while interacting our risk measures with its capital structure adjustments.[45] We find that firms with financial surpluses and above-target leverage are likely to adjust their leverage more quickly toward their target when both firm-specific and macroeconomic risks are high. Hence, a firm that has a financial surplus with leverage exceeding the target quickly readjusts its capital structure in periods of high risk to avoid the costs of financial distress along with the likelihood of bankruptcy during periods of high risk. In contrast, we observe that firms that experience financial surpluses with below-target leverage do not strive to achieve their target capital structure but rather maintain their current state.

When we turn to firms that experience financial deficits with above-target leverage, we see that these firms are more likely to issue equity to achieve their target leverage in times of low risk (particularly macroeconomic).[46] For such firms, given the level of macroeconomic risk, an *increase* in firm-specific risk *speeds up* the capital adjustment process. Whereas, firms that have financial deficits with below-target leverage are more likely to adjust their capital structure by issuing debt in times when both firm-specific risk and macroeconomic risks are relatively low. An increase in either type of risk simply delays the adjustment process. Overall, our investigation provides evidence that the type (macroeconomic *versus* firm-specific) and the extent (low, median, or high) of risk under which firms operate really matter regarding the capital structure adjustment speed of firms. That is, asymmetries in firms' capital structure adjustments are significantly related to both the level and the type of risk over and above the financial state or/and the level of leverage with respect to a firm's target leverage.

The results presented in this chapter are robust to both alternative proxies for firm-specific and macroeconomic risk and alternative measures of the level of firms' target leverage. This confirms that the asymmetry in leverage adjustment speeds across different levels of risk are not driven by either the specific measure of risk or the specific estimate of the target leverage. By proving evidence of the asymmetrical leverage adjustments across different levels of risk and across different types of risk, we indicate that

[45] Byoun (2008), Elsas and Florysiak (2011), and Faulkender, Flannery, Hankins, and Smith (2011) investigate the importance of financial imbalances in capital structure adjustments when the firm is above or below its target leverage. However, these studies are silent about the role of risk in leverage adjustments.

[46] Since good macroeconomic prospects (low macroeconomic risks) are positively related to the market value of equities, firms generally issue new equity during such periods.

ignoring the role of risk in capital structure adjustments would likely yield biased speed of adjustment estimates. Our results on the asymmetry in capital structure adjustments across firm characteristics also bear on the recent findings that the differential adjustment speeds are conditional on firms' financing deficits and the deviations of firms' actual leverage from the leverage target (Korajczyk and Levy (2003), Flannery and Hankins (2007), Byoun (2008), Dang, Kim, and Shin (2009), Elsas and Florysiak (2011), and Faulkender, Flannery, Hankins, and Smith (2011)).

Our investigation proceeds as follows. Section 2 provides a brief literature survey on the capital structure adjustments and the impact of risk on corporate financing decisions. Section 3 presents some basic information on the dataset. This section also lays out the procedures we implement to generate firm-specific and macroeconomic risk measures. Section 4 describes the estimation methods. Section 5 presents and discusses the empirical findings. Section 6 concludes the chapter.

3.3 Capital Structure Adjustments, Prior Evidence, and Risk

This section first reviews the existing empirical studies that focus on the speed of adjustment toward the target leverage. Then it provides the theoretical predictions and a summary of the empirical evidence on the sensitivity of firms' capital structure to risk. Finally, the section presents the capital structure theories' predictions on the relation between firms' financing decisions and firm-specific factors along with their empirical confirmations.

3.3.1 Empirical Evidence on Capital Structure Adjustments

3.3.1.1 *The Speed of Adjustment to A Target Capital Structure*

The question when and how quickly a firm adjusts its capital structure toward its target has recently received substantial interest in the corporate finance literature. Numerous existing papers estimate the speed at which firms move toward their target leverage ratio. In their investigation, researchers relate the adjustment process of capital structure to firm-specific characteristics as well as to macroeconomic conditions. For instance, in a recent paper, Elsas and Florysiak (2011) analyze how firm-specific factors affect US firms' speed of adjustment by estimating the standard partial adjustment model of capital structure. Specifically, to take asymmetry in adjustments across firms into account, they sort their sample firms according to firm size, the market-to-book-equity ratio, industry affiliation, and the deviation of observed leverage from target leverage. They find that the market-to-book-equity value of firms affects speed of adjustment toward target capital structure positively, while firm size affects adjustment speeds negatively. Further, they show that highly over-levered firms adjust their leverage with a relatively rapid speed of about 50.5% per year, while highly under-levered firms do so with a speed of about 45% per year. They also find that firms that have large deficits or surpluses with above-target leverage adjust their leverage with a speed of as high as 59.2% per year.

Faulkender, Flannery, Hankins, and Smith (2011) estimate the impact of firms' cash flow realizations, financial constraints, and market conditions on the capital structure adjustments of over-levered and under-levered firms. They find that adjustment costs are significant in adjustments, generating asymmetry in the speed of adjustment of firms toward the target leverage ratio. Estimating the modified form of the standard partial-adjustment model, they show that when firms' cash flow realizations are near to zero, while under-levered firms eliminate about 23% their deviations from the target leverage per year, over-levered firms do so about 26%. However, they estimate a much faster speed of adjustment toward the target when firms have excess cash flows relative to their leverage deviations: 51.5% per year for under-levered firms and 69.3% per year for over-levered firms. Cook and Tang (2010) examine the effect of macroeconomic conditions on firm leverage adjustments for listed US firms. They find that firms' leverage converges to its target with a speed of 46.1% (43.7%) in a year when the economy is in an expansionary (a recessionary) phase. Likewise, in a working paper, Halling, Yu, and Zechner (2011) also relate speeds of adjustments with business cycle using a firm-level panel data from 18 countries. They show that firms adjust their capital structure toward their targets more rapidly during economic expansions than they do during recessions.[47]

Huang and Ritter (2009) estimate the speed of adjustment using long differencing estimator. They find that firms adjust their capital structure with a moderate speed of adjustment: the book leverage with a speed of 17% per year, while the market leverage with a speed of 23.2% per year. In a recent working paper, Elsas and Florysiak (2010) estimate the speed of adjustment taking into account the fractional nature of the dependent variable (debt ratios) and find that firms adjust their leverage with a speed of about 26% in a year. Chang and Dasgupta (2009) estimate the speed of adjustment at around 37.8% per year for publicly traded US firms.

Byoun (2008) estimates speeds of adjustment in a financing needs-adjustment framework and finds that the adjustment speed is around 33% per year for firms which have a financial surplus with debt above-target level. He also reports that the adjustment speed

[47]Recently, DeAngelo, DeAngelo, and Whited (2011) propose a dynamic capital structure model to examine the role of transitory debt in capital structure adjustments. Specifically, in their model, they allow firms to have target capital structure and to issue transitory debt that enables them to fund their financing needs associated with anticipated investment shocks. As well, firms can economize the cost of equity issuance and of maintaining their cash balances. They predict that despite firms temporarily depart from their leverage targets, all proactive financing decisions move them toward their targets. But the speed of this move is relatively slow, however.

is about 20% per year for firms which face a financial deficit with debt below-target level. Lemmon, Roberts, and Zender (2008) find that firms adjust their book leverage around 25% per year. Similarly, Antoniou, Guney, and Paudyal (2008) also estimate a relatively rapid speed of adjustment of 32.2%, implying a half-life of 1.8 years. Chen and Zhao (2007) and Frank and Goyal (2008) provide evidence that the leverage ratio of firms reverts to its mean over time regardless of whether firms have a target leverage or not. Flannery and Hankins (2007) relate leverage adjustments of publicly traded US firms with rebalancing benefits and costs. They find that firms rebalance their capital structure relatively quickly, making adjustment toward their target by a speed of around 22% per year.

On the other hand, Fama and French (2002) estimating a partial adjustment model of capital structure find that firms that do not pay dividends adjust their leverage toward target debt ratios with a speed of between 15 and 18% per year, while firms that pay dividends do so with a speed of between 7 and 10% per year. Thus, they conclude that firms adjust their capital structure toward their targets at "a snail's pace".[48] Graham and Harvey (2001b) conduct a survey of U.S. CFOs and find that about 44% of the sample firms have a tight target capital structure, about 34% of the firms have a flexible target debt ratio, while only 19% of the firms responded that they do not have target capital structure.[49]

3.3.1.2 *Market Timing and Capital Structure Adjustments*

Another strand of literature focuses on how equity market timing affects the corporate capital structure adjustment process. Baker and Wurgler (2002) show that the impact of market timing is very persistent and it exists even beyond 10 years. They find that the historical market valuations–the "external finance weighted-average" market-to-book ratio–of firms have a significant and negative impact on firms' leverage. They also find the market-to-book value ratio affects the change in leverage negatively in the short run, mainly through its impact on new equity financing. They conclude that firms that raised external financing when their historical equity market valuations were high tend to be low-levered, while conversely firms that raised external financing when their historical equity market valuations were low tend to be high-levered. Huang and Ritter (2009) examine the effects of the cost of equity financing on securities issuance for listed US firms. Consistent with the findings of Baker and Wurgler (2002), they find that the past values of the cost of equity financing influencing the historical financing decisions of a firm have a long-lasting impact on the firm capital structure.

[48] Xu (2007) also reports that the speed of adjustment toward target leverage is between 15 and 18% per year.

[49] To see variations in speed-of-adjustment estimates (henceforth AOS-estimates) across firms, estimated estimates of the speed of adjustment in recent empirical studies are given in Table 3-A, Appendix A.

Recently, the papers by Elsas and Florysiak (2011), Faulkender, Flannery, Hankins, and Smith (2011), and Warr, Elliott, Koëter-Kant, and Öztekin (2011) have also been focused to explore the effects of market timing on the speed of adjustment toward a leverage target. Elsas and Florysiak (2011) find that the market-to-book value is positively related to leverage adjustments, suggesting that firms with high market-to-book value ratios rapidly adjust toward their capital structure. Likewise, Faulkender, Flannery, Hankins, and Smith (2011) provide evidence of a significant role of market timing in firms' decisions of making capital structure adjustments. Specifically, they find that while higher equity valuations measured by average industry market-to-book value increase the speed of adjustment of over-leveraged firms, under-leveraged firms adjust less quickly when their equity valuations are high. Warr, Elliott, Koëter-Kant, and Öztekin (2011) analyze how equity mispricing affects firms' capital structure adjustment costs. They show that firms with high leverage ratios relative to their target are likely to make fast adjustment in their leverage when their shares are over-valued than when their shares are under-valued. Conversely, they show that firms that are below-target leverage adjust more quickly when their equity is under-valued than they do so when their equity is over-valued.[50]

Kayhan and Titman (2007) carry out a comprehensive analysis to show how changes in stock price and firms' financial position (a financing deficit or surplus) relates to changes in the capital structure of firms and find that firms eventually adjust their capital structure to achieve their leverage targets. In addition, they show that while stock price changes and firms' financial positions are significantly related to capital structure, their impacts are partially reversed over long horizons.[51] However, Alti (2006) and Leary and Roberts (2005) find that the impact of equity financing totally dissipates within two to four years, indicating a rapid convergence toward target leverage. Similarly, the studies by Butler, Cornaggia, Grullon, and Weston (2011) and Flannery and Rangan (2006) have questioned the long-term persistence and the economic significance of the effects of market timing on firms' financing decisions.

3.3.1.3 *Risk and Leverage Adjustments: Hypotheses Development*

Given the state of the literature, we know that managers do not commit to an instantaneous adjustment of firms' capital structure but prefer to have gradual adjustments. It appears that managers take into account various firm-specific factors as well as the imbal-

[50] An early study by Jalilvand and Harris (1984) analyzes the adjustment behavior of firms by examining US firms' security issuance decisions and documents that stock valuations have a significant impact on the rate at which firms adjust their capital structure toward the target. As well, they show that firm size and interest rates are important in explaining variations in speeds of adjustments across companies.

[51] Hovakimian, Opler, and Titman (2001) find that more profitable firms, although having low leverage, on average, have a tendency to issue debt rather than equity and have a tendency to repurchase equity instead of retire debt to adjust their capital structure toward an optimum level.

ances in cash flows (financial deficits or surpluses), the state of firms' debt with respect to the target (above or below) and the state of the environment within which firms operate while pursuing the target debt levels. However, studies on the adjustment speed of capital structure have largely ignored the role of risk on the adjustment speed of capital structure. Thus, to the best of our knowledge, the effects of risk on the rate at which firms adjust their capital structure toward their target have not been articulated in the literature so far. The extent and the type of risk affect the costs of adjustments, such as the relative costs of external financing, equity valuations, and financial constraints, and benefits of making leverage adjustments, such as the expected value of tax shields, the probability of default, and the potential costs of distress, which in turn affect the speed of adjustment. Given that, the question whether risk increases or reduces the speed of adjustment as the firm's actual leverage deviates from its target and as its financial state changes is an important issue without which one cannot have a good understanding of the adjustment process.

We hypothesize that whether risk accelerates or decelerates the speed of adjustment of firms toward the target leverage depends on whether firms have positive or negative financial deficits and whether firms' actual leverage ratios are above or below their targets. In principle, the adjustment of capital structure toward the target of firms that have financing surpluses with above-target leverage calls for retiring debt. Since higher debt levels make firms more exposed to risk, in particulate macroeconomic risk, these firms are more likely to pay off their outstanding debts when risk is relatively high, making a rapid adjustment toward the target. These firms may find it easy to do so when they are relatively more certain about their potential earnings. In this context, it is likely that these firms do a relatively rapid adjustment in their capital structure to attain their leverage targets when macroeconomic risk is high but firm-specific risk is low relatively.

The adjustment of firms that have financing deficits with above-target leverage requires equity issuance. We conjecture the speed of adjustment of these firms to be higher when firm-specific risk is high and when macroeconomic risk is low. We predict this, because high firm-specific risk increasing risk premiums and the probability of bankruptcy and stable macroeconomic conditions increasing firms' equity values make debt borrowing expensive relative to equity financing. In such circumstances, firms prefer equity financing over debt issues when financing their deficits, decreasing their leverage ratios quickly toward their targets.

In case new borrowing is needed to adjust the capital structure of the firm, we expect that the speed of adjustment toward the target would be higher when both firm-specific and macroeconomic risk are low than when both types of risk are high. For instance, a firms having financing deficits with below-target leverage will simultaneously adjust its leverage toward the target and finance its financing needs by issuing debt. The cost of adjustments (issuing debt) for this firm would very likely to be less when the firm is relatively less uncertain about its expected earnings (cash flow streams) and when macroeconomic conditions are good. This can be explained as follows. Since firms are less cautious about bankruptcy costs and the fixed cost of debt when variations in their earnings are less. Further, banks are less reluctant to channel funds to firms with relatively stable earnings. Thus, firms are more likely to finance their financial deficits by issuing debt in periods when risk about their own business activity is low. On the other hand, relative stable macroeconomic conditions decreasing risk premia raise the discounted values of tax benefits, which, in turn, induce firms to increase their outstanding amounts of debt. Thus, firms with a financial deficit and below-target leverage are expected to adjust their leverage toward the target rapidly when both firm-specific and macroeconomic risks are relatively low.

Finally, for those firms that have a financial surplus with below-target leverage, we predict relatively slow and insignificant adjustments toward leverage targets. In essence, the adjustment of such firms' leverage would require either issuing new debt or repurchasing existing equity. However, these firms may find it favorable—perhaps to increase their financial flexibility—to reduce their debt obligations rather than equity finance in periods when their projections indicate the relative stability of earnings and when macroeconomic prospects are good. We therefore expect to observe that the speed of adjustment of these firms would be either slower or negative when both types of risks are low. A more detailed discussion of the role of risk in firms' financing decisions is presented below.

3.3.2 Financing Decisions and the Impact of Risk

3.3.2.1 *The Role of Business Risk*

Several researchers have explored how business risk influences the change in a firm's capital structure. For instance, using the tax shelter-bankruptcy cost model, Castanias (1983) establishes an inverse relationship between business risk and a firm's leverage. He shows that with a given marginal tax rate and marginal default cost function, higher business risk results in a decline in the debt level of firms. He further shows that if risk is normally distributed, the relaxation of some of the assumptions would not affect the inverse relationship between leverage and risk. In line with bankruptcy cost theory, Bradley, Jarrell, and Kim (1984) present a single period corporate capital structure model and show the presence of an inverse relation of a firm's optimal level of debt with its earnings volatility.

When we search the empirical literature, we come across a long list of studies which provide evidence consistent with the above theoretical predictions. For instance, Caglayan and Rashid (2010) show that uncertainty exerts negative and significant effects on the leverage of UK public and non-public firms. Bokpin, Aboagye, and Osei (2010) present evidence that firms' external financing is significantly negatively related to both business risk and financial risk. Baum, Stephan, and Talavera (2009) report a significant and negative impact of idiosyncratic risk on the optimal short-term leverage for US non-financial firms. Lemmon, Roberts, and Zender (2008) report a negative effect of cash flow volatility measured by the standard deviations of historical operating income on both the book and market leverage. Wald (1999) investigates how earnings volatility affects the optimal firm leverage by examining the determinants of capital structure in France, Germany, Japan, USA, and the United Kingdom. He finds a significant negative effect of firm-level risk on the debt-to-assets ratio for the United States and Germany. Brealey and Myers (1981) argue that financial distress is costly regardless of the presence or the absence of bankruptcy so that risky firms use less debt in their capital structure to avoid expensive bankruptcy procedures. Furthermore, given that an increase in business risk would cause an increase in the probability of bankruptcy one should observe less debt in firms' capital structure. There are several earlier studies which express similar views. For instance, MacKie-Mason (1990), Titman and Wessels (1988), Ferri and Jones (1979), and Baxter (1967) document that firm-level risk exerts a significant and negative impact on leverage.

In contrast, Myers (1977) suggests that there is a positive relationship between firms' debt and risk. He argues that large business risk may tend to reduce debt-related agency costs which as a result induces firms to use more debt in their capital structure. Consistent with the Myers' views, Chu, Wu, and Chiou (1992), Auerbach (1985), and Kim and Sorensen (1986) provide evidence of a positive relationship between firms' debt levels and business risk. We should also note that an earlier study by Toy, Stonehill, Remmers, and Wright (1974) which investigates the determinants of optimal firm debt for manufacturing firms in Japan, Norway, and the United States, too, reports a significant and positive effect of earnings volatility on the debt ratio.

3.3.2.2 *The Role of Macroeconomic Risk*

When we turn to explore the effects of macroeconomic risks on corporate debt structure we come across a handful of studies in the literature that examine this aspect. Gertler and Hubbard (1993) argue that firms take into account both firm-level risk and aggregate risk while making their production and financing decisions. They further explain that while firms can manipulate the firm-level risk, to extenuate the costs of financial distress, firms should share the aggregate risk with outside lenders by issuing equity. Hence, the optimal capital structure is a mixture of debt and equity rather than of pure debt. In this context, the relation of firms' debt levels with macroeconomic risk is expected to be negative. However, if there is a tax bias against equity financing and if the cost of new equity is greater than the costs of exposure to macroeconomic risk, then firms may prefer debt financing (Myers and Majluf (1984)). As a consequence, the association between macroeconomic risk and leverage depends on the firm-managers' perceptions regarding the state of the economy and to what level the tax bias against equity finance exists.

Recent theoretical studies relate firms' financing decisions to business cycle risks, too. For instance, Hackbarth, Miao, and Morellec (2006) propose a contingent claims model in which the cash flows of firms are conditional on both idiosyncratic risk and macroeconomic conditions. Their model suggests that firms' borrowing capacity exhibits pro-cyclicity and that both the pace and the size of capital structure changes depend on macroeconomic conditions. Levy and Hennessy (2007) examine firms' financing choices in a general equilibrium framework. They predict that firms issue equity pro-cyclically. They also document that firms are more likely to reduce their outstanding debt in periods of poor macroeconomic conditions. More recently, Bhamra, Kuehn, and Strebulaev (2010) and Chen (2010) develop a dynamic capital structure model to examine how corporate financing policy responds to macroeconomic fluctuations. They predict that unpredictable variations in macroeconomic conditions significantly affect firms' financing policies. Caglayan and Rashid (2010) examine a large panel of UK public and non-public manufacturing firms and show that macroeconomic volatility has a significant and negative impact on leverage. Furthermore, they argue that the negative impact of macroeconomic risk on leverage is stronger when firms' cash holdings are low. Baum, Stephan, and Talavera (2009) also report a negative association between macroeconomic risk and firms' optimal short-term leverage for US manufacturing firms.

This quick review of the literature shows that researchers so far have not examined to what extent firms adjust their leverage when leverage deviates from targets as macroeconomic/firm-specific risk varies. However, since the extent of risk affects the costs and benefits of adjustment which in turn affects the speed of adjustment, the question whether risk increases or reduces the speed of adjustment as the firm's actual leverage deviates from its target and as its financial state changes is an important issue without which one cannot have a good understanding of the adjustment process. In this study, we address the importance of risk on the capital structure adjustment process of a firm as we consider both the actual state of the firm's leverage with respect to its target and the financial state of the firm.

3.3.3 Financing Decisions and Firm-Specific Factors

Several studies in the literature have focused to empirically examine the role of firm-specific factors in determining an optimal capital structure. These studies have identified a large number of factors that have significant influences on firms' financing decisions. These factors include the profitability of firms, the tangibility of assets, firms' capital expenditures, firm size, non-debt tax shields, the market-to-book value ratio, stock returns, selling expense, cash flows, and so on. Table 3-E of Appendix E presents the summary of the theoretical predictions and empirical findings on the relation of capital structure with firm-specific factors identified in the existing literature.

Although the focus of this study is to examine how risks about firms' own business activity and macroeconomic conditions affect firms' capital structure rebalancing decisions, it is important to control for firm-specific effects. Therefore, we include several firm-specific variables in our empirical analysis while examining the impact of risk on firms' financing decisions. We discuss the definitions of these variables in detail later in the data section of the chapter. However, in what follows below, we provide a brief discussion on how these variables theoretically relate to capital structure. We also present the empirical evidence in support of these predictions. We find that different theoretical models predict different relations of leverage with firm-specific factors. These differences are mainly attributed to the underlying assumptions. We also find that on empirical grounds, results differ based on the sample and the definition of variables used in the empirical analysis.

A. Profitability

The free cash flow theory predicts a significant positive impact of firms' profitability on debt ratios. Jensen (1986) describes that free cash flow-related agency costs increase with an increase in free cash flow. This implies that high-free-cash-flow firms are more likely to incur the agency cost of free cash flow. This is because firm managers are expected to invest this cash in low-return investments rather than pay it out to equityholders. However, debt serving as bonding or discipline instrument reduces such types of agency costs. The use of debt assures that firms' managers are well-disciplined, select most profitable investments, and do not quest for their own interests as debt adds bankruptcy risk (Harris and Raviv (1990)). Further, higher debt ratio serves as a devise for signal quality. Finally, the Jensen's (1986) model suggests that more profitable firms are more likely to takeover and hence, they in turn increase their leverage. Thus, profitable firms tend to use more debt in their capital structure. An alternative channel to explain the positive relation of leverage with profitability is that it is very likely that financial distress costs for profitable firms are low and interest tax shields are more available for them. Thus, the higher interest tax shield and lower bankruptcy risk motivate them to use more debt.[52] Alti (2006), Hovakimian, Hovakimian, and Tehranian (2004), Hovakimian (2004), and Jensen (1986) find a positive impact of profitability on leverage.

Alternatively, according to the pecking order model of Myers and Majluf (1984), there is a negative relationship between firms' profitability and leverage. Myers (1984) and Myers and Majluf (1984) argue that the problem of asymmetric information and adverse selection costs cause firms to prefer the use of internal funds (retained earnings) to finance new investment over external financing. Thus, firms with high profitability have tendency to use less debt in their capital structure. Several empirical studies such as Huang and Ritter (2009), Antoniou, Guney, and Paudyal (2008), Kayhan and Titman (2007), Hovakimian (2006), Rajan and Zingales (1995), Ozkan (2001), and Titman and Wessels (1988) find a negative relationship between firms' profitability and leverage and support the pecking order theory's prediction.

B. Tangibility

The pecking order theory suggests a negative association between tangibility and firms' debt financing. Since compared to intangible (non-monetary) assets, such as goodwill, trademarks, and patents, tangible assets, such as property, plant, and equipment, are easy to value for outsiders, they low information asymmetries between firms' management and outside lenders. This low tangible assets-related information asymmetry reduces the cost of issuance of new equity. Therefore, the higher tangibility inclines firms to issue more equity, and thus the leverage ratio will be lower.[53] The study by Huang and Ritter (2009), Feidakis (2007), Leary and Roberts (2005), and Hovakimian, Hovakimian, and Tehranian (2004) confirm the prediction of pecking theory by reporting a negative impact of tangibility on firm debt ratio.

In contrast, the trade-off theory predict a positive impact of tangibility on debt borrowing. Firms with higher tangibility are well-collateralized and risk of lending to them is lower, and thus they can do easily debt financing. In addition, tangibility reduces the chance for shareholders to engage in substitution of high-risk assets with low-risky ones and hence results in lower agency costs. Lower debt-related agency costs prompt firms to borrow more, suggesting a positive relation of leverage with the tangibility of assets. The findings of Frank and Goyal (2009), Lemmon, Roberts, and Zender (2008), Hovakimian (2006), Alti (2006), Flannery and Rangan (2006), and Titman and Wessels (1988) are in line with the trade-off theory.

[52]The trade-off theory also predict a positive relationship between profitability and leverage (Frank and Goyal (2003)).

[53]If adverse selection costs associated with assets exist, then firms with higher tangibility face higher adverse selection costs, and thus do more debt financing.

C. Firm Size

The trade-off theory of capital structure postulates a positive relationship between leverage and firm size. The rationale behind this predictions is that large firms are more diversified and are likely to have a low likelihood of being bankrupt. In addition, large and relatively older firms having good reputation in debt markets are most likely to face lower debt-related agency costs and are in position to negotiate for borrowing at favorable interest rates. Lower default risks, less agency costs associated with debt financing, and negotiation power allow large firms to increase the use of debt in their capital structure.

Several empirical studies including Sibilkov (2009), Chang and Dasgupta (2009), Brav (2009), Frank and Goyal (2009), Antoniou, Guney, and Paudyal (2008), Flannery and Rangan (2006), and Hovakimian, Hovakimian, and Tehranian (2004) lend strong support for the trade-off theory by proving evidence of the positive impact of firm size on firms' leverage ratios.[54] On the contrary, a negative relation of leverage with firm size is predicted by the pecking order theory. Since big firms face relatively less severe information asymmetric problem and have more opportunities to retain earnings, they opt internal funds over external borrowing and thus borrow less. Alternatively, since equity issues is less costly for large firms than for small firms, large firms are likely to be less levered (Smith (1977)). The findings of the studies such as Johnson (1998), Titman and Wessels (1988) and Kester (1986) are in line with the pecking order theory's prediction.

D. Stock Returns

The pecking order theory states that firms are likely to issue net equity when their share are overvalued (Myers (1984)). Under pecking order model of corporate capital structure, the existing of informational asymmetric conflicts between firms' managers and outside investors push managers to sell new equity at discounted price. Such discount can be offered without any real loss in existing shareholders' wealth when shares are overvalued. Thus, managers prefer to issue new equity after increased stock prices as run-ups in stock prices outweigh the cost of discount. This idea is reincarnated and received anew surge of popularity in the empirical literature of corporate finance by the Graham and Harvey's (2001b) survey of corporate managers. They report that most of the CFOs believe that they can issue new equity under favorable conditions when their shares price is higher.

Hovakimian, Opler, and Titman (2001) also report similar observations that firms tend to repurchase their shares when share prices are low and tend to issue new shares when there are increases in their share prices. Welch (2004) argues that firms do not quickly re-equilibrium (alter) their capital structure to outweigh the impact of stock price

[54] Ferri and Jones (1979), Friend and Lang (1988), Chung (1993), Ozkan (2001), and Mao (2003) are among the early studies, who also report the positive impact of firm size on firms' leverage decisions.

fluctuations and therefore the role of stock returns is substantially significant in explaining debt ratios. This suggests that there is an inverse relationship between leverage and stock returns. On the empirical side, Chang and Dasgupta (2009), Bokpin (2009), Antoniou, Guney, and Paudyal (2008), Kayhan and Titman (2007), Hovakimian (2006), Kahle and Shastri (2005), Hovakimian, Hovakimian, and Tehranian (2004), and Korajczyk and Levy (2003) find a significant effect of stock returns on capital structure.

E. Non-debt Tax Shields

The trade-off theory predicts a positive association between debt borrowing and tax rates. The interest tax benefits of debt financing increase with the rate of tax. Therefore, to acquire a higher interest tax shield, firms borrow more when the rate of tax is higher.[55] However, under the model proposed by DeAngelo and Masulis (1980), non-debt tax shield proxies such as the ratio of depreciation expense to book value of total assets, investment tax credit, and net operating loss carryforwards are considered as substitutes for the tax-related benefits of debt financing. As a result, firms with large amounts of non-debt tax shield relative to their cash flow are less likely to include debt in their capital structure.[56]

With regard to empirical evidence, several researchers Frank and Goyal (2009), Antoniou, Guney, and Paudyal (2008), Mao (2003), MacKie-Mason (1990), and Titman and Wessels (1988) prove a positive relationship between debt financing and the amount of non-debt tax shields proxied by depreciation expense to total assets ratio. In contrast, the findings of the studies Leary and Roberts (2005), DeMiguel and Pindado (2001), and DeAngelo and Masulis (1980) confirm the negative impact of non-debt tax shield on leverage.

F. Market-to-Book Value

According to the trade-off theory of capital structure, the growth opportunities of firms (the market-to-book value) are inversely related to leverage. This is because growth lowering free cash flow problems and increasing debt-related agency costs and the costs of financial distress forces firms to reduce their use of debt in their capital structures. In addition, growing firms' stocks are overvalued and thus firms with high growth are more likely to issue equity instead of debt, reducing their leverage ratios. Several empirical studies including Frank and Goyal (2009), Sibilkov (2009), Chang and Dasgupta (2009), Lemmon, Roberts, and Zender (2008), Antoniou, Guney, and Paudyal (2008), Kayhan and Titman (2007), Alti (2006), Miao (2005), Hovakimian (2004), Mao (2003), and Rajan and

[55] However, one should note that in practice, tax implications for firms financing decisions are crucially subject to the tax policy objectives. This is whether the tax system is designed to encourage dividend payout against the retention of retained earnings or vice versa.

[56] However, it is important to note that a proxy such as depreciation expense to total assets ratio may also serve as a proxy for other things than only non-debt tax shields (Titman and Wessels (1988)).

Zingales (1995) find a negative effect of the market-to-book value on leverage supporting trade-off theory.[57]

However, a positive relation of leverage with growth opportunities is expected under the pecking order theory. The growing firms may not have enough internal recourses to finance their all positive net present value (NPV) investments. Thus, firms may require external financing. In the pecking order model, firms first prefer to issue debt than equity while raising external capital. In this context, the leverage of firms increases with their growth (see, for example, Jensen (1986), Myers (1984), and Myers and Majluf (1984)).

G. Financial Deficits

Under Myers's (1984) and Myers-Majluf's (1984) pecking order models, firms do not have target debt ratios. Rather, information asymmetries and signaling problems related with external financing force firms to use first internal funds to finance new investment. However, firms strictly prefer debt borrowing over equity issues when doing external financing and hence this results in high debt ratios. Firms do, only as a last resort, equity financing. This suggests that leverage positively relates to financial deficits. Shyam-Sunder and Myers (1999) construct financial deficit variable and test the pecking order hypothesis. Consistent with the the Myers-Majluf's model, they find that firms are likely to increase their debt ratios by raising more external capital when they face higher financial deficit. Analogously, Kayhan and Titman (2007) and Byoun (2008) also find that financial deficits have a positive and robust impact on leverage. However, the findings of Frank and Goyal (2003) are inconsistent with the Myers-Majluf's prediction.

H. Leverage Deviations

The simple version of the target adjustment model predicts that deviations of firms' actual (observed) leverage ratio from the target play a significant role in explaining changes in debt ratio. Indeed, under the assumption of symmetric cost for both leverage-decreasing adjustments and leverage-increasing adjustments, firms have tendency to increase (decrease) their debt ratios when their current ratios are below (above) their target leverage. Byoun (2008), Kayhan and Titman (2007), and Shyam-Sunder and Myers (1999) examine how firms' debt ratios relate to leverage deviations from the target, where target leverage is estimated leverage from the regression of observed leverage on the firm-specific factors.

[57] As in Shyam-Sunder and Myers (1999), the investment spending of firms, which is also considered as a proxy for firms' growth, directly increases the financing deficit of firms, and thus it is positively related to debt ratios according to the pecking order theory's prediction. Besides the market-to-book value, we include firms' investment spending as an explanatory variable in our empirical analysis to control for the investment opportunity sets. So that our market-to-book value proxy fully represents to the market timing (Baker and Wurgler (2002)).

They show that leverage deviations have a significant influence on capital structure.[58]

3.4 Data

In this section, we provide information on our dataset and discuss how we generate the firm-specific and macroeconomic risk measures. Detailed information on all variables are given in Table 3-B of Appendix B.

3.4.1 The Sample

In our investigation, we use a firm-level unbalanced annual panel dataset for the United Kingdom. The data are obtained from the WorldScope database via DataStream and cover the period between 1981–2009. The analysis is carried out for manufacturing firms and each firm in the dataset contributes at least five years of observations.[59,60] As in Baker and Wurgler (2002) and Kayhan and Titman (2007), we drop firm-year observations if the ratio of book leverage is negative or exceeds one. All remaining firm-specific variables are scaled by total assets and are winzorised at the first and ninety-ninth percentile to eliminate the adverse effects of outliers and misreported data.[61]

Following earlier empirical studies, including Baker and Wurgler (2002), Alti (2006), and Kayhan and Titman (2007), we define book equity as total assets minus total liabilities and preferred stock plus deferred taxes and convertible debt. Book debt is defined as total assets less the book value of equity. Book leverage is then defined as the ratio of book debt to total assets. Our choice of the book leverage is due to the observation that since market leverage is very sensitive to the market value of equity and it can change substantially due to movements in equity markets, even if firms do not alter their actual borrowing.[62] In addition, firm managers are more concerned about the book value of debt ratio because banks and other financial institutions utilize the book value of debt in ascertaining the creditworthiness of a firm. Similarly, credit-rating agencies such as Standard & Poor's,

[58] Hovakimian, Opler, and Titman (2001) and Fama and French (2002) construct the leverage deficit with same fashion and show that firms' debt-equity choice is significantly associated with firms' actual leverage deviations from the target.

[59] Allowing for both entry and exit in the sample, we extenuate potential sample selection and survivor bias.

[60] We restrict our attention to those firms which contribute at least 5 years of observations to generate meaningful measures of risk at the firm level and to properly instrument the endogenous variables in our model when we implement the two-step system-GMM method.

[61] The data screening we implement here is commonly applied in the literature; e.g., see, including others, Brav (2009), Baum, Stephan, and Talavera (2009), Kayhan and Titman (2007), and Baker and Wurgler (2002).

[62] Using leverage measure based on book value is not a serious limitation because several studies in the literature using both the book and market leverage measures have shown that both of the measures primarily behave in similar manner. See, for example, Rajan and Zingales (1995), Fama and French (2002), and Leary and Roberts (2005). Further, recently, DeAngelo and Roll (2011) finding high correlation between the book and market leverage conclude "that there not all that much incremental informational in the market series".

Moody's, and A.M. Best also consider the book value of debt in determining a firm's credit rating.[63]

Firm size is defined as the logarithm of net sales deflated by the GDP deflator.[64] Asset tangibility is equal to the ratio of net plant, property, and equipment to the book value of total assets. Profitability is the ratio of earnings before interest, taxes, and depreciation to the book value of total assets (Titman and Wessels (1988)). The 2-year stock return is defined as the difference between share prices at time t and share prices at time $t-2$. The market-to-book value ratio is defined as the book value of total assets less the book value of equity plus the market value of equity divided by the book value of total assets (Kayhan and Titman (2007)). Market equity is common shares outstanding multiplied by the market price of each share. The non-debt tax shield is defined as total depreciation expense divided by the book value of total assets.

To investigate the impact of risk on firms' financial decisions we consider two types of risk: firm-specific risk which is derived from firms' sales to total asset ratio, and macroeconomic risk which is computed using real gross domestic product (GDP). Seasonally adjusted quarterly data spanning 1975Q1-2009Q4 on UK real GDP are taken from the Office for National Statistics (ONS) database (Pn: A2: ABMI: Gross Domestic Product: chained volume measure).

3.4.2 Measuring Firm-Specific Risk

Researchers have utilized various approaches to generate measures of firm-specific risk. Some researchers simply compute the moving standard deviation of a variable as a proxy for risk, while others use state space models, ARCH/GARCH models, stochastic volatility models, the intra-annual variation approach, and survey-based methods.

In this study, we estimate an autoregressive (AR) model of order one for firms' annual sales normalized by the book value of total assets to generate firm-specific risk based on the residuals of the model as suggested in Bo (2002).[65] Specifically, we estimate the following model for each underlying firm:

$$Sales_{i,t} = \mu_i + \varphi Sales_{i,t-1} + \zeta_{i,t} \tag{3.1}$$

where $Sales_{i,t}$ is the ratio of sales to book value of total assets for firm i at time t, μ_i is the constant for firm i, φ is the autoregressive parameter, $\zeta_{i,t}$ is the error term with zero mean and finite variance. We next obtain the residuals from the above $AR(1)$ process for each firm and compute the cumulative variance of the obtained residuals. Ultimately, the

[63] See Shyam-Sunder and Myers (1999) and Frank and Goyal (2003) along these lines.

[64] Our measure of firm size is in line with Titman and Wessels (1988), Whited (1992), Rajan and Zingales (1995), Ozkan (2001), De Jong, Kabir, and Nguyen (2008), and Huang and Ritter (2009).

[65] We scale sales by the book value of total assets to mitigate the problem of heterogeneity across firms.

square root of the estimated cumulative variance, denoted by $R_{i,t}^{firm}$, is used as a proxy for firm-specific risk in the empirical investigation. Given each firm is contributing at least 5 years of observations, the measure above uses a minimum of four observations to generate the risk measure.

3.4.3 Measuring Macroeconomic Risk

To generate a proxy for macroeconomic risk, we estimate an ARCH model on quarterly real GDP over 1975-2009. We allow an ARMA term in the mean equation of our ARCH specification and estimate the following model:

$$\Delta GDP_t = \omega + \eta(L)\Delta GDP_t + \delta(L)\epsilon_t + \epsilon_t \tag{3.2}$$

$$\sigma_t^2 = \alpha + \beta(L)\epsilon_t^2 \tag{3.3}$$

where ω is a constant term, η and δ are the autoregressive and moving average parameters, respectively, and L is the polynomial lag operator. The estimated conditional variance, $\hat{\sigma}_t^2$, is the one-period-ahead forecast variance based on prior information. α is the constant and $\epsilon|\Delta GDP_{t-1} \sim N(0, \sigma_{t-1}^2)$ is the innovation in real GDP.

The model is estimated using the maximum likelihood method. The estimated conditional variance, $\hat{\sigma}_t^2$, is used as a measure of risk surrounding the one-quarter change in the real GDP between time $t-1$ and t. The obtained conditional variance series is then annualized by averaging over 4-quarter periods to match the frequency of the firm level data. The generated series is denoted by R_t^{macro} and used as a proxy for macroeconomic risk.

Panel A of Table 3-C in Appendix C presents the estimated coefficients for our $ARCH(1)$ specification. The $ARCH$ coefficient ($\beta = 0.781$) is less than one and is statistically significant at the 1% level of significance. Panel B of the table reports the diagnostic test statistics. The LM and Q statistics provide evidence that the mean and variance equations are correctly specified and there are no remaining $ARCH$ effects left in the standardized residuals.

3.4.4 Summary Statistics

Table 3.1 provides the basic summary statistics of the firm-specific variables for the full sample as well as three sub-periods. We observe that the book leverage, which has a mean of 0.574 for the full sample, has increased over time suggesting that firms, on average, were less levered and were not actively involved in altering their leverage in the 1980s in comparison to the later years of the sample period.

The average fixed capital expenditures (investment) to the book value of total assets ratio is 0.059 for the entire sample period. In contrast to the leverage, it appears that the investment rate has declined over the sample period. Similar patterns can be observed for firms' profitability. On average, firms were more profitable during the first ten years of the sample period. Reductions in average profitability during the last nine years of the sample could be one of the reasons why firms' fixed capital investment, on average, declined.

The average 2-year stock return is 0.098 for the full sample period, yet, it is negative, on average, with a value of -0.134 but with a high standard deviation during the last nine years of the sample period. The 1990s happens to be a period when firms' share prices have risen as the average stock returns are positive and higher than the other two sub-periods. The mean values of tangibility and firm size, measured by the log of total net sales, are 0.287 and 11.141, respectively, for the whole sample period. Inspecting the behavior of both variables, we see that while the means of both series monotonically declined, their volatility increased over time. Finally, we observe that the average non-debt tax shield for the full sample is 0.052, yet, it exhibits increasing trends over the years.

Overall, the summary statistics across the three sub-periods show that firms are relatively more-leveraged, earn less returns on their assets, have less fixed investment expenditures, and have declining trends in their share values in the later years of the sample, particularly over the 2001-09 period than the earlier sub-periods.

Table 3.2 provides the summary statistics of our risk measures for the full and the sub-samples. The table shows that firm-specific risk has consistently increased over time. Specifically, the average firm-specific risk during the 1980s and 1990s was considerably less than that of the 2001-09 period. We also observe that firm-specific risk was more volatile during the last nine years of the sample as its standard deviation is higher in these years compared to the 1980s and the 1990s. This implies that firms experienced greater risks associated with their sales in the latter years of the sample. Similar to the case of firm-specific risk, the macroeconomic risk also appears to be on the rise throughout the period of investigation. Further, the estimates of the standard deviations provide evidence that the overall macroeconomic environment is more volatile over the 2001-2009 period as compared to earlier years. That is, in the last 9-year period, the average macroeconomic risk was not only high but it was also very volatile.

In summary, both macroeconomic risk and firm-specific risk have increased markedly and became more volatile over the recent years. This observation makes sense as the financial crisis toward the end of the data took its toll on businesses and the economy. One last question that we must clarify is that to what extent firm-specific and macroeconomic risks carry similar information. The answer is not much as we find little correlation between the two series (0.002) which is statistically insignificant. Low correlation implies that each measure covers a different aspect of risk associated with the business and macroeconomic environment that firms face in their operations.

Table 3.1: Summary Statistics of Firm-Specific Factors

The second, third and fourth columns of Table 3.1 report the firm-year observations (N), mean and standard deviation (S.D) of the firm-specific variables, respectively. The last three columns of the table report the 25^{th}, 50^{th}, and 75^{th} percentiles of the firm-specific variables. The variables are defined as follows. Book leverage is the ratio of the book value of total debt to the book value of total assets. The market-to-book value ratio is defined as the book value of total assets less the book value of equity plus the market value of equity divided by the book value of total assets. Investment is the ratio of total expenditures to purchase fixed tangible assets to the total book assets. Profitability is the ratio of earnings before interest, taxes, and depreciation to the total book assets. Tangibility is defined as the ratio of net plant, property, and equipment to the total book assets. The 2-year stock return is the difference between share prices at time t and share prices at time $t-2$. Firm size is defined as the logarithm of net sales deflated by the GDP deflator. The non-debt tax shield is defined as total depreciation expense divided by the book value of total assets. The sample consists of all UK manufacturing firms listed on the London Stock Exchange at any point over the period 1981-2009. The data are drawn from the WorldScope database via DataStream.

Variables	N	Mean	S.D	P25	Median	P75
Book Leverage						
1981-90	1546	0.506	0.176	0.401	0.504	0.608
1991-00	4387	0.556	0.317	0.379	0.522	0.661
2001-09	7841	0.598	0.568	0.332	0.509	0.689
1981-2009	13774	0.574	0.469	0.358	0.513	0.669
Market-to-Book Value						
1981-90	1434	1.491	0.773	1.005	1.279	1.722
1991-00	4171	2.241	2.691	1.095	1.528	2.242
2001-09	7120	1.987	1.807	1.033	1.424	2.178
1981-2009	12725	2.014	2.077	1.047	1.437	2.136
Investment						
1981-90	1917	0.084	0.062	0.042	0.066	0.107
1991-00	4456	0.066	0.059	0.028	0.051	0.083
2001-09	7766	0.049	0.062	0.012	0.029	0.059
1981-2009	14139	0.059	0.063	0.018	0.041	0.076
Profitability						
1981-90	1904	0.166	0.087	0.117	0.161	0.211
1991-00	4425	0.096	0.257	0.073	0.137	0.197
2001-09	7852	0.001	0.399	-0.007	0.097	0.164
1981-2009	14181	0.053	0.337	0.049	0.121	0.184
2-year Stock Returns						
1981-90	1421	0.283	1.187	-0.442	0.288	0.873
1991-00	3932	0.427	1.351	-0.439	0.438	1.236
2001-09	6715	-0.134	1.722	-1.171	0.113	1.072
1981-2009	12068	0.098	1.575	-0.789	0.249	1.098
Tangibility						
1981-90	1922	0.362	0.196	0.229	0.324	0.468
1991-00	4460	0.348	0.228	0.176	0.311	0.459
2001-09	7907	0.235	0.234	0.050	0.152	0.348
1981-2009	14289	0.287	0.235	0.090	0.243	0.417
Firm Size						
1981-90	1931	11.761	1.986	10.321	11.600	13.267
1991-00	4465	11.229	2.210	9.737	11.019	12.653
2001-09	7932	10.941	2.381	9.155	10.805	12.485
1981-2009	14328	11.141	2.295	9.486	11.003	12.654
Non-debt Tax Shields						
1981-90	1904	0.036	0.026	0.022	0.032	0.044
1991-00	4425	0.046	0.121	0.025	0.038	0.054
2001-09	7852	0.052	0.095	0.022	0.038	0.059
1981-2009	14181	0.048	0.098	0.023	0.037	0.055

Table 3.2: Summary Statistics of Risk Measures
The second and third columns of Table 3.2 report the mean and standard deviation (S.D) of firm-specific and macroeconomic risk, respectively. The last three columns of the table report the 25^{th}, 50^{th}, and 75^{th} percentiles of the risk measures. Firm-specific risk is constructed using data on firms' sales estimating the following model for each underlying firm:

$$Sales_{i,t} = \mu_i + \varphi(L)Sales_{i,t} + \zeta_{i,t}$$

where $Sales_{i,t}$ denotes the ratio of sales to the book value of total assets for firm i at time t, μ_i is the constant for firm i, φ is the autoregressive parameter, L is the polynomial lag operator, $\zeta_{i,t}$ is the error term with zero mean and finite variance. Residuals obtained from this regression are then used to calculate the cumulative variance for each firm. The square root of the cumulative variance is used as a proxy for firm-specific risk.

Macroeconomic risk is proxied by the conditional variance of UK real GDP over the period under investigation. In order to generate the conditional variance, we estimate the following ARCH model:

$$\Delta GDP_t = \omega + \eta(L)\Delta GDP_t + \delta(L)\epsilon_t + \epsilon_t$$
$$\sigma_t^2 = \alpha + \beta(L)\epsilon_t^2$$

where ω is a constant term, η and δ are the autoregressive and moving average parameters, respectively, and L is the polynomial lag operator. The estimated conditional variance, $\widehat{\sigma}_t^2$, is the one-period-ahead forecast variance based on prior information. α is the constant and $\epsilon|\Delta GDP_{t-1} \sim N(0, \sigma_{t-1}^2)$ is the innovation in real GDP. In the variance equation, the weights are (1-α, β) and the long-run average variance is $\sqrt{\alpha/(1-\beta)}$, where $\alpha > 0$ and $0 < \beta < 1$. The sample consists of all UK manufacturing firms listed on the London Stock Exchange at any point over the period 1981-2009. The data are drawn from the WorldScope database via DataStream. Quarterly data spanning 1975Q1-2009Q4 on seasonally adjusted UK real GDP are taken from the Office for National Statistics (ONS) database (Pn: A2: ABMI: Gross Domestic Product: chained volume measure).

Variables	Mean	S.D	P25	Median	P75
Firm-Specific Risk					
1981-90	0.241	0.287	0.093	0.161	0.289
1991-00	0.262	0.249	0.118	0.192	0.319
2001-09	0.349	0.503	0.135	0.232	0.399
1981-2009	0.309	0.418	0.124	0.212	0.359
Macroeconomic Risk					
1981-90	1.133	0.916	1.455	1.221	1.458
1991-00	1.328	0.385	1.013	1.323	1.411
2001-09	1.884	1.403	1.189	1.556	2.172
1981-2009	1.779	1.002	1.172	1.440	1.958

3.5 Empirical Models

In this section, we first present a standard augmented leverage model which incorporates firm-specific and macroeconomic risk measures that we use to compute the target leverage of firms. We then describe the standard partial-adjustment model and a specific form of the target adjustment model with full (100%) adjustment speed that we use to estimate the speed of adjustment toward a target while we take into account the effects of risk. We finally present an extended version of the adjustment model which allows us to investigate the asymmetric effects of risk in conjunction with firms' financial imbalances and deviations of firms' actual leverage from the target on the adjustment of firms' capital structure.

3.5.1 The Impact of Risk on Adjustment Speed

We start our examination estimating a standard leverage model augmented by firm-specific and macroeconomic risk measures to compute the firm-specific target debt ratio, L_{it}^T. We then use this information to quantify the effects of risk on the adjustment process following earlier work including that of Hovakimian, Opler, and Titman (2001), Fama and French (2002), Korajczyk and Levy (2003), Flannery and Rangan (2006), Lemmon, Roberts, and Zender (2008), Antoniou, Guney, and Paudyal (2008), Brav (2009), Frank and Goyal (2009), Huang and Ritter (2009), and Goyal, Nova, and Zanetti (2011). Specifically, we estimate the following model to compute the target leverage:

$$L_{i,t}^T = \beta_1 X_{i,t-1} + \beta_2 R_{i,t-1}^{firm} + \beta_3 R_{t-1}^{macro} + \upsilon_i + \varepsilon_{i,t} \tag{3.4}$$

where X_{it} is a vector of firm-specific variables that includes the market-book-value ratio, profitability, tangibility, capital investment expenditures-to-total assets ratio, the 2-year stock returns, non-debt tax shields, the log of firms' sales as a proxy for firm size, and the lagged dependent variable. $R_{i,t}^{firm}$ and R_t^{macro} depict time-varying firm-specific and macroeconomic risks, respectively. The term υ_i captures time-invariant unobservable firm-specific fixed effects. The term $\varepsilon_{i,t}$ is the error term. The subscripts i and t denote firm and time, respectively.

A Partial-Adjustment Model of Capital Structure

Once we obtain the firm-specific target leverage it is possible to investigate the adjustment process of leverage toward the target using equation (3.5) below.[66] This equation captures the effects of transactions costs which prevent firms from carrying out frequent adjustments in their leverage through the adjustment coefficient, ϕ, as follows:

$$L_{i,t} - L_{i,t-1} = \phi(L_{i,t}^T - L_{i,t-1}) \tag{3.5}$$

where $L_{i,t}$ is the observed (actual) leverage of firm i in year t. If there exists some positive costs of adjustment then the adjustment coefficient, ϕ, should strictly lie between zero and one. However, if the adjustment costs are significantly higher than the cost of being off the target, the adjustment coefficient would not be statistically different from zero. Substituting equation (3.4) into equation (3.5) and rearranging, we obtain the following

[66] Shyam-Sunder and Myers (1999) estimate a target adjustment model to similar one presented in equation (3.5.)

reduced-form partial adjustment model:[67]

$$L_{i,t} = \lambda L_{i,t-1} + \phi\beta_1 X_{i,t-1} + \phi\beta_2 R^{firm}_{i,t-1} + \phi\beta_3 R^{macro}_{t-1} + \phi\upsilon_i + \phi\varepsilon_{i,t} \tag{3.6}$$

where $\lambda = 1 - \phi$. Thus, the speed of adjustment (SOA) is given by $\phi = 1 - \hat{\lambda}$, where $\hat{\lambda}$ is the estimated coefficeint. The coefficient on the lagged leverage (λ) measures how quickly firms adjust their capital structure to attain their target leverage and it is expected to be less than 1. If the cost of staying away from the target is higher (lower) than the cost of adjustment, the value of the coefficient on the lagged leverage would be smaller (larger) and hence the speed of adjustment will be faster (slower).

To test for possibility that risk affects the speed of capital adjustment process, we augment equation (3.6) by including an interaction variable between both measures of risk and one-period lagged leverage (the lagged dependent variable).[68] The model now takes the following form:

$$\begin{aligned} L_{i,t} = {} & \lambda L_{i,t-1} + \lambda L_{i,t-1} \times R^{firm}_{i,t-1} + \lambda L_{i,t-1} \times R^{macro}_{t-1} + \phi\beta_1 X_{i,t-1} \\ & + \phi\beta_2 R^{firm}_{i,t-1} + \phi\beta_3 R^{macro}_{t-1} + \phi\upsilon_i + \phi\varepsilon_{i,t} \end{aligned} \tag{3.7}$$

Given the modification in the standard model, we can compute the speed of adjustment at various (high, median, and low) levels of firm-specific and macroeconomic risk where these levels are based on the quartiles of each risk measure for our sample period.

3.5.2 Risk and the Speed of Adjustment: Controlling for Deviations from the Target Leverage

A Modified Standard Adjustment Model of Capital Structure

If a firm's actual leverage happens to be above its target, the firm should either reduce its use of debt or issue new equity to move toward its target. Whereas, if a firm's leverage is below its target, the firm can repurchase equity or issue more debt to move toward its target leverage. However, the speed with which firms adjust their capital structure depends on whether firms are above or below their target leverage ratio along with the risk structure of the environment. Indeed, firms are expected to adjust their leverage asymmetrically as the risk structure of the environment within which firms operate will render firm to give different weights to positive and negative deviations of actual leverage from the target. Hence, we modify equation (3.5) by interacting our risk measures with indicators that capture the state of current leverage with respect to target leverage.[69] The

[67] Several prior empirical papers estimate the reduced-form partial adjustment model to examine firms' adjustment speed. Examples of these papers include studies by Flannery and Rangan (2006), Lemmon, Roberts, and Zender (2008), Frank and Goyal (2009), Huang and Ritter (2009), Cook and Tang (2010), and Elsas and Florysiak (2011).

[68] See, for example, Drobetz and Wanzenried (2006) who study the effects of size and growth on the speed of adjustment within a similar structure to ours.

[69] Byoun (2008) specifies a target-adjustment model in a similar manner to analyze asymmetry in capital structure adjustments conditional on firm characteristics.

results model takes the following form:

$$L_{i,t} - L_{i,t-1} = (\beta_1 D_{i,t}^{abov} + \beta_2 D_{i,t}^{belo}) DVT_{i,t} + (\beta_3 D_{i,t}^{abov} + \beta_4 D_{i,t}^{belo}) DVT_{i,t} \times R_{i,t-1}^{firm} + (\beta_5 D_{i,t}^{abov} + \beta_6 D_{i,t}^{belo}) DVT_{i,t} \times R_{t-1}^{macro} + \upsilon_i + \varepsilon_{i,t} \quad (3.8)$$

where $DVT_{i,t} = L_{i,t}^T - L_{i,t-1}$ denotes the deviation of the firm's actual leverage from the target leverage at time t, where L^T is computed from equation (3.4) above. $D_{i,t}^{abov}$ is a dummy variable equal to one if the leverage ratio is above the target and zero otherwise for firm i at time t. Similarly, $D_{i,t}^{belo}$ is a dummy variable equal to one if leverage is below the target and zero otherwise.

This model allows one to investigate the speed of adjustment as firms go through periods of higher or lower risk when leverage exceeds or falls short of the target. In general, we know that if the adjustment of equity is costlier than debt and if firm leverage is above target, then the firm adjusts its capital structure to attain its target debt ratio by retiring debt. However, the risk structure of the environment within which the firm operates affects the costs and benefits of adjusting a firm's leverage toward a target, which in turn affects the speed of adjustment.

3.5.3 Risk and the Speed of Adjustment: Controlling for Deviations from the Target Leverage and Financial Deficits/Surpluses

According to the Myers and Majluf's (1984) pecking order model, there is a hierarchy in firms' financing decisions. Several researchers, among others Leary and Roberts (2005) and Strebulaev (2007) empirically show that firms prefer to use internally generated funds (e.g., retained earnings) over external financing and debt over equity. Analogously, Hovakimian, Opler, and Titman (2001), and Hovakimian, Hovakimian, and Tehranian (2004) provide empirical evidence that firms prefer to use internal funds over external funds even when they have a target leverage. Frank and Goyal (2003) document that an imbalance in cash flows plays a central role in the pecking order.

Kayhan and Titman (2007) and Byoun (2008) empirically examine the role of financial deficits in changes in the debt ratio and the speed of adjustment, respectively. Specifically, Kayhan and Titman (2007) report that financial deficits have a strong influence on capital structure which are partly reversed over long horizons. Furthermore, they report that the effect of financial status on capital structure is relatively more substantial when firms raise capital (i.e., firms have financial deficits) than when firms retire external capital (i.e., firms have financial surpluses). Byoun (2008) proposes a financial needs-induced adjustment framework to investigate how firms adjust their capital structure toward target debt levels. He finds that firms adjust their leverage faster when their leverage is above the target as they experience a financial surplus, or when their leverage is below the target while they experience a financial deficit. Given the empirical evidence, it appears that firms are more likely to adjust their capital structure toward their target debt levels when they face imbalances in their cash flows (financial deficits or surpluses). However, none of the earlier work allows for risk to exert an impact on the adjustment process as firms experience changes in their financial state and actual leverage with respect to a target.

To test the effects of risk on the capital adjustment process as firms experience changes in their financial sate, we follow Kayhan and Titman (2007) and Byoun (2008) and calculate the imbalances in cash flows (financial deficits/surpluses) utilizing the cash flow identity below:

$$CF_{i,t} - CAPE_{i,t} - \Delta WC_{i,t} \equiv DIV_{i,t} - \Delta d_{i,t} - \Delta e_{i,t} \tag{3.9}$$

where $CF_{i,t}$ is the operating cash flow after interest and taxes, $CAPE_{i,t}$ denotes capital expenditures, $\Delta WC_{i,t}$ denotes changes in working capital, $DIV_{i,t}$ denotes payments of dividends, $\Delta d_{i,t}$ is equal to net debt issues and $\Delta e_{i,t}$ denotes net equity issues.[70] Rearranging equation (3.9), it is possible to define a firm's financial deficit ($FD_{i,t}$) as below:

$$FD_{i,t} = CAPE_{i,t} + \Delta WC_{i,t} + DIV_{i,t} - CF_{i,t} \equiv \Delta d_{i,t} + \Delta e_{i,t} \tag{3.10}$$

A negative value of $FD_{i,t}$ implies a financial surplus (i.e., the firm invests less than the internally generated cash). A positive $FD_{i,t}$ implies a financial deficit (i.e., the firm invests more than the internally generated cash). In order to examine how risk affects the impact of financial deficits and surpluses on the speed of adjustment, we augment equation (3.8) by incorporating an interaction term between our measures of risk, above- and below-target leverage indicators, and the financial status of the firm as given in the following equation:

$$\begin{aligned} L_{i,t} - L_{i,t-1} = {} & (\beta_1 D^{sur}_{i,t} D^{abov}_{i,t} + \beta_2 D^{def}_{i,t} D^{abov}_{i,t} + \beta_3 D^{sur}_{i,t} D^{belo}_{i,t} + \beta_4 D^{def}_{i,t} D^{belo}_{i,t}) DVT_{i,t} \\ & + (\beta_5 D^{sur}_{i,t} D^{abov}_{i,t} + \beta_6 D^{def}_{i,t} D^{abov}_{i,t} + \beta_7 D^{sur}_{i,t} D^{belo}_{i,t} + \beta_8 D^{def}_{i,t} D^{belo}_{i,t}) DVT_{i,t} \times R^{firm}_{i,t} \\ & + (\beta_9 D^{sur}_{i,t} D^{abov}_{i,t} + \beta_{10} D^{def}_{i,t} D^{abov}_{i,t} + \beta_{11} D^{sur}_{i,t} D^{belo}_{i,t} + \beta_{12} D^{def}_{i,t} D^{belo}_{i,t}) DVT_{i,t} \times R^{macro}_{i,t} \\ & + (\beta_{13} D^{sur}_{i,t} + \beta_{14} D^{def}_{i,t}) + \upsilon_i + \varepsilon_{i,t} \end{aligned} \tag{3.11}$$

As defined earlier, $DVT_{i,t} = L^T_{i,t} - L_{i,t-1}$, where $L^T_{i,t}$ is the estimated target leverage ratio for firm i at time t. $D^{abov}_{i,t}$ is a dummy variable equal to one if the actual leverage ratio is above the target and zero otherwise for firm i at time t. $D^{belo}_{i,t}$ is a dummy variable equal to one if the leverage ratio is below the target and zero otherwise for firm i at time

[70] Net equity issues are defined as the ratio of the change in book equity minus the change in retained earnings to total assets. Newly retained earnings are the change in balance sheet retained earnings during an accounting year period divided by the book value of total assets. Net debt issues are then defined as the ratio of the change in total assets to total assets less the sum of net equity issues and newly retained earnings.

t. $D_{i,t}^{sur}$ is a dummy variable equal to one if the ith firm has a financial surplus at time t and zero otherwise, and $D_{i,t}^{def}$ is a dummy variable equal to one if the ith firm has a financial deficit at time t and zero otherwise. $R_{i,t}^{firm}$ is a measure of time-varying firm-specific risk and R_t^{macro} is a measure of time-varying macroeconomic risk. The term υ_i captures firm-specific fixed effects and the term $\varepsilon_{i,t}$ represents the time-varying residuals.

3.6 Estimation

Several researcher have earlier used OLS methodology to estimate speed of the adjustment toward target capital structure. However, a model which incorporates the lagged dependent variable as an explanatory variable requires the use of an instrumental variable technique because the error term will not be orthogonal to the lagged dependent variable. In this instance, the use of OLS approach would yield biased results.[71] Specifically, because the OLS coefficient of the lagged dependent variable will be biased upward, the speed of adjustment toward the target capital structure will be underestimated. Also, when a model contains the lagged dependent variable as a regressor, the use of fixed-effects estimator would not be recommended as this approach yields a downward bias on the estimate of the lagged dependent variable leading to overestimating the speed of adjustment.[72]

In our case, similar to Antoniou, Guney, and Paudyal (2008) and Lemmon, Roberts, and Zender (2008), and others, we apply the the system GMM estimator to estimate the reduced-form partial adjustment model of capital structure. The system-GMM technique removes the time-invariant unobservable firm-specific effects by taking the first difference of each underlying variable effectively controlling for the correlation between the regressors and the residuals. In addition, using the system GMM method, one can mitigate the possibility of endogeneity by instrumenting differenced equations with lagged levels of the variables and equations in levels with the lags of the first-differences of the variables.

However, in the context of GMM estimation the use of deeper lags may not provide enough additional information, and the use of extra instruments may lead to the problem of "many instruments" relative to the sample size, which weakens the power of the overidentification test (Roodman (2009a)). Here, we confirm the validity of the instruments by implementing the J test of Hansen (1982). We also apply the Arellano-Bond test, AR(2), to examine the presence of second-order serial correlation in the residuals. These diagnostic test statistics along with the number of firms and the firm-year observations are reported in Panel B of each table that we present below. The J statistics show that the instruments used for the system-GMM estimator are valid and satisfy the orthogonality

[71] Hsiao (2003) presents the derivation of the bias due to the use of an OLS estimator in the presence of the lagged dependent variable.

[72] See Nickell (1981), Bond (2002), and Judson and Owen (1999) for more on related issues.

conditions. The serial correlation tests provide evidence for the absence of second-order serial correlation in the residuals. Thus, we claim that the instruments we use in the estimation are valid for each underlying model. For the sake of consistency and brevity, we, therefore, do not comment further on these aspects when we discuss our results.[73]

3.6.1 Risk Effects on Target Leverage

We start our empirical analysis by estimating equation (3.4) which yields the target leverage of firms. Table 3.3 shows that the coefficient of lagged leverage is statistically significant. That is, firms which currently use debt financing continue to borrow in the following period as well. Looking at the remaining firm-specific determinants of leverage, we find that leverage is positively affected by an increase in investment expenditures, the profitability of firms, firm size, and the non-debt tax shield. We also observe that stock returns, tangibility, and the market-to-book value of the firm have a negative and significant effect on leverage. Overall, our results relating to the effects of firm-specific variables, in terms of both sign and statistical significance, are consistent with the earlier research.[74] Hence, we do not expand on these observations.

Table 3.3 shows that firm-specific risk has a negative and significant effect on firms' leverage. Given positive bankruptcy costs and given that an increase in idiosyncratic risk leads to an increase in the probability of default, firms reduce their borrowing in times of heightened idiosyncratic risk. Table 3.3 also provides evidence that macroeconomic risk exerts a negative impact on leverage confirming the idea that firms reduce their leverage during periods of high risk to reduce their exposure to macroeconomic risks. During periods of high macroeconomic risk firms' cash flows deteriorates and the likelihood of bankruptcy and financial distress increases inducing firms to use sources of finance other than debt to mitigate the cost of financial distress. The negative sensitivity of firms' target leverage to macroeconomic and idiosyncratic risks is consistent with the earlier literature.

Overall, our results suggest that an increase in firm-specific risk or macroeconomic risk causes firms to reduce the use of debt. It appears that to avoid financial distress and the risk of bankruptcy, firms reduce their leverage at times of high risk. In summary, Table 3.3 provides evidence that firms consider both firm-specific risk as well as macroeconomic

[73]To further ensuring the robustness of the system GMM estimates, we test time-series properties of the underlying variables. In particular, we test for the presence of unit roots because of two reasons. First, we use relatively long-span data here, spanning a 29-year period. Using a long span of data increases the possibility that the series of interest may contain a unit root. Second, despite the system GMM estimator effectively accounts for persistency in dependent variable, it considers moment conditions valid under stationary data. Specifically, we apply the Fisher-type panel-data unit-root tests. The results are given in Table 3-D of Appendix D. The test statistics do not provide any significant evidence of the existence of a unit root in the underlying series.

[74]For instance, among others, see Huang and Ritter (2009), Brav (2009), Baum, Stephan, and Talavera (2009), Brav (2009), Antoniou, Guney, and Paudyal (2008), Frank and Goyal (2004), Korajczyk and Levy (2003), Ozkan (2001), and Titman and Wessels (1988).

Table 3.3: Robust Two-step System-GMM Estimates for the Determinants of Leverage

Table 3.3 reports the robust two-step system-GMM estimation results of the impact of risk on leverage for the following model:

$$L_{i,t} = \beta_0 + \beta_1 X_{i,t-1} + \beta_2 R^{firm}_{i,t-1} + \beta_3 R^{macro}_{i,t-1} + \upsilon_i + \varepsilon_{i,t}$$

where $L_{i,t}$ is a measure of the book leverage of firm i in year t. $X_{i,t}$ is a vector of the firm-specific variables. $R^{firm}_{i,t}$ is a measure of time-varying firm-specific risk. R^{macro}_{t} is a measure of time-varying macroeconomic risk. The term υ_i captures the effects of time-invariant unobservable firm-specific factors such as reputation and capital intensity. The term $\varepsilon_{i,t}$ represents the time-varying residuals. Subscripts i and t denote firm and time period, respectively. The variables are defined as follows. Book leverage is the ratio of the book value of total debt to the book value of total assets. The market-to-book value ratio is defined as the book value of the total book assets less the book value of equity plus the market value of equity divided by the book value of total assets. Investment is the ratio of total expenditures to purchase fixed tangible assets to the book value of total assets. Profitability is the ratio of earnings before interest, taxes, and depreciation to the total book assets. Tangibility is the ratio of net plant, property, and equipment to the total book assets. The 2-year stock return is the difference between share prices at time t and share prices at time $t-2$. Firm size is defined as the logarithm of net sales deflated by the GDP deflator. The non-debt tax shield is defined as total depreciation expense divided by the book value of total assets. Firm-specific risk is drawn from sales of firms. Macroeconomic risk is proxied by the conditional variance of UK real GDP over the period under investigation. The sample consists of all UK manufacturing firms listed on the London Stock Exchange at any point over the period 1981-2009. The data are drawn from the WorldScope database via DataStream. Panel B reports the number of firms, the firm-year observations, the J statistics, which is a test of the over identifying restrictions, the Arellano-Bond test, AR(2), for second-order autocorrelation in the first-differenced residuals, and firm-year observations. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

Panel A: Estimation results		
Regressors	Coefficient	Std. Error
$\text{Leverage}_{i,t-1}$	0.688	(0.093)***
$\text{Market-to-Book}_{i,t-1}$	-0.011	(0.005)**
$\text{Investment}_{i,t-1}$	0.402	(0.128)***
$\text{Profitability}_{i,t-1}$	0.251	(0.130)**
$\text{Tangibility}_{i,t-1}$	-0.429	(0.135)***
$\text{Firm Size}_{i,t-1}$	0.034	(0.013)***
$\text{2-year Stock Return}_{i,t-1}$	-0.120	(0.016)***
$\text{Non-debt Tax Shields}_{i,t-1}$	0.772	(0.388)**
$R^{firm}_{i,t-1}$	-0.101	(0.032)**
R^{macro}_{t-1}	-0.006	(0.002)***
Constant	-0.245	(0.124)**
Panel B: Diagnostic tests		
Firm-years	10,882	
Firm	997	
AR(2)	-0.890	
p-value	0.373	
J-statistic	57.620	
p-value	0.379	

risk in determination of their capital structure.

3.6.2 The Role of Risk on the Speed of Adjustment in Achieving Target Leverage

In this section, we examine the effects of risk on the speed of adjustment toward target leverage using an extended reduced-form partial adjustment model, as shown in equation (3.7). This model incorporates the interaction terms between risk measures and the lagged dependent variable into the standard adjustment model of leverage and enables us to calculate the speed of adjustment toward the target leverage at different levels of risk.

Table 3.4 presents the estimates of the speed of adjustment toward target capital structure at low, median, and high levels of firm-specific and macroeconomic risk. The fourth column of the table reports the standard errors and the last column gives the half-life, the time required for a deviation from target leverage ratio to be halved. We compute half life as $ln(0.5)/ln(1-\phi)$, where ϕ is the estimate of the speed of adjustment toward the target.

This table shows that an increase in any type of risk leads to a slow down in the capital structure adjustments. That is, as a firm experiences higher risk, regardless of its source, the speed of adjustment toward the target will be slower. In particular, we find that firms tend to adjust their capital structure faster toward their target leverage (with a speed of 45.2% per year) in periods when both types of risk are set to zero. This finding suggests that it will take a firm about 1.15 years to adjust half of the deviation from its target once perturbed by a shock when there is no firm-specific and macroeconomic risk. In contrast, the adjustment in leverage is relatively slower (35.7% per year) when both types of risk are high.[75]

The table shows that for a given level of firm specific risk, an increase in macroeconomic risk slows down the capital adjustment process. For instance, when the firm-specific risk is at its medium level, the half life of deviations will be between 1.37 to 1.46 years to correct the misalignment of target capital structure caused by a shock depending on the extent of macroeconomic risk: the higher the macroeconomic risk the slower the adjustment. In the case of high levels of firm-specific risk, the half life of deviations further slows down and spans the range between 1.47 to 1.57 years depending on the level of macroeconomic risk. This implies that although firms have a target capital structure, revisions to the target are delayed when either type of risk is on the rise.

This observation suggests that those firms that are relatively uncertain about their

[75] At both ends of the range, the speed of adjustment is slightly slower than that estimated by Cook and Tang (2010) for US manufacturing firms in good and bad times of the economy. However, this difference may be due to the fact that Cook and Tang (2010) use a fixed effects mean difference estimator to calculate the speed of adjustment, which biases the estimated speed of adjustment coefficient upward and hence the half life downwards.

sales figures are likely to stay away from their targets because the cost of adjusting toward the target leverage tends to exceed the adjustment benefits. In contrast, for those firms that are relatively more certain about their own business activities, it is a priority to adjust their capital structure toward the target.

The estimates suggest that given the firm-specific risk, firms revert relatively faster to the target leverage in periods when macroeconomic risk is relatively low. Faster adjustment in times of low macroeconomic risk makes sense as firms find it easier to alter their capital structure by either issuing external capital (new equity and debt issues) or retiring external capital over periods of stable economic environment. In other words, firms align their capital structure to the desired capital structure at a higher pace in states of low macroeconomic risk rather than in states of high macroeconomic risk, timing issuance of equity. Panel A in Figure 3.1 illustrates these patterns.

The estimates of the speed of adjustment suggest that both the trade-off model and the market timing model have a significant role to play in explaining the dynamics of capital structure. In periods of low risk, the observation of fast adjustment supports the trade-off models in that firms quickly shake-off the effects of a shock to trace back to their target capital structure. In periods of high risk, however, low speed of adjustment to targets provides evidence that firms do not immediately adjust their capital structure toward the target, supporting the predictions of the market timing theory of capital structure. In other words, firms time both equity and debt markets as firms are more likely to issue or retire their financial securities during periods of stable economic environment.[76]

Although the results shown in Table 3.4 provide evidence that risk impacts the capital structure adjustment mechanism, they do not allow us to comment on whether the speed of adjustment is more sensitive to risk when firm leverage is below or above the target leverage. That is, firms with above-target leverage could adjust at a different speed than those with below-target leverage as firms in each categories have different adjustment costs and benefits, implying the presence of asymmetric adjustment speeds. Therefore, we next estimate the extended version of adjustment model of capital structure enabling us to examine the impacts of risk on the speed of adjustment for firms with above- and below-target leverage while we allow for asymmetric adjustment.

[76]Flannery and Rangan (2006) estimating a relatively high speed of adjustment provide support for the trade-off models, whereas, Fama and French (2002) find low speed of adjustment toward the target and support the pecking order theory. However, Huang and Ritter (2009) argue that the slow speed of adjustment is attributed to the market timing theory.

Table 3.4: Effects of Risk on the Speed of Adjustment (SOA)

Table 3.4 reports the estimates of the speed of adjustment. To estimate the adjustment speeds, we calculate the total derivatives at low (25^{th} percentile), median (50^{th} percentile), and high (75^{th} percentile) levels of risk for the following model estimated by the robust two-step system-GMM estimator:

$$L_{i,t} = (1-\phi)L_{i,t-1} + (1-\phi)L_{i,t-1}.R^{firm}_{i,t-1} + (1-\phi)L_{i,t-1}.R^{macro}_{t-1} + \phi\beta_1 X_{i,t-1}$$
$$+ \phi\beta_2 R^{firm}_{i,t-1} + \phi\beta_3 R^{macro}_{t-1} + \phi\upsilon_i + \phi\varepsilon_{i,t}$$

where $L_{i,t}$ is a measure of the book leverage of firm i in year t. $X_{i,t}$ is a vector of the firm-specific variables. $R^{firm}_{i,t}$ is a measure of time-varying firm-specific risk. R^{macro}_{t} is a measure of time-varying macroeconomic risk. The term υ_i captures the effects of time-invariant unobservable firm-specific factors such as reputation and capital intensity. The term $\varepsilon_{i,t}$ represents the time-varying residuals. Subscripts i and t denote firm and time period, respectively. The half-life, the time required for a deviation from the target leverage ratio to be halved, is computed as $ln(0.5)/ln(1-\phi)$, where ϕ is the estimate of the speed of adjustment toward target leverage. The variables are defined as follows. Book leverage is the ratio of book value of total debt to the book value of total assets. The market-to-book value ratio is defined as the total book assets less the book value of equity plus the market value of equity divided by the total book assets. Investment is the ratio of total expenditures to purchase fixed tangible assets to the total book assets. Profitability is the ratio of earnings before interest, taxes, and depreciation to the book value of total assets. Tangibility is the ratio of net plant, property, and equipment to the book value of total assets. The 2-year stock return is the difference between share prices at time t and share prices at time $t-2$. Firm size is defined as the logarithm of net sales deflated by the GDP deflator. The non-debt tax shields is defined as total depreciation expense divided by the total book assets. Firm-specific risk is drawn from sales of firms. Macroeconomic risk is proxied by the conditional variance of UK real GDP over the period under investigation. The sample consists of all UK manufacturing firms listed on the London Stock Exchange at any point over the period 1981-2009. The data are drawn from the WorldScope database via DataStream. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

Firm-Specific Risk ($R^{firm}_{i,t}$)	**Macroeconomic Risk** (R^{macro}_{t})	**SOA** (%)	**Estimated Std. Error**	**Half-Life Years**
High	High	35.7	(0.037)***	1.57
High	Median	36.9	(0.039)***	1.51
High	Low	37.5	(0.040)***	1.47
Median	High	37.7	(0.047)***	1.46
Median	Median	37.5	(0.049)***	1.41
Median	Low	39.9	(0.050)***	1.37
Low	High	39.8	(0.055)***	1.37
Low	Median	40.2	(0.056)***	1.35
Low	Low	40.7	(0.057)***	1.33
Zero	Zero	45.2	(0.072)***	1.15

3.6.3 Effects of Risk on the Speed of Adjustment: Controlling for Deviations from the Target Leverage

The main focus of this subsection is to address the following two issues. i) Do firms weigh/consider deviations of actual leverage from their targets differently in times of risk? ii) Does risk have differential effects for firms with above-target leverage and firms with below-target leverage? To answer these questions, we estimate an augmented version of the adjustment model of capital structure as given in equation (3.8), where deviations from the target as well as risk measures are interacted with the *above-target* ($D^{abov}_{i,t}$) and the *below-target* ($D_{i,t}^{belo}$) dummies.[77]

In general, if a firm's actual leverage exceeds its target, then the firm can adjust its capital structure to reach the target debt ratio by retiring debt or by issuing new equity. In contrast, if a firm's leverage is below its target, then we would expect that the firm can restructure its capital structure by issuing more new debt or repurchasing equity. One can suggest that the best time to adjust the capital structure of the firm is when both business and macroeconomic risks are at their lowest. However, given firms experience different levels of macroeconomic and business risks at any point in time, managers must weigh deviations from the target leverage differently as either type of risk varies.

3.6.3.1 ***Marginal Effects of Risk***

Table 3.5 presents the results for equation (3.8). In estimating equation (3.8), we first set both risk measures to zero to obtain a benchmark. Results for this set are given in Model 1. The benchmark results show that firms with above-target leverage ($DVT_{i,t}.D_{i,t}^{abov}$) adjust their capital structure faster than the firms with below-target leverage ($DVT_{i,t}.D_{i,t}^{belo}$). These findings for the firms in UK are in line with those of Byoun (2008), who concentrates on the US manufacturing firms.

Model 2 incorporates the effect of risk into the baseline specification and shows that firm-specific and macroeconomic risk have asymmetric effects on the speed of adjustment, depending on whether the actual leverage exceeds or falls short of the target leverage. Specifically, we observe that the impact of firm-specific risk interacted with the below-target indicator ($DVT_{i,t}.D_{i,t}^{belo}.R_{i,t-1}^{firm}$) is negative and statistically significant. This implies that heightened firm-level risk deters firms from adjusting their capital structure toward their targets. In contrast, the impact of firm-specific risk when actual leverage is above-target ($DVT_{i,t}.D_{i,t}^{abov}.R_{i,t-1}^{firm}$) is positive, but not statistically significant. This result suggests that firm-specific risk decelerates the capital structure adjustment process only when the actual leverage of firms lies below the target.

When we turn to inspect the role of macroeconomic risk, we observe that it has a significant role in firm leverage adjustment decisions regardless of whether the actual leverage is above or below the target. We find that macroeconomic risk has a negative impact on the adjustment speed of firms with above-target leverage ($DVT_{i,t}.D_{i,t}^{abov}.R_{t-1}^{macro} < 0$), whereas it has a positive effect on the adjustment process of firms with below-target leverage ($DVT_{i,t}.D_{i,t}^{abov}.R_{t-1}^{macro} > 0$). These results suggest that firms having actual leverage above (below) the target are likely to adjust their leverage slowly (quickly) toward the

[77] Recall that the *above-target* ($D_{i,t}^{abov}$) dummy is set to one if the firm's observed leverage ratio is above its estimated target leverage and zero otherwise. The *below-target* ($D_{i,t}^{belo}$) dummy is set to one if the firm's observed leverage ratio is below its estimated target leverage and zero otherwise.

target in periods when macroeconomic risk is high.

3.6.3.2 *The Speed of Adjustment*

Table 3.5 shows that the capital structure adjustment process is asymmetric and it is related to both risk and the level of the actual leverage of firms in comparison to their leverage targets. Given the estimates in Table 3.5, we next compute the speed of adjustment when risk takes high, medium, and low levels for firms with above- and below-target leverage, and report these values in Table 3.6. Note that the adjustment speeds are statistically different from zero for each firm category and vary as both types of risk change when firms' actual leverage is above or below the target leverage.

Inspecting Table 3.6, we see that the speed of adjustment for the benchmark model with above target leverage is greater (yielding a lower half-life) than the remaining cases when risk is introduced. In fact, the table presents an interesting ordering of the speed of adjustment estimates as risk about firms' own business activity and macroeconomic conditions takes different levels. Specifically, it turns out that in the presence of both types of risk, the speed of adjustment is highest (lowest half-life) when macroeconomic risk is low and that there is a monotonic increase as firm specific risk is increased from low to medium and high levels within each level of macroeconomic risk. That is, when macroeconomic risk is low, the highest speed of adjustment is recorded when firm specific risk is high and the lowest value is recorded when firm-specific risk is low. Hence, as illustrated in Panel B of Figure 3.1, it seems that firms with above-target leverage adjust their capital structure faster in times of low macroeconomic risk and high firm-specific risk.[78]

Also note that as firm-specific risk gets higher, the speed of adjustment gets faster because firms adjust their capital structure quicker possibly by retiring their debt as their leverage is already above target. When we look at the evidence as we sort out results with respect to the level of firm-specific risk, for each level of firm-specific risk, we observe that an increase in macroeconomic risk slows the capital adjustment process. This observation accords with intuition. As macroeconomic risk increases, a firm will find it harder to adjust its capital structure because retiring debt will be costlier in such circumstances due to increased asymmetric information problems. In particular, looking at these results, we can say that the cost of reducing leverage for firms with above-target leverage should be less in periods of low macroeconomic risk than in periods of high macroeconomic risk. This finding supports that of Korajczyk and Levy (2003), who show that firms are more

[78] Part of the explanation for higher adjustment speeds at low macroeconomic risks is that an overall relatively stable macroeconomic environment leads to an increase in share prices which makes equity issues an attractive source of financing, and thus, firms' managers are likely to use equity issuance as a leverage-decreasing transaction.

Table 3.5: Effects of Risk on the Speed of Adjustment while Controlling for Deviations from the Target Leverage

Table 3.5 reports the robust two-step system-GMM estimation results of the impact of risk on the marginal effects of deviations from the target leverage ratio on the adjustment speed for the following model:

$$L_{i,t} - L_{i,t-1} = (\beta_1 D_{i,t}^{abov} + \beta_2 D_{i,t}^{belo})DVT_{i,t} + (\beta_3 D_{i,t}^{abov} + \beta_4 D_{i,t}^{belo})DVT_{i,t}.R_{i,t-1}^{firm} + (\beta_5 D_{i,t}^{abov} + \beta_6 D_{i,t}^{belo})DVT_{i,t}.R_{t-1}^{macro} + \upsilon_i + \varepsilon_{i,t}$$

where $L_{i,t}$ is a measure of leverage for firm i in year t. $DVT_{i,t}$ is the deviation of observed (actual) leverage from the target leverage ratio for firm i at time t, $D_{i,t}^{abov}$ is a dummy variable equal to one if the leverage ratio is above the target and zero otherwise for firm i at time t, $D_{i,t}^{belo}$ is a dummy variable equal to one if the leverage ratio is below the target and zero otherwise for firm i at time t, $R_{i,t}^{firm}$ is a measure of time-varying firm-specific risk and R_t^{macro} is a measure of time-varying macroeconomic risk. Firm-specific risk is drawn from the sales of firms. Macroeconomic risk is proxied by the conditional variance of UK real GDP over the period under investigation. Model 1, a modified standard adjustment model of capital structure, reflects our baseline specifications where the firm capital structure adjustments are interacted with above- and below-target leverage indicators. Model 2 reflects the interactions among the firm's capital structure adjustments, above- and below-target leverage indicators, and our measures of risk. The sample consists of all UK manufacturing firms listed on the London Stock Exchange at any point over the period 1981-2009. The data are drawn from the WorldScope database via DataStream. Panel B of the table reports the number of firms, the firm-year observations, the J statistics, which is a test of the over identifying restrictions, the Arellano-Bond test, AR(2), for second-order autocorrelation in the first-differenced residuals, and firm-year observations. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

Panel A: Estimation Results; Dependent Variable: ΔLeverage				
	Model 1		Model 2	
	Coefficient	Std. Error	Coefficient	Std. Error
$DVT_{i,t}.D_{i,t}^{abov}$	0.295	(0.055)***	0.322	(0.127)***
$DVT_{i,t}.D_{i,t}^{belo}$	0.255	(0.033)***	0.247	(0.054)***
$DVT_{i,t}.D_{i,t}^{abov}.R_{i,t-1}^{firm}$			0.036	(0.059)
$DVT_{i,t}.D_{i,t}^{belo}.R_{i,t-1}^{firm}$			-0.252	(0.140)**
$DVT_{i,t}.D_{i,t}^{abov}.R_{t-1}^{macro}$			-0.059	(0.029)**
$DVT_{i,t}.D_{i,t}^{belo}.R_{t-1}^{macro}$			0.041	(0.170)***
Panel B: Diagnostic tests				
Firm-years	10,943		9,782	
Firm	999		963	
AR(2)	0.950		1.230	
p-value	0.341		0.217	
J-statistic	10.290		23.940	
p-value	0.740		0.775	

likely to issue equity when macroeconomic prospects are good.

When we turn our attention to the estimated speed of adjustment for firms with below target leverage, we see that it is around 24.7% per year for the benchmark model. Comparing this value with other cases when we allow uncertainty in the model, we do not observe a clear-cut ranking, although there is a tendency that the adjustment is faster when firm-specific risk is lower than when it is higher (Panel C of Figure 3.1). Given the

Table 3.6: The Speed of Adjustment (SOA) for Firms with Above and Below the Target Leverage at Different Risk Levels

Table 3.6 reports the estimates of the SOA for firms above and below the target leverage ratio at different risk levels. To calculate the SOA we estimate the model below by using the robust two-step system-GMM estimator (results are given in Table 3.5) and then we calculate the total derivatives at low (25^{th} percentile), median (50^{th} percentile), and high (75^{th} percentile) levels of risk.

$$L_{i,t} - L_{i,t-1} = (\beta_1 D^{abov}_{i,t} + \beta_2 D^{belo}_{i,t}) DVT_{i,t} + (\beta_3 D^{abov}_{i,t} + \beta_4 D^{belo}_{i,t}) DVT_{i,t}.R^{firm}_{i,t-1}$$
$$+ (\beta_5 D^{abov}_{i,t} + \beta_6 D^{belo}_{i,t}) DVT_{i,t}.R^{macro}_{t-1} + \upsilon_i + \varepsilon_{i,t}$$

where $L_{i,t}$ is a measure of leverage for firm i in year t. $DVT_{i,t}$ is the deviation of observed (actual) leverage from the target leverage ratio for firm i at time t, $D^{abov}_{i,t}$ is a dummy variable equal to one if the leverage ratio is above the target and zero otherwise for firm i at time t, $D^{belo}_{i,t}$ is a dummy variable equal to one if the leverage ratio is below the target and zero otherwise for firm i at time t, $R^{firm}_{i,t}$ is a measure of time-varying firm-specific risk and R^{macro}_{t} is a measure of time-varying macroeconomic risk. Firm-specific risk is drawn from the sales of firms. Macroeconomic risk is proxied by the conditional variance of UK real GDP over the period under investigation. The half-life, the time required for a deviation from the target leverage ratio to be halved, is computed as $ln(0.5)/ln(1-\phi)$, where ϕ is the estimate of the speed of adjustment toward target leverage. The sample consists of all UK manufacturing firms listed on the London Stock Exchange at any point over the period 1981-2009. The data are drawn from the WorldScope database via DataStream. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

Risk		**Firms Above Target**			**Firms Below Target**		
Firm ($R^{firm}_{i,t}$)	**Macro** (R^{macro}_{t})	**SOA** (%)	**Estimated Std.Error**	**Half-Life Years**	**SOA** (%)	**Estimated Std.Error**	**Half-Life Years**
High	High	22.1	(0.901)***	2.78	23.5	(0.034)***	2.59
High	Median	25.3	(0.098)***	2.38	21.3	(0.032)***	2.89
High	Low	26.7	(0.103)***	2.23	20.5	(0.145)**	3.02
Median	High	21.5	(0.091)**	2.86	27.2	(0.301)***	2.18
Median	Median	24.7	(0.099)***	2.44	25.0	(0.029)**	2.41
Median	Low	26.2	(0.103)***	2.28	24.0	(0.300)***	2.53
Low	High	21.2	(0.091)**	2.91	29.5	(0.035)***	1.98
Low	Median	24.5	(0.099)**	2.47	27.3	(0.034)***	2.17
Low	Low	25.9	(0.103)***	2.31	26.0	(0.103)**	2.30
Zero	Zero	32.2	(0.128)**	1.78	24.7	(0.054)***	2.44

results in Table 3.6, it seems that the managers substantially consider firm-specific and macroeconomic risks before adjusting firms' capital structure when the actual leverage of firms is also below the target so that the firm will be less susceptible to adverse selection problems and bankruptcy.

On the whole, the estimates given in Table 3.6 show that firms adjust their actual leverage toward their targets at different speeds as they face different levels of risk when the actual leverage is above or below the target. That is, firms consider the levels of firm-specific and macroeconomic risk as well as positive and negative deviations of actual leverage from the target when adjusting their capital structure.

3.6.4 Effects of Risk on the Speed of Adjustment: Controlling for Deviations from the Target Leverage and Financial Deficits/Surpluses

In this section, we incorporate the role of financial imbalances along with deviations of leverage from the target on the adjustment of capital structure and examine the asymmetry in the adjustment process as shown in equation (3.11). The empirical model shows whether adjustments in capital structure are more sensitive to risk when firms have financial surpluses or when they have financial deficits with leverage ratios above or below the targets.

3.6.4.1 *Marginal Effects of Risk*

Table 3.7 provides results for two models. Both of these models are based on equation (11): Model 1 is the benchmark and it does not incorporate risk. Model 2 includes both types of risk.

Model 1: The Benchmark

The benchmark model provides evidence that, on average, publicly traded UK manufacturing firms increase their leverage regardless of the fact that the firm has a financial deficit or surplus as the coefficients of $D_{i,t}^{sur}$ and $D_{i,t}^{def}$ are both positive. This is in line with the statistics provided in Table 3.1 which shows that firm leverage in the UK has been increasing over the period of investigation. It is also useful to note that according to the benchmark model, firms with financial surpluses tend to increase their leverage more than those that experience a financial deficit. This observation is in contrast to that of Byoun (2008) which shows that US firms with a financial surplus reduce their leverage. An inspection of the data shows that the increase in leverage in the UK is due to issuance of new debt instruments rather than equity repurchases.

Next, we examine the coefficient estimates of the interaction terms between firms' financial status (financial surpluses/deficits) and above- and below-target leverage indicators. We find that the coefficient estimates for $D_{i,t}^{sur}.DVT_{i,t}.D_{i,t}^{abov}$ and that of $D_{i,t}^{def}.DVT_{i,t}.D_{i,t}^{abov}$ are both positive and statistically significant, where the former is significantly larger. This implies that firms whose actual leverage is above the target adjust their capital structure toward the target relatively faster when they have a financial surplus than when they face financial deficits. The estimate of the coefficient on the interaction between firms' financial deficit and below-target indicator ($D_{i,t}^{def}.DVT_{i,t}.D_{i,t}^{belo}$) is positive and statistically significant but smaller in magnitude than that of the above-target leverage regardless of the financial status of the firm. This finding suggests that firms that have financial deficits with below-target leverage change their leverage but at a lower speed than those

Table 3.7: Effects of Risk on the Speed of Adjustment while Controlling for Deviations from the Target Leverage and Financial Imbalances

Table 3.7 reports the robust two-step system-GMM estimation results of the impact of risk on the marginal effects of deviations from the target leverage ratio and financial imbalances on the speed of adjustment (SOA) for the following model:

$$L_{i,t} - L_{i,t-1} = (\beta_1 D^{sur}_{i,t} + \beta_2 D^{def}_{i,t}) + (\beta_3 D^{sur}_{i,t} + \beta_4 D^{def}_{i,t}) DVT_{i,t}.D^{abov}_{i,t} + (\beta_5 D^{sur}_{i,t} + \beta_6 D^{def}_{i,t}) DVT_{i,t}.D^{belo}_{i,t} + (\beta_7 D^{sur}_{i,t} + \beta_8 D^{def}_{i,t}) DVT_{i,t}.D^{abov}_{i,t}.U_{i,t} + (\beta_9 D^{sur}_{i,t} + \beta_{10} D^{def}_{i,t}) DVT_{i,t}.D^{belo}_{i,t}.U_{i,t} + \upsilon_i + \varepsilon_{i,t}$$

where $L_{i,t}$ is a measure of leverage for firm i in year t. $DVT_{i,t}$ is the deviation of observed (actual) leverage from the target leverage ratio for firm i at time t, $D^{abov}_{i,t}$ is a dummy variable equal to one if the leverage ratio is above the target and zero otherwise for firm i at time t, $D^{belo}_{i,t}$ is a dummy variable equal to one if the leverage ratio is below the target and zero otherwise for firm i at time t. $D^{sur}_{i,t}$ is a dummy variable equal to one if the ith firm has a financial surplus at time t and zero otherwise, and $D^{def}_{i,t}$ is a dummy variable equal to one if the ith firm has a financial deficit at time t and zero otherwise. $U_{i,t}$ is a vector of one-period lagged time-varying firm-specific ($R^{firm}_{i,t}$) and macroeconomic risk (R^{macro}_{t}). Financial deficit is the ratio of the change in working capital plus investment expenditure plus dividends less net cash flows to the book value of total assets. Firm-specific risk is drawn from the sales of firms. Macroeconomic risk is proxied by the conditional variance of UK real GDP over the period under investigation. Model 1 reflects our baseline specifications where the firm capital structure adjustments are interacted with its financial status and above- and below-target leverage indicators. Model 2 reflects the interactions among the firm's financial status, above- and below-target leverage indicators, our measures of risk, and the firm's capital structure adjustments. The sample consists of all UK manufacturing firms listed on the London Stock Exchange at any point over the period 1981-2009. The data are drawn from the WorldScope database via DataStream. Panel B of the table reports the number of firms, the firm-year observations, the J statistics, which is a test of the over identifying restrictions, the Arellano-Bond test, AR(2), for second-order autocorrelation in the first-differenced residuals and firm-year observations. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

Panel A: Estimation Results; Dependent Variable: ΔLeverage				
	Model 1		Model 2	
	Coefficient	Std. Error	Coefficient	Std. Error
$D^{sur}_{i,t}$	0.215	(0.081)***	0.194	(0.078)***
$D^{def}_{i,t}$	0.094	(0.027)***	0.069	(0.028)***
$D^{sur}_{i,t}.DVT_{i,t}.D^{abov}_{i,t}$	0.588	(0.197)***	0.312	(0.126)***
$D^{def}_{i,t}.DVT_{i,t}.D^{abov}_{i,t}$	0.357	(0.069)***	0.588	(0.129)***
$D^{sur}_{i,t}.DVT_{i,t}.D^{belo}_{i,t}$	-0.437	(0.216)**	-0.667	(0.301)**
$D^{def}_{i,t}.DVT_{i,t}.D^{belo}_{i,t}$	0.148	(0.033)***	0.284	(0.109)***
$D^{sur}_{i,t}.DVT_{i,t}.D^{abov}_{i,t}.R^{firm}_{i,t-1}$			-0.082	(0.039)**
$D^{def}_{i,t}.DVT_{i,t}.D^{abov}_{i,t}.R^{firm}_{i,t-1}$			0.256	(0.128)**
$D^{sur}_{i,t}.DVT_{i,t}.D^{belo}_{i,t}.R^{firm}_{i,t-1}$			0.207	(0.118)*
$D^{def}_{i,t}.DVT_{i,t}.D^{belo}_{i,t}.R^{firm}_{i,t-1}$			-0.102	(0.134)
$D^{sur}_{i,t}.DVT_{i,t}.D^{abov}_{i,t}.R^{macro}_{t-1}$			0.169	(0.065)***
$D^{def}_{i,t}.DVT_{i,t}.D^{abov}_{i,t}.R^{macro}_{t-1}$			-0.269	(0.058)***
$D^{sur}_{i,t}.DVT_{i,t}.D^{belo}_{i,t}.R^{macro}_{t-1}$			0.095	(0.046)**
$D^{def}_{i,t}.DVT_{i,t}.D^{belo}_{i,t}.R^{macro}_{t-1}$			-0.037	(0.018)**
Panel B: Diagnostic tests				
Firm-years	9,751		9,751	
Firm	970		970	
AR(2)	-0.600		-0.310	
p-value	0.552		0.760	
J-statistic	45.980		47.980	
p-value	0.205		0.252	

with above-target leverage. Interestingly, we also find that firms with a financial surplus do not strive to revert back to the target when their actual leverage ratio is below the target. Rather, these firms further deviate from the targets as the coefficient estimate on the financial surplus with below-target interaction ($D^{sur}_{i,t}.DVT_{i,t}.D^{belo}_{i,t}$) is negative and statistically significant.

Overall, the results from our benchmark model provide evidence that capital structure adjustments are asymmetric and significantly related to both firms' cash flow imbalances and the stance of the actual leverage of firms with respect to their target leverage. Our these findings are consistent with evidence in Byoun (2008), Elsas and Florysiak (2011), and Faulkender, Flannery, Hankins, and Smith (2011), which indicates heterogeneity in the speed of adjustment across firms.

Model 2: The Asymmetric Impact of Firm-specific Risk

Model 2 incorporates both types of risk into the benchmark model. In what follows below, we squarely emphasize the role of the interaction terms with risk measures on the adjustment process.

We first observe that the effect of firm-specific risk on the rebalancing behavior of firms with a financial surplus and above-target leverage ($D^{sur}_{i,t}.DVT_{i,t}.D^{above}_{i,t}.R^{firm}_{t-1}$) is negative. This observation indicates that firms that have a financial surplus with above-target leverage slow down their capital adjustment when firm-specific risk is high. Hence, we expect that firms with above-target leverage and financial surplus use their surplus to reduce their outstanding debt when these firms are certain about their expected future cash flow streams. In contrast, the effect of firm-specific risk on firms that have financial deficits with above-target leverage ($D^{def}_{i,t}.DVT_{i,t}.D^{above}_{i,t}.R^{firm}_{t-1}$) is positive. This implies that firms with above target leverage experiencing a financial deficit are more likely to issue equity to finance their financial deficits when they go through periods of high firm-specific risk to move toward their targets. A possible reason for doing so is that since debt becomes relatively expensive for risky firms as banks and other financial institutions charge them higher risk premiums, these firms prefer equity over debt financing.

When we turn to the case of firms with financial surpluses and below-target leverage, we find that the variable, $D^{sur}_{i,t}.DVT_{i,t}.D^{belo}_{i,t}.R^{firm}_{t-1}$, takes a positive coefficient, implying that an increase in firm-level risk leads to an increase in the speed of adjustment toward the target leverage. This suggests that below-target firms with financial surpluses tend to repurchase their equities in periods when they experience high firm-specific risk. Hence, these firms move their leverage toward the target by reducing their outstanding external financing.

We next observe that the effect of firm-specific risk on the capital structure adjustment decisions of firms with a financial deficit and below-target leverage ($D_{i,t}^{def}.DVT_{i,t}.D_{i,t}^{belo}.R_{t-1}^{firm}$) is negative. Hence, firms that have financial deficits with below-target leverage slow down their capital adjustment process when firm-specific risk is high. That is, firms that have financial deficits with below-target leverage are more likely to plug their financial deficits and attain their target leverage by issuing debt when firm-specific risk is low. Firms do so because they face less debt-related problems, such as the likelihood of bankruptcy, in periods of low firm-specific risk.

These estimates suggest that the effects of firm-specific risk on leverage depends on the state of firms' actual leverage (above or below the target) and firms' financing state (financial deficits or surpluses).

Model 2: The Asymmetric Impact of Macroeconomic Risk

We next turn to examine the impact of macroeconomic risk on the adjustment process. We observe that the impact of macroeconomic risk on the change in leverage when firms experience financial deficits with above-target leverage ($D_{i,t}^{def}.DVT_{i,t}.D_{i,t}^{above}.R_{t-1}^{macro}$) and that for firms with financial deficits and below-target ($D_{i,t}^{def}.DVT_{i,t}.D_{i,t}^{belo}.R_{t-1}^{macro}$) are both negative and statistically significant. In other words, firms in these two groups adjust their leverage toward their targets faster in periods when macroeconomic risks are low. These results suggest that firms facing financial deficits with above-target (below-target) leverage are more likely to finance their financial deficits and adjust their leverage to the target by issuing equity (debt) when macroeconomic risks are low. These observations also suggest that firms with financial deficits, regardless of whether their observed leverage is below or above the target, may face low adjustment costs when macroeconomic conditions are stable and certain, therefore, they are more likely to make adjustments in their capital structure.

In case when firms have a financial surplus along with above-target leverage, the effect of macroeconomic risk on the change in leverage ($D_{i,t}^{sur}.DVT_{i,t}.D_{i,t}^{above}.R_{t-1}^{macro}$) is positive and statistically significant. Hence, this class of firms adjust their leverage toward their target relatively faster in periods of higher macroeconomic risk. This finding is in line with the fact that high levels of outstanding debt tend to expose firms to macro-level risk and, as a result, firms are more likely to reduce their use of debt during volatile states of the economy. Last, but not least, we find that the effect of macroeconomic risk on the change in leverage when firms have a financial surplus with below-target leverage ($D_{i,t}^{sur}.DVT_{i,t}.D_{i,t}^{belo}.R_{t-1}^{macro}$) is positive, suggesting that such firms are more likely to use their financial surpluses to repurchase existing equity in order to reduce the overall external financing when macroeconomic risks are high.

Overall, the results given in Table 3.7 provide evidence that asymmetric speeds of adjustment are related to risk as well as to deviations of leverage from the target and the financial state of the firm. Further, both firm-specific risk and macroeconomic risk affect the adjustment speed differently. These differences suggest that firms not only take into account the imbalances in their cash flows and the deviation of their leverage ratio from the target but also carefully consider both firm-specific and macroeconomic risks.

3.6.4.2 *The Speed of Adjustment with Financial Imbalances and Deviations from the Target Leverage*

In this section, we compute the speed of adjustment toward the target allowing the risk to vary across low-medium-high levels. To present full evidence, we compute the adjustment speed and the corresponding half-life in four-way interactions with respect to financial imbalances of the firm (financing deficits/surpluses) and the positive or negative deviation of actual leverage from the target. For all sub-panels, we also compute the adjustment speed and the corresponding half-life when both types of risks are set to zero. We observe several interesting patterns in speed-of-adjustment estimates across firms and across different levels of risk. Specifically, the results given in Table 3.8 show that the speed of adjustment toward the target leverage significantly varies as the level of risk changes. As well, the estimates of the speed of adjustment clearly reveal that heterogeneities in speeds of adjustments across risk levels are conditional on whether firms have financing deficits or surpluses and whether firms are over- or under-levered. Figure 3.2 plots the adjustment speeds that are given in Table 3.8.

The table shows that when there is no risk, firms that have a financial surplus with above-target leverage attain the lowest speed of adjustment coefficient in contrast to the cases when there is risk. Sorting out the adjustment speeds according the categories of firms, we can see that firms with a financial surplus and above-target leverage adjust their capital structure faster when macroeconomic risk is high; the speed of adjustment declines with a decline in macroeconomic risk. In contrast, firm-specific risk exerts a negative effect on the adjustment process, yet, its impact is minor compared to that of macroeconomic risk. For instance, when macroeconomic uncertainty is high and firm-specific uncertainty is low, the speed of adjustment is 82.5% per year. The speed of adjustment drops to 67.4% per year if macroeconomic risk is low and firm-specific risk is high. That is, firms that hold a financial surplus with above-target leverage reduce their outstanding debt faster as macroeconomic risk heightens the cost of holding more leverage. Further, given the level of macroeconomic risk, firms also prefer to lower their debt in periods when firm-specific

Table 3.8: The Speed of Adjustment (SOA) for Firms having Above/Below-Target Debt with a Financial Surplus/Deficit at Different Risk Levels

Table 3.8 reports the estimates of the SOA for firms having above- or below-target leverage ratio with a financial deficit or surplus. To calculate the SOA we estimate the model below by using the robust two-step system-GMM estimator (results are given in Table 3.7) and we then calculate the total derivatives at low (25^{th} percentile), median (50^{th} percentile) and high (75^{th} percentile) risk levels.

$$L_{i,t} - L_{i,t-1} = (\beta_1 D_{i,t}^{sur} + \beta_2 D_{i,t}^{def}) + (\beta_3 D_{i,t}^{sur} + \beta_4 D_{i,t}^{def}) DVT_{i,t}.D_{i,t}^{abov} + (\beta_5 D_{i,t}^{sur} + \beta_6 D_{i,t}^{def}) DVT_{i,t}.D_{i,t}^{belo} + (\beta_7 D_{i,t}^{sur} + \beta_8 D_{i,t}^{def}) DVT_{i,t}.D_{i,t}^{abov}.U_{i,t} + (\beta_9 D_{i,t}^{sur} + \beta_{10} D_{i,t}^{def}) DVT_{i,t}.D_{i,t}^{belo}.U_{i,t} + \upsilon_i + \varepsilon_{i,t}$$

where $L_{i,t}$ is a measure of leverage for firm i in year t. $DVT_{i,t}$ is the deviation of observed (actual) leverage from the target leverage ratio for firm i at time t, $D_{i,t}^{abov}$ is a dummy variable equal to one if the leverage ratio is above the target and zero otherwise for firm i at time t, $D_{i,t}^{belo}$ is a dummy variable equal to one if the leverage ratio is below the target and zero otherwise for firm i at time t. $D_{i,t}^{sur}$ is a dummy variable equal to one if the ith firm has a financial surplus at time t and zero otherwise, and $D_{i,t}^{def}$ is a dummy variable equal to one if the ith firm has a financial deficit at time t and zero otherwise. Financial deficit is the ratio of the change in working capital plus investment expenditure plus dividends less net cash flows to the book value of total assets. $U_{i,t}$ is a vector of one-period lagged time-varying firm-specific ($R_{i,t}^{firm}$) and macroeconomic risk (R_t^{macro}). Firm-specific risk is drawn from sales of firms. Macroeconomic risk is proxied by the conditional variance of UK real GDP over the period under investigation. The half-life, the time required for a deviation from the target leverage ratio to be halved, is computed as $ln(0.5)/ln(1-\phi)$, where ϕ is the estimate of the speed of adjustment toward target leverage. The sample consists of all UK manufacturing firms listed on the London Stock Exchange at any point over the period 1981-2009. The data are drawn from the WorldScope database via DataStream. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

	Risk		Firms Above Target			Firms Below Target		
	Firm ($R_{i,t}^{firm}$)	Macro (R_t^{macro})	SOA (%)	Estimated Std.Error	Half-Life Years	SOA (%)	Estimated Std.Error	Half-Life Years
Financial Surplus	High	High	80.6	(0.269)***	0.42	-21.2	(0.172)	-3.61
	High	Median	71.4	(0.282)**	0.55	-26.4	(0.168)	-2.96
	High	Low	67.4	(0.289)**	0.62	-28.7	(0.167)*	-2.75
	Median	High	81.8	(0.270)***	0.40	-24.2	(0.192)	-3.20
	Median	Median	72.6	(0.283)**	0.54	-29.4	(0.189)	-2.69
	Median	Low	68.6	(0.289)**	0.60	-31.7	(0.188)*	-2.52
	Low	High	82.5	(0.279)***	0.39	-26.1	(0.206)	-2.99
	Low	Median	77.6	(0.284)***	0.46	-35.1	(0.219)	-2.30
	Low	Low	69.3	(0.290)**	0.59	-33.5	(0.202)*	-2.40
	Zero	Zero	50.6	(0.331)**	0.98	-47.3	(0.227)**	-1.79
Financial Deficit	High	High	22.4	(0.132)	2.73	24.4	(0.041)***	2.48
	High	Median	37.1	(0.119)***	1.50	26.4	(0.045)***	2.26
	High	Low	43.5	(0.116)***	1.21	27.3	(0.061)***	2.17
	Median	High	18.7	(0.145)	3.35	25.8	(0.056)***	2.32
	Median	Median	33.3	(0.132)**	1.71	28.0	(0.061)***	2.11
	Median	Low	39.8	(0.145)***	1.37	28.8	(0.062)***	2.04
	Low	High	16.4	(0.153)	3.87	26.8	(0.066)***	2.22
	Low	Median	31.1	(0.140)**	1.86	28.8	(0.071)***	2.04
	Low	Low	37.5	(0.136)***	1.47	29.7	(0.072)***	1.97
	Zero	Zero	65.7	(0.146)***	0.65	35.3	(0.099)***	1.59

risk is low as they are sure of their cash inflow.

When we compute the speed of adjustment for those firms with financial surpluses and below-target leverage, we come across with an interesting phenomena that these firms do not significantly adjust their capital structure when they experience risk. In general, the adjustment speeds for these firms are negative but they are not statistically different from zero. However, in some cases of this category, the negative speed of adjustment becomes statistically significant at the 5% or 10% level of significance, indicating that these firms deviate even further from their targets by retiring their debts. This finding suggests that those firms that have financial surpluses and are below-target leverage appear to use their surpluses to retire their outstanding debts rather than to repurchase equity issues. As a results, they further move away from their target capital structure. One potential explanation of such behaviour of these firms is that perhaps to increase financial flexibility these firms prefer to reduce their debt financing instead of equity issues when retiring their external capital. Another possible explanation is that as it is well accepted in the literature, the cost of being under-levered is relatively less than being over-levered, and thus, under-levered firms with financial surpluses may not endeavour to increase their leverage by repurchasing equity issues. Rather, these firms appear to retire their debt borrowing and as a result, they even further deviate from their leverage targets. The evidence of negative speeds of adjustment is an interesting observation and warrants further investigation.[79]

We next turn to understand the capital structure adjustment of those firms that have financial deficits with above-target leverage. We see that these firms are likely to make the most significant adjustments toward the target capital structure when we set both types of risk to zero. Once we incorporate the effects of risk in our computations, we find that these firms adjust fastest when macroeconomic risk is low and when firm-specific risk is high. The slowest adjustment will occur when macroeconomic risk is high and firm-specific risk is low. A potential explanation behind this observation is that since the adjustment toward the target leverage for these firms requires issuing equity as firms have financial deficits, reducing outstanding debt is a hard task for these firms. To this end, firms find it easier to issue equity to meet their financial obligations and to adjust their leverage toward their target when macroeconomic risks are lower than when they are higher.[80] These results are in contrast with the prediction of the simple pecking order model that firm managers prefer to raise funds by issuing debt when they do external financing. However, our observations firmly support the market timing theory, which predicts that firms managers are opportunist and they time equity issues.

The last possibility is the case when firms have financial deficits with below-target leverage. These firms adjust their capital structure most quickly when there is no risk. When we allow for risk it appears that such firms adjust the quickest when both firm-specific and macroeconomic risk are low where the speed of adjustment is about 30% per year. We also find that the slowest adjustment takes place when both types of risk are

[79] For further discussion on negative speeds of adjustments, see Hovakimian and Li (2010b), Iliev and Welch (2010), and Baker and Wurgler (2002), who also report a negative speed of adjustment.

[80] Unpredictable variations in macroeconomic conditions may cause sudden variations in the market value of firms rendering the issuance of equity an unattractive source of finance for managers.

high as the speed of adjustment falls to around 24% per year. As the adjustment of capital structure toward the target for this category of firms requires issuance of debt, these firms are more likely to issue debt when they are relatively less uncertain about their potential cash flow stream and when macroeconomic prospects are good. This is in line with the fact that firms are less cautious about the cost of financial distress and bankruptcy in periods of low risk, and they thus tend to increase their use of debt in their capital structure.

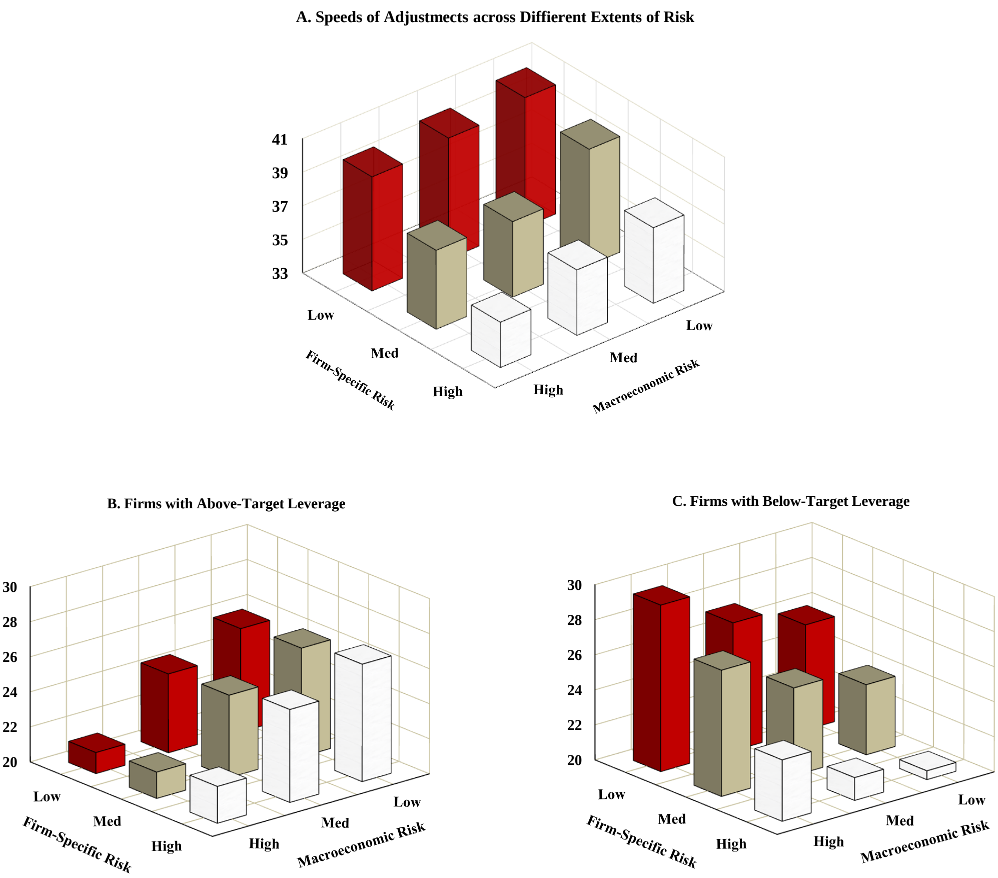


Figure 3.1: The Speeds of Adjustment (SOA) across Different Levels of Risk from the Modified Partial-Adjustment Model of Capital Structure
Panel A plots the estimates of the speed of adjustment from the modified reduced-form partial adjustment model of capital structure. Panel B and C plot the estimates of the speed of adjustment across different levels of risk for firms with above-target leverage and for firms with below-target leverage, respectively. Firm-specific risk is drawn from sales of firms scaled by the book value of total assets. Macroeconomic risk is proxied by the conditional variance of UK real GDP over the period under investigation. Low risk is measured at the 25^{th} percentile, median risk is at the 50^{th} percentile, and high risk is measured at the 75^{th} percentile.

Overall, the results in Tables 3.7 and 3.8 provide evidence that the adjustment speeds are affected asymmetrically with respect to either type of risk while we control for firms' financial imbalances and deviations from the target leverage. In particular, these two tables show that the capital structure adjustments of different categories of firms exhibit differential patterns in responding to risk: risk accelerates the speed of adjustment for firms with a financial surplus and above-target leverage and decelerates the speed of adjustment

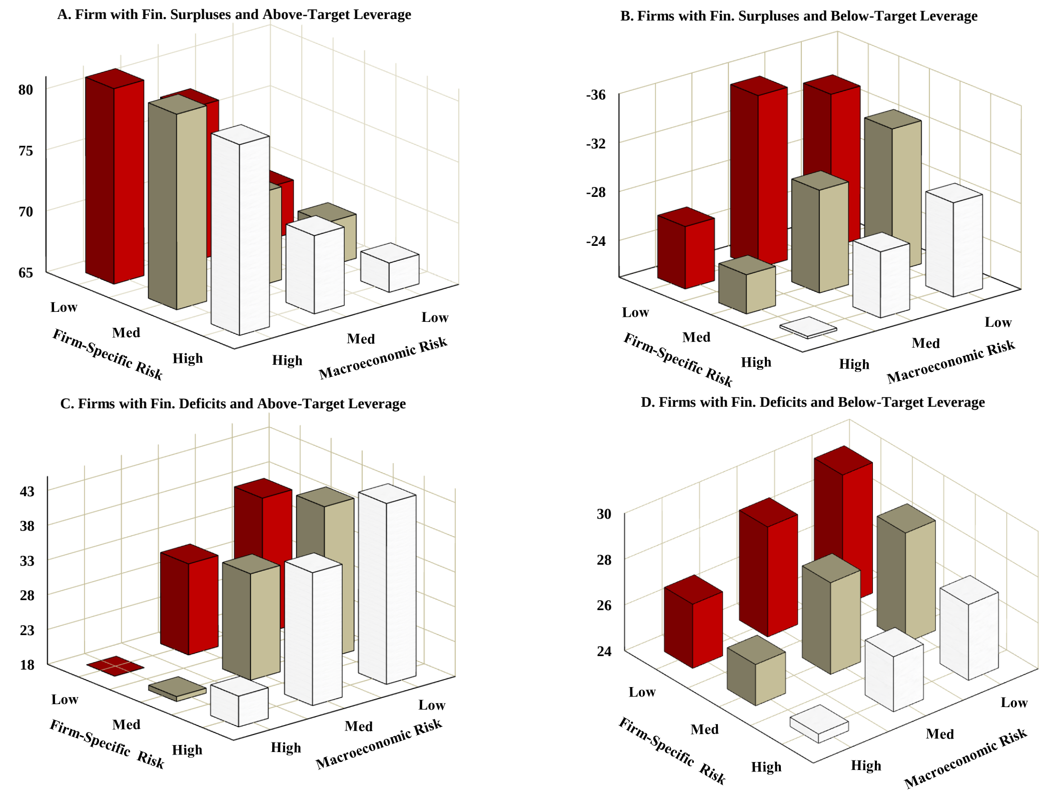


Figure 3.2: The Speeds of Adjustment (SOA) from the Modified Partial-Adjustment Model of Capital Structure across Different Levels of Risk while Controlling for Deviations from the Target and Financial Surpluses/Deficits as Shown in Equation (3.11)
Panel A plots the estimates of the speed of adjustment for firms when they have a financial surplus with above-target leverage. Panel B plots the estimates of the speed of adjustment for firms when they have a financial surplus with below-target leverage. Panel C plots the estimates of the speed of adjustment for below-target firms when they have a financial surplus. Panel D plots the estimates of the speed of adjustment for below-target firms when they have a financial deficit. Firm-specific risk is drawn from sales of firms scaled by the book value of total assets. Macroeconomic risk is proxied by the conditional variance of UK real GDP over the period under investigation. Low risk is measured at the 25^{th} percentile, median risk is at the 50^{th} percentile, and high risk is measured at the 75^{th} percentile.

for firms with a financial deficit and below-target leverage.

These observations are of interest because they suggest that the differences in the adjustment speeds are not fully explained by the imbalances of firms' cash nor by the deviations of firms' actual leverage from the target leverage but also they relate to the levels of firm-specific and macroeconomic risk. In that sense, our findings are useful to interpret earlier research which discusses why firms are not always responsive to changes in the market value of their equity (Welch (2004)) or gains and losses in their earnings (Hovakimian, Hovakimian, and Tehranian (2004)), and why they significantly time the debt and equity market conditions while financing external capital (Baker and Wurgler (2002) and Antoniou, Zhao, and Zhou (2009)). Our study also provides new insights on the interlinkages between the state of risk and the costs and benefits of adjusting toward the target capital structure.

3.7 Robustness Check

To guard ourselves from the possibility that the results are driven by the specific measures of risk we used, we examine the robustness of the findings by using alternative measures of firm-specific and macroeconomic risk. We also check the robustness of our findings by using the historical mean of the firm leverage as a proxy for the firm's target leverage ratio in our estimation. Regarding firm-specific risk we use cash flow volatility (the cumulative standard deviation of cash flows). This measure is earlier used in the literature by Antoniou, Guney, and Paudyal (2008), Lemmon, Roberts, and Zender (2008), and Leary and Roberts (2005). We used quarterly Consumer Price Index (CPI) to generate macroeconomic risk. Using these new measures of risk and alternative targets, we re-estimated equation (3.11) and report the results in columns labeled "Model 1" and "Model 2" respectively of Table 3.10. The results from this exercise, presented in Table 3.10, suggest that our earlier findings are robust and confirm that the effects of risks on capital structure adjustments are not driven by the specific measure of risk or the specific estimate of firms' leverage targets.

We also examine the robustness of our results using an alternative definition of leverage. Specifically, we quantify the impact of risks on both the target level of firms' leverage and the speed of adjustment toward the target by re-estimating the models with the total debt (short-term debt + long-term debt) to total assets ratio. We consider this measure of leverage because most of the previous studies in the empirical capital structure literature have utilized the ratio of total debt to total assets ratio rather than a broader measure of leverage that includes both financial debt and non-financial liabilities.

Table 3.11 presents the results from regressions of total debt to total assets ratio on both firm-specific and macroeconomic risks as well as several firm characteristics. Specifically, we re-run two models. For Model 1, the specifications are similar to those reported in Table 3.3 except that the dependent variable in this model is the ratio of the total debt (short-term debt + long-term debt) to total assets ratio. The specification of Model 2 is similar to those in Model 1 except that Model 2 does not include investment variable as it appears statistically significant only at margin (10%). In general, both regressions yield similar results to those reported in Table 3.3. The coefficient estimates of both types of risk are negative and statistically significant. This suggests that firms appear to reduce their leverage targets when either firm-specific risk increases or when the overall macroeconomic conditions become more volatile. The target level of firms' leverage increases with the profitability of firms, the size of firms, and non-debt tax shields, whereas, it decreases with the market-to-book value, the tangibility of assets, and stock returns.

To examine the robustness of the results of the effects of risks on the capital structure adjustments of firms using an alternative definition of leverage, we re-estimate the regression shown in equation (3.11) with the total debt (short-term debt + long-term debt) to total assets ratio. The rest of the specification are similar to those given in Table 3.7. The results from this exercise are presented in Table 3.12. Overall, the the results reported in Table 3.12 are similar to those presented in Table 3.7. Firms appear to increase their leverage ratio regardless of whether they have financial surpluses or deficits. However, firms that have a financial surpluses are likely to increase their leverage ratio more as compared to those firms that have a financial deficits. The results on the interactions of leverage deviations with firm financial status indicators and above- and below-target indicators are similar to those findings that we presented earlier. Over-levered firms do relatively quick adjustments in their capital structure toward their leverage targets when they raise capital (i.e., firms have financial deficits) than when they retire their existing external capital (i.e., firms have financing surpluses). These findings are consistent with the findings of Kayhan and Titman (2007).

The coefficient estimate on the interaction between firms' financial deficit and below-target leverage indicator is positive and statistically significant but it is smaller in magnitude than that of the above-target leverage. This implies that under-leveraged firms with a financial deficit are less likely to adjust their leverage ratio than over-levered firms regardless of their financial status. The coefficient estimate for the below-target leverage with financial surpluses is negative and statistically significant. This implies that firms move further away from their leverage target when they are under-levered have a financial surplus. This finding suggests that those firms that have financial surpluses and are below-target leverage ratio appear to use their surpluses to retire their outstanding debts rather than to repurchase equity issues. As a results, they further turn away from their target capital structure. One potential explanation of this behaviour of firms is that perhaps to increase financial flexibility firms prefer to reduce their debts instead of equity when retiring their external capital.

The results reported in Table 3.12 on risks are also similar to our earlier findings that we present in Table 3.7. The coefficient estimates provide evidence of the asymmetric impacts of both types of risk on firms' rebalancing behavior depending on whether firms have financial deficits or surpluses and whether firms' actual leverage ratios are below or above their targets. Firm-specific risk affects firm leverage adjustments negatively when firms have a financial surplus with above-target leverage and when they have a financial deficits with below-target leverage. In contrast, the impacts of firm-specific risk on capital structure adjustments are positive for those firms that have a financial surplus with below-target leverage and for those firms that have a financial deficits with below-target leverage.

Turning to the effects of macroeconomic risk on leverage adjustments we observe that the capital structure adjustments of firms that experience financial surpluses regardless of whether they are over-levered or under-levered are positively affected by increases in the volatility of macroeconomic conditions. Conversely, the coefficient estimates suggest that firms that face financial deficits regardless of the level of their actual leverage with respect to the target are less likely to do adjustments in their capital structure when macroeconomic conditions are move volatile. These findings are consistent with those reported in Table 3.7. Thus, our findings that risks are important in adjusting leverage toward the target and the impacts of risks on adjustments are asymmetric, depending on both firms' cash flow imbalances and deviations of firms' actual leverage from the target are robust to alternative measures of leverage.

3.8 Summary and Concluding Remarks

In this chapter, we hypothesize that if the optimal debt level varies by firm, the risk structure of the environment within which the firm operates should affect the cost of adjusting firm's leverage and in return the speed of adjustment. To investigate this hypothesis, we examine the role of firm-specific and macroeconomic risk on firms' capital structure adjustments considering the recent literature which allows for asymmetric adjustment. In our investigation, we use a dynamic model and employ a panel of UK manufacturing firms over the 1981-2009 period.

We first estimate a standard leverage model augmented by both firm-specific and macroeconomic risk measures to compute the target leverage of each firm. The model provides evidence that firms' target leverage is negatively (and significantly) related to both types of risk. Next, we estimate a reduced-form partial adjustment model of capital structure to quantify the effects of risk on the speed of adjustment toward the target. We show that while both firm-specific and macroeconomic risk have robust effects on firms' capital structure adjustments, the speed of adjustment is more sensitive to firm-specific risk. Firms adjust their leverage faster toward the target when firm-specific risk is low than when the risk is high. This is perhaps because firms face lower costs of adjustment when both firm-specific and macroeconomic risks are low.

When we explore the possibility that the adjustment process may be asymmetric with respect to the level of risk, we find that firms with financial surpluses and above-target leverage adjust their leverage toward their targets much more quickly when firm-specific risk is low and macroeconomic risk is high. Since excess debt makes firms more exposed to aggregate risk, firms with actual leverage exceeding their target choose to reduce leverage when firm-specific risk is low. Results for those firms with financial deficit and above-target leverage show that these firms make adjustments in capital structure quicker when macroeconomic risk is low regardless of the level of firm-specific risk. This observation supports the market timing hypothesis and suggests that firms are more likely to issue equity when macroeconomic conditions are stable.

In contrast, firms with financial deficits and below-target leverage adjust their leverage toward their targets more rapidly in periods when both firm-specific and macroeconomic risk are low than in periods when both types of risk are high. This finding provides evidence that firms with financial deficits and below-target leverage require stability to raise funds. Last but not least, firms that have a financial surplus with below-target leverage do not appear to adjust their leverage.

Overall, our investigation provides evidence that different levels and different types of risk exert asymmetric effects on the capital adjustment process even when we control for the firms' financial state and the deviations of firm leverage from the target. Our results can also be useful to understand why firms would not aggressively act to offset the effects of changes in the market value of equity or gains and losses in earnings as it is clear that managers have to carefully consider both the overall state of the economy and the solvency of their own business activities.

Table 3.9: Robustness: Target Leverage with Alternative Measures of Risk

Table 3.9 reports the robust two-step system-GMM estimation results of the impact of risk on firms' target leverage ratio from estimating the following model for alternative measures of risk:

$$L_{i,t} = \beta_0 + \beta_1 X_{i,t-1} + \beta_2 R^{firm}_{i,t-1} + \beta_3 R^{macro}_{i,t-1} + \upsilon_i + \varepsilon_{i,t}$$

where $L_{i,t}$ is a measure of the book leverage of firm i in year t. $X_{i,t}$ is a vector of the firm-specific variables. $R^{firm}_{i,t}$ is a measure of time-varying firm-specific risk. R^{macro}_{t} is a measure of time-varying macroeconomic risk. The term υ_i captures the effects of time-invariant unobservable firm-specific factors such as reputation and capital intensity. The term $\varepsilon_{i,t}$ represents the time-varying residuals. Subscripts i and t denote firm and time period, respectively. The variables are defined as follows. Book leverage is the ratio of the book value of total debt to the book value of total assets. The market-to-book value ratio is defined as the book value of the total book assets less the book value of equity plus the market value of equity divided by the book value of total assets. Investment is the ratio of total expenditures to purchase fixed tangible assets to the book value of total assets. Profitability is the ratio of earnings before interest, taxes, and depreciation to the total book assets. Tangibility is the ratio of net plant, property, and equipment to the total book assets. The 2-year stock return is the difference between share prices at time t and share prices at time $t-2$. Firm size is defined as the logarithm of net sales deflated by the GDP deflator. The non-debt tax shield is defined as total depreciation expense divided by the book value of total assets. Firm-specific risk is drawn from firms' cash flow realizations. Macroeconomic risk is proxied by the conditional variance of Consumer Price Index (CPI) over the period under investigation. The sample consists of all UK manufacturing firms listed on the London Stock Exchange at any point over the period 1981-2009. The data are drawn from the WorldScope database via DataStream. Panel B reports the number of firms, the firm-year observations, the J statistics, which is a test of the over identifying restrictions, the Arellano-Bond test, AR(2), for second-order autocorrelation in the first-differenced residuals, and firm-year observations. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

Panel A: Estimation results		
Regressors	Coefficient	Std. Error
Leverage$_{i,t-1}$	0.723	(0.059)***
Market-to-Book$_{i,t-1}$	-0.039	(0.018)**
Investment$_{i,t-1}$	0.524	(0.144)***
Profitability$_{i,t-1}$	0.187	(0.089)**
Tangibility$_{i,t-1}$	-0.145	(0.060)**
Firm Size$_{i,t-1}$	0.036	(0.011)***
2-year Stock Return$_{i,t-1}$	-0.054	(0.019)***
Non-debt Tax Shields$_{i,t-1}$	0.600	(0.369)*
$R^{firm}_{i,t-1}$	-0.012	(0.003)**
R^{macro}_{t-1}	-0.252	(0.072)***
Constant	-0.263	(0.148)*
Panel B: Diagnostic tests		
Firm-years	10,947	
Firm	996	
AR(2)	-0.920	
p-value	0.360	
J-statistic	91.610	
p-value	0.218	

Table 3.10: Robustness: Alternative Measures of Risk and the Alternative Estimate of Firms' Target Leverage

Table 3.10 reports results from estimating the following model for alternative measures of risk and the alternative measure of the firm target leverage levels:

$$L_{i,t} - L_{i,t-1} = (\beta_1 D_{i,t}^{sur} + \beta_2 D_{i,t}^{def}) + (\beta_3 D_{i,t}^{sur} + \beta_4 D_{i,t}^{def}) DVT_{i,t}.D_{i,t}^{abov} + (\beta_5 D_{i,t}^{sur} + \beta_6 D_{i,t}^{def}) DVT_{i,t}.D_{i,t}^{belo} + (\beta_7 D_{i,t}^{sur} + \beta_8 D_{i,t}^{def}) DVT_{i,t}.D_{i,t}^{abov}.U_{i,t} + (\beta_9 D_{i,t}^{sur} + \beta_{10} D_{i,t}^{def}) DVT_{i,t}.D_{i,t}^{belo}.U_{i,t} + \upsilon_i + \varepsilon_{i,t}$$

where $L_{i,t}$ is a measure of leverage for firm i in year t. $DVT_{i,t}$ is the deviation of observed (actual) leverage from the target leverage ratio for firm i at time t, $D_{i,t}^{abov}$ is a dummy variable equal to one if the leverage ratio is above the target and zero otherwise for firm i at time t, $D_{i,t}^{belo}$ is a dummy variable equal to one if the leverage ratio is below the target and zero otherwise for firm i at time t. $D_{i,t}^{sur}$ is a dummy variable equal to one if the ith firm has a financial surplus at time t and zero otherwise, and $D_{i,t}^{def}$ is a dummy variable equal to one if the ith firm has a financial deficit at time t and zero otherwise. $U_{i,t}$ is a vector of one-period lagged time-varying firm-specific ($R_{i,t}^{firm}$) and macroeconomic risk (R_t^{macro}). Firm-specific risk is drawn from firms' cash flow realizations. Macroeconomic risk is proxied by the conditional variance of Consumer Price Index (CPI) over the period under investigation. Financial deficit is the ratio of the change in working capital plus investment expenditure plus dividends less net cash flows to the book value of total assets. Model 1 estimates the effect of our alternative measures of risk on adjustments, while Model 2 quantifies the effect of risk on adjustments when the firm target leverage is proxied by the historical mean of the firm leverage. The sample consists of all UK manufacturing firms listed on the London Stock Exchange at any point over the period 1981-2009. The data are drawn from the WorldScope database via DataStream. Panel B of the table reports the number of firms, the firm-year observations, the J statistics, which is a test of the over identifying restrictions, the Arellano-Bond test, AR(2), for second-order autocorrelation in the first-differenced residuals, and firm-year observations. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

Panel A: Estimation Results; Dependent Variable: ΔLeverage				
	Model 1		Model 2	
	Coefficient	Std. Error	Coefficient	Std. Error
$D_{i,t}^{sur}$	0.197	(0.081)***	0.164	(0.041)***
$D_{i,t}^{def}$	0.081	(0.027)***	0.064	(0.016)***
$D_{i,t}^{sur}.DVT_{i,t}.D_{i,t}^{abov}$	0.433	(0.197)***	0.372	(0.123)***
$D_{i,t}^{def}.DVT_{i,t}.D_{i,t}^{abov}$	0.610	(0.069)***	0.568	(0.075)***
$D_{i,t}^{sur}.DVT_{i,t}.D_{i,t}^{belo}$	-0.866	(0.216)**	-0.609	(0.167)**
$D_{i,t}^{def}.DVT_{i,t}.D_{i,t}^{belo}$	0.225	(0.033)***	0.474	(0.054)***
$D_{i,t}^{sur}.DVT_{i,t}.D_{i,t}^{abov}.R_{i,t-1}^{firm}$	-0.210	(0.018)***	-0.087	(0.025)**
$D_{i,t}^{def}.DVT_{i,t}.D_{i,t}^{abov}.R_{i,t-1}^{firm}$	0.019	(0.001)***	0.215	(0.088)***
$D_{i,t}^{sur}.DVT_{i,t}.D_{i,t}^{belo}.R_{i,t-1}^{firm}$	0.063	(0.003)***	0.258	(0.031)***
$D_{i,t}^{def}.DVT_{i,t}.D_{i,t}^{belo}.R_{i,t-1}^{firm}$	-0.001	(0.001)	-0.111	(0.018)***
$D_{i,t}^{sur}.DVT_{i,t}.D_{i,t}^{abov}.R_{t-1}^{macro}$	0.659	(0.256)***	0.141	(0.036)***
$D_{i,t}^{def}.DVT_{i,t}.D_{i,t}^{abov}.R_{t-1}^{macro}$	-2.146	(0.442)***	-0.221	(0.035)***
$D_{i,t}^{sur}.DVT_{i,t}.D_{i,t}^{belo}.R_{t-1}^{macro}$	1.627	(0.518)***	0.061	(0.025)**
$D_{i,t}^{def}.DVT_{i,t}.D_{i,t}^{belo}.R_{t-1}^{macro}$	-0.298	(0.097)***	-0.046	(0.013)***
Panel B: Diagnostic tests				
Firm-years	9,751		9,751	
Firm	970		970	
AR(2)	-0.790		0.310	
p-value	0.428		0.757	
J-statistic	34.240		74.770	
p-value	0.159		0.241	

Table 3.11: Robustness: An Alternative Measure of Leverage

Table 3.11 reports the robust two-step system-GMM estimation results of the impact of risk on firms' target leverage ratio from estimating the following model for alternative measures of leverage:

$$L_{i,t} = \beta_0 + \beta_1 X_{i,t-1} + \beta_2 R^{firm}_{i,t-1} + \beta_3 R^{macro}_{i,t-1} + \upsilon_i + \varepsilon_{i,t}$$

where $L_{i,t}$ is a measure of the book leverage of firm i in year t. $X_{i,t}$ is a vector of the firm-specific variables. $R^{firm}_{i,t}$ is a measure of time-varying firm-specific risk. R^{macro}_t is a measure of time-varying macroeconomic risk. The term υ_i captures the effects of time-invariant unobservable firm-specific factors such as reputation and capital intensity. The term $\varepsilon_{i,t}$ represents the time-varying residuals. Subscripts i and t denote firm and time period, respectively. The variables are defined as follows. Book leverage is the ratio of the book value of total debt (short-term + long-term debt) to the book value of total assets. The market-to-book value ratio is defined as the book value of the total book assets less the book value of equity plus the market value of equity divided by the book value of total assets. Investment is the ratio of total expenditures to purchase fixed tangible assets to the book value of total assets. Profitability is the ratio of earnings before interest, taxes, and depreciation to the total book assets. Tangibility is the ratio of net plant, property, and equipment to the total book assets. The 2-year stock return is the difference between share prices at time t and share prices at time $t-2$. Firm size is defined as the logarithm of net sales deflated by the GDP deflator. The non-debt tax shield is defined as total depreciation expense divided by the book value of total assets. Firm-specific risk is drawn from firms' cash flow realizations. Macroeconomic risk is proxied by the conditional variance of Consumer Price Index (CPI) over the period under investigation. The sample consists of all UK manufacturing firms listed on the London Stock Exchange at any point over the period 1981-2009. The data are drawn from the WorldScope database via DataStream. Panel B reports the number of firms, the firm-year observations, the J statistics, which is a test of the over identifying restrictions, the Arellano-Bond test, AR(2), for second-order autocorrelation in the first-differenced residuals, and firm-year observations. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

Panel A: Estimation Results; Dependent Variable: Leverage				
	Model 1		**Model 2**	
	Coefficient	**Std. Error**	**Coefficient**	**Std. Error**
Leverage$_{i,t-1}$	0.912	(0.044)***	0.932	(0.042)***
Market-to-Book$_{i,t-1}$	-0.018	(0.006)***	-0.014	(0.006)**
Investment$_{i,t-1}$	0.225	(0.133)*	——	——
Profitability$_{i,t-1}$	0.085	(0.035)***	0.092	(0.032)***
Tangibility$_{i,t-1}$	-0.164	(0.046)***	-0.129	(0.042)***
Firm Size$_{i,t-1}$	0.012	(0.003)***	0.011	(0.003)***
2-year Stock Return$_{i,t-1}$	-0.031	(0.005)***	-0.032	(0.005)***
Non-debt Tax Shields$_{i,t-1}$	0.440	(0.166)***	0.498	(0.162)***
$R^{firm}_{i,t-1}$	-0.050	(0.012)***	-0.049	(0.011)***
R^{macro}_{t-1}	-0.006	(0.001)***	-0.005	(0.001)***
Constant	-0.029	(0.052)***	0.141	(0.036)***
Panel B: Diagnostic tests				
Firm-years	10,882		10,882	
Firm	970		970	
AR(2)	-0.560		-0.620	
p-value	0.577		0.536	
J-statistic	88.320		81.680	
p-value	0.158		0.181	

Table 3.12: Robustness: An Alternative Measure of Leverage and the Impacts of Risks on Adjustment Speeds

Table 3.12 reports results from estimating the following model for an alternative measure of leverage:

$$L_{i,t} - L_{i,t-1} = (\beta_1 D_{i,t}^{sur} + \beta_2 D_{i,t}^{def}) + (\beta_3 D_{i,t}^{sur} + \beta_4 D_{i,t}^{def}) DVT_{i,t}.D_{i,t}^{abov} + (\beta_5 D_{i,t}^{sur} + \beta_6 D_{i,t}^{def}) DVT_{i,t}.D_{i,t}^{belo} + (\beta_7 D_{i,t}^{sur} + \beta_8 D_{i,t}^{def}) DVT_{i,t}.D_{i,t}^{abov}.U_{i,t} + (\beta_9 D_{i,t}^{sur} + \beta_{10} D_{i,t}^{def}) DVT_{i,t}.D_{i,t}^{belo}.U_{i,t} + \upsilon_i + \varepsilon_{i,t}$$

where $L_{i,t}$ is a measure of leverage for firm i in year t. $DVT_{i,t}$ is the deviation of observed (actual) leverage from the target leverage ratio for firm i at time t, $D_{i,t}^{abov}$ is a dummy variable equal to one if the leverage ratio is above the target and zero otherwise for firm i at time t, $D_{i,t}^{belo}$ is a dummy variable equal to one if the leverage ratio is below the target and zero otherwise for firm i at time t. $D_{i,t}^{sur}$ is a dummy variable equal to one if the ith firm has a financial surplus at time t and zero otherwise, and $D_{i,t}^{def}$ is a dummy variable equal to one if the ith firm has a financial deficit at time t and zero otherwise. $U_{i,t}$ is a vector of one-period lagged time-varying firm-specific ($R_{i,t}^{firm}$) and macroeconomic risk (R_t^{macro}). Firm-specific risk is drawn from firms' cash flow realizations. Macroeconomic risk is proxied by the conditional variance of Consumer Price Index (CPI) over the period under investigation. Financial deficit is the ratio of the change in working capital plus investment expenditure plus dividends less net cash flows to the book value of total assets. The sample consists of all UK manufacturing firms listed on the London Stock Exchange at any point over the period 1981-2009. The data are drawn from the WorldScope database via DataStream. Panel B of the table reports the number of firms, the firm-year observations, the J statistics, which is a test of the over identifying restrictions, the Arellano-Bond test, AR(2), for second-order autocorrelation in the first-differenced residuals, and firm-year observations. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

Panel A: Estimation results		
Regressors	Coefficient	Std. Error
$D_{i,t}^{sur}$	0.074	(0.015)***
$D_{i,t}^{def}$	0.049	(0.006)***
$D_{i,t}^{sur}.DVT_{i,t}.D_{i,t}^{abov}$	0.703	(0.130)***
$D_{i,t}^{def}.DVT_{i,t}.D_{i,t}^{abov}$	0.810	(0.057)***
$D_{i,t}^{sur}.DVT_{i,t}.D_{i,t}^{belo}$	-0.556	(0.175)***
$D_{i,t}^{def}.DVT_{i,t}.D_{i,t}^{belo}$	0.464	(0.129)***
$D_{i,t}^{sur}.DVT_{i,t}.D_{i,t}^{abov}.R_{i,t-1}^{firm}$	-0.282	(0.105)***
$D_{i,t}^{def}.DVT_{i,t}.D_{i,t}^{abov}.R_{i,t-1}^{firm}$	0.297	(0.054)***
$D_{i,t}^{sur}.DVT_{i,t}.D_{i,t}^{belo}.R_{i,t-1}^{firm}$	0.538	(0.210)***
$D_{i,t}^{def}.DVT_{i,t}.D_{i,t}^{belo}.R_{i,t-1}^{firm}$	-0.554	(0.124)***
$D_{i,t}^{sur}.DVT_{i,t}.D_{i,t}^{abov}.R_{t-1}^{macro}$	0.214	(0.058)***
$D_{i,t}^{def}.DVT_{i,t}.D_{i,t}^{abov}.R_{t-1}^{macro}$	-0.051	(0.020)***
$D_{i,t}^{sur}.DVT_{i,t}.D_{i,t}^{belo}.R_{t-1}^{macro}$	0.182	(0.066)***
$D_{i,t}^{def}.DVT_{i,t}.D_{i,t}^{belo}.R_{t-1}^{macro}$	-0.123	(0.053)**
Panel B: Diagnostic tests		
Firm-years	9,718	
Firm	962	
AR(2)	-1.370	
p-value	0.169	
J-statistic	62.370	
p-value	0.231	

Appendix A: A Summary of the SOA in Prior Studies

Table 3-A: Estimated Capital Structure Adjustment Speeds in Prior Empirical Studies

The second and third columns of Table 3-A report the estimated annual capital structure adjustment speeds toward capital structure and half-life, the time required for a deviation from the target capital structure to be halved, respectively. The half-life is computed as $ln(0.5)/ln(1-\phi)$, where ϕ is the estimate of the speed of adjustment toward target leverage. All reported estimates of the speed of adjustments are based on book leverage expect Flannery and Rangan (2006), who have used the market leverage in their study. The speed of adjustment from Kayhan and Titman (2007) is an annualized rate based on five-year rate reported in their paper, Table 2. The estimated annual speed of adjustment from Antoniou, Guney, and Paudyal (2008) is for UK and US firms in their Table 5.

Article	Sample Period	Country	SOA	Half-Life
Jalilvand and Harris (1984)	1966-1978	USA	56.1%[a], 10.9%[b]	0.8, 6.0 years
Ozkan (2001)	1984-1996	UK	56.9%	0.8 years
Fama and French (2002)	1965-1999	USA	10.0%[c], 18.0%[d]	6.6, 3.5 years
Flannery and Rangan (2006)	1965-2001	USA	34.0%	1.7 years
Kayhan and Titman (2007)	1960-2003	USA	10.0%	6.6 years
Flannery and Hankins (2007)	1968-2004	USA	22.0%	2.8 years
Xu (2007)	1970-2004	USA	18.0%	3.5 years
Lemmon, Roberts, and Zender (2008)	1963-2003	USA	25.0%	2.4 years
Antoniou, Guney, and Paudyal (2008)	1987-2000	UK, USA	32.0%[e], 32.2%[f]	1.8, 1.8 years
Byoun (2008)	1971-2003	USA	33.0%[g], 20.0%[h]	1.7, 3.1 years
Brav (2009)	1997-2003	UK	10.2%[j], 22.5%[k]	6.4, 2.7 years
Huang and Ritter (2009)	1963-2001	USA	17.0%	3.7 years
Chang and Dasgupta (2009)	1971-2004	USA	37.8%	1.4 years
Elsas and Florysiak (2010)	1965-2009	USA	26.0%	2.3 years
Cook and Tang (2010)	1977-2006	USA	46.1%[m], 43.7%[n]	1.1, 1.2 years
Elsas and Florysiak (2011)	1965-2009	USA	50.5%[0], 45.0%[p]	1.0, 1.1 years
Faulkender et al. (2011)	1965-2006	USA	22.9%[q], 69.3%[r]	2.6, 0.6 years

[a] For debt financing.
[b] For equity financing.
[c] Firms that pay dividends.
[d] Firms that do not pay dividends.
[e] UK firms.
[f] US firms.
[g] Firms that are above target leverage and have a financial surplus.
[h] Firms that are above target leverage and have a financial deficit.
[j] Public firms.
[k] Private firms.
[m] When the economy in an expansionary phase.
[n] When the economy in a recessionary phase.
[0] Highly over-levered firms.
[p] Highly under-levered firms.
[q] Under-levered firms with near-zero cash flow realization.
[r] Over-levered firms with excess cash flow realization.

Appendix B: Variable Definitions

Table 3-B: Variables Definitions

Variables	**Definition**
Dependent	
Book leverage	The ratio of book debt to the book value of total assets.
Explanatory	
Book debt	Total assets less the book value of equity.
Book equity	Total assets minus total liabilities and preferred stock plus deferred taxes and convertible debt.
Market-to-book value	The book value of total assets minus the book value of equity plus the market value of equity divided by the book value of total assets.
Profitability	The ratio of earnings before interest, taxes, and depreciation to the book value of total assets.
Firm size	Natural logarithm of net sales deflated by the GDP deflator.
Non-debt tax shield	Ratio of total depreciation expense to the book value of total assets.
Tangibility	The ratio of net plant, property, and equipment to the book value of assets.
Investment	The ratio of total capital expenditures to the book value of total assets.
2-year stock returns	Difference between share prices at time t and share prices at time $t-2$.
Financial deficit	The ratio of the change in working capital plus investment plus dividends less net cash flow to the book value of total assets.
Target leverage	Estimated from the regression of observed leverage on the firm-specific variables and risk measures.
Leverage deviation	Deviations of current leverage from the target leverage ratio.
Firm-specific risk	Drawn from the net sales of firms scaled by the book value of total assets.
Macroeconomic risk	Proxied by the conditional variance of UK real GDP obtained from the ARCH model.

Appendix C: Generating Macroeconomic Risk

Table 3-C: ARCH Model Estimates for Macroeconomic Risk

Panel A of Table B reports the estimates obtained by estimating the ARCH(1) model for real gross domestic (GDP) over the period 1975Q1-2009Q4. Specifically, allowing an $ARMA$ term in the mean equation, we estimate the following mean and variance equations simultaneously:

$$\Delta GDP_t = \omega + \eta(L)\Delta GDP_t + \delta(L)\epsilon_t + \epsilon_t$$
$$\sigma_t^2 = \alpha + \beta(L)\epsilon_t^2$$

where ω is a constant term, η and δ are the autoregressive and moving average parameters, respectively, and L is the polynomial lag operator. The conditional variance, σ_t^2, is the one-period-ahead forecast variance based on prior information. α is a constant term and $\epsilon|\Delta GDP_{t-1} \sim N(0,\sigma_{t-1}^2)$ is the innovation in real GDP. In the variance equation, the weights are (1-α,β) and the long-run average variance is $\sqrt{\alpha/(1-\beta)}$, where $\alpha > 0$ and $0 < \beta < 1$. The figures given in parentheses are standard errors. The estimates of the log-likelihood, Lagrange multiplier ($ARCH$ LM) test, and Q-statistics to test for the remaining ARCH effects in the model are given in Panel B of the table. We average the conditional variance across four quarters to obtain a yearly measure of the risk of macroeconomic conditions. Seasonally adjusted quarterly data spanning 1975Q1-2009Q4 on UK real GDP are taken from the Office for National Statistics (ONS) database (Pn: A2: ABMI: Gross Domestic Product: chained volume measure). Statistical significance at the 1% and 5% level is indicated by three and two asterisks, correspondingly.

Panel A: ARCH(1) Estimates		
Regressors	**ΔGDP**	
	Coefficients	Std.Error
ΔGDP_{t-1}	0.777	(8.450)***
Constant	0.415	(0.159)***
AR(1)	-0.808	(0.059)***
MA(1)	0.346	(0.153)**
MA(2)	-0.532	(0.140)***
ARCH(1)	0.781	(0.234)***
Constant	0.813	(0.161)***
Panel B: Tests for remaining ARCH effects		
Log-likelihood	-233.961	
Observations	139.000	
LM-test(4)	0.610	
P-value	0.962	
LM-test(8)	1.050	
P-value	0.994	
Q(4)	1.128	
P-value	0.889	
Q(8)	2.527	
P-value	0.960	

Appendix D: Testing for Unit Roots in Variables

Table 3-D: Fisher-Type Panel-Data Unit Root Tests

Table 3-D reports unit-root tests for firm-specific variables and risk series. Fisher-type panel-data unit-root tests are based on the Augmented Dickey-Fuller (ADF) regressions that include a constant, or a constant and time trend. Specifically, these tests first conduct unit-root tests for each panel individually included in the dataset. And then the p-values from these individually conducted unit root tests are combined to produce an overall test. Z and L* Statistics combine p-values using inverse normal and inverse logit transformations, respectively. The figures given in parentheses are p-value to test the null hypothesis that all panels contain unit roots against an alternative hypothesis that at least one panel is stationary for the underlying series. The number of lags used in the test is two. For macroeconomic risk series, the Augmented Dickey-Fuller unit-root test is contact including a constant, or a constant and linear time trend in the regressions. The null hypothesis for the ADF test is that the series contains a unit root, and the alternative is that the series does not has unit roots. The optimal number of lags for the ADF unit-root test is determined by the "general to specific" method proposed by Perron and Campbell (1991). Book leverage is the ratio of the book value of total debt to the book value of total assets. Market leverage is defined as the book value of total debt divided by the sum of the book value of debt and the market value of equity. Net equity issues are defined as the ratio of change in book equity minus the change in retained earnings to total assets. Newly retained earnings are the change in balance sheet retained earnings during an accounting year period divided by the book value of total assets. Net debt issues are then defined as the change in total assets to total assets less the sum of net equity issues and newly retained earnings. The market-to-book value ratio is defined as the book value of total assets less the book value of equity plus the market value of equity divided by the book value of total assets. Investment is the ratio of total expenditures to purchase fixed tangible assets to the total book assets. Profitability is the ratio of earnings before interest, taxes, and depreciation to the total book assets. Tangibility is defined as the ratio of net plant, property, and equipment to the total book assets. The 2-year stock return is the difference between share prices at time t and share prices at time $t-2$. Firm size is defined as the logarithm of net sales deflated by the GDP deflator. The non-debt tax shield is defined as total depreciation expense divided by the book value of total assets. Firm-specific risk is drawn from firms' sales. Macroeconomic risk is proxied by the conditional variance of UK real GDP over the period under investigation.The sample consists of all UK manufacturing firms listed on the London Stock Exchange at any point over the period 1981-2009. The data are drawn from the WorldScope database via DataStream.

Variable	**Constant**		**Constant & Trend**	
	Z Statistic	**L* Statistic**	**Z Statistic**	**L* Statistic**
Book Leverage	-8.756	-22.903	-3.427	-15.308
	(0.000)	(0.000)	(0.000)	(0.000)
Market Leverage	-5.703	-8.101	-3.836	-8.011
	(0.000)	(0.000)	(0.000)	(0.000)
Net Equity Issues	-21.081	-32.455	-13.238	-21.553
	(0.000)	(0.000)	(0.000)	(0.000)
Newly Retained Earnings	-17.208	-23.664	-11.470	-20.598
	(0.000)	(0.000)	(0.000)	(0.000)
Net Debt Issues	-21.186	-27.266	-13.164	-20.294
	(0.000)	(0.000)	(0.000)	(0.000)
Debt-Equity Ratio	-16.267	-35.982	-2.750	-10.915
	(0.000)	(0.000)	(0.003)	(0.000)
Market-to-Book Value	-18.557	-31.535	-13.107	-25.936
	(0.000)	(0.000)	(0.000)	(0.000)
Investment	-20.637	-34.035	-16.790	-26.660
	(0.000)	(0.000)	(0.000)	(0.000)
Portability	-9.470	-17.363	-4.379	-9.529
	(0.000)	(0.000)	(0.000)	(0.000)
Tangibility	-5.768	-19.680	-2.828	-10.744
	(0.000)	(0.000)	(0.002)	(0.000)
Firm Size	-7.426	-4.893	-3.430	-1.992
	(0.000)	(0.000)	(0.000)	(0.023)
2-year Stock Returns	-2.851	-7.495	-3.089	-1.510
	(0.002)	(0.000)	(0.001)	(0.065)
Non-debt Tax Shields	-6.707	-14.689	-1.263	-7.566
	(0.002)	(0.000)	(0.103)	(0.065)
Firm-Specific Risk	-24.693	-43.985	-13.796	-28.306
	(0.002)	(0.000)	(0.103)	(0.065)
Macroeconomic Risk	-3.695		-4.956	
	(0.004)		(0.000)	

Appendix E: Predictions and Prior Empirical Evidence

Table 3-E: Prediction and Empirical Evidence on the Determinants of Capital Structure

Variables	**Predictions**		**Empirical Evidence**	
Explanatory Variables	**Positive Relation with Leverage**	**Negative Relation with Leverage**	**Positive Relation with Leverage**	**Negative Relation with Leverage**
Lagged leverage			Caglayan and Rashid (2010), Brav (2009), Baum, Stephan, and Talavera (2009), Antoniou, Guney, and Paudyal (2008) Frank and Goyal (2004), DeMiguel and Pindado (2001), Ozkan (2001), MacKie-Mason (1990), this study	
Market-to-book value	Pecking order theory	Trade-off theory, Market timing	Myers and Majluf (1984), Myers (1984), Jensen (1986)	Frank and Goyal (2009), Sibilkov (2009), Chang and Dasgupta (2009), Lemmon, Roberts, and Zender (2008), Antoniou, Guney, and Paudyal (2008), Kayhan and Titman (2007), Alti (2006), Miao (2005), Hovakimian (2004), Mao (2003) Rajan and Zingales (1995), this study

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Variables	Predictions		Empirical Evidence	
Explanatory **Variables**	**Positive Relation with Leverage**	**Negative Relation with Leverage**	**Positive Relation with Leverage**	**Negative Relation with Leverage**
Profitability	Free cash flow theory	Pecking order theory	Alti (2006), Hovakimian, Hovakimian, and Tehranian (2004), Hovakimian (2004) Frank and Goyal (2003) Jensen (1986), this paper	Huang and Ritter (2009), Antoniou, Guney, and Paudyal (2008), Kayhan and Titman (2007), Hovakimian (2006) and Rajan and Zingales (1995) Ozkan (2001) and Titman and Wessels (1988)
Tangibility	Trade-off theory	Pecking order theory	Frank and Goyal (2009), Lemmon, Roberts, and Zender (2008), Hovakimian (2006), Alti (2006), Flannery and Rangan (2006) and Titman and Wessels (1988)	Huang and Ritter (2009), Feidakis (2007), Leary and Roberts (2005)and Hovakimian, Hovakimian, and Tehranian (2004), this study
Firm Size	Trade-off theory	Pecking order theory	Caglayan and Rashid (2010), Sibilkov (2009), Chang and Dasgupta (2009), Brav (2009), Frank and Goyal (2009), Antoniou, Guney, and Paudyal (2008), Flannery and Rangan (2006), Hovakimian, Hovakimian, and Tehranian (2004)Mao (2003), Ozkan (2001), Chung (1993),Friend and Lang (1988) Ferri and Jones (1979), this study	Johnson (1998), Titman and Wessels (1988), Kester (1986)

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Variables	Predictions		Empirical Evidence	
Explanatory **Variables**	**Positive Relation with Leverage**	**Negative Relation with Leverage**	**Positive Relation with Leverage**	**Negative Relation with Leverage**
Stock Returns	Pecking order theory, Inertia theory			Chang and Dasgupta (2009), Bokpin (2009), Antoniou, Guney, and Paudyal (2008), Kayhan and Titman (2007), Hovakimian (2006), Kahle and Shastri (2005), Hovakimian, Hovakimian, and Tehranian (2004), Korajczyk and Levy (2003), this study
Investment	Pecking order theory		Caglayan and Rashid (2010), Huang and Ritter (2009), Baum, Stephan, and Talavera (2009), Brav (2009), Korajczyk and Levy (2003), Titman and Wessels (1988), this study	
Non-debt tax shields	Trade-off theory	DeAngelo and Musulis's (1980) model	Frank and Goyal (2009), Antoniou, Guney, and Paudyal (2008), Mao (2003), MacKie-Mason (1990), Titman and Wessels (1988), this study	Leary and Roberts (2005), DeMiguel and Pindado (2001), DeAngelo and Masulis (1980)

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Variables	Predictions		Empirical Evidence	
Explanatory **Variables**	**Positive Relation with Leverage**	**Negative Relation with Leverage**	**Positive Relation with Leverage**	**Negative Relation with Leverage**
Firm-specific risk	The Myers' (1977) model, The Jaffe and Westerfiel's (1987) model	The tax shelter-bankruptcy cost model (Castanias (1983) and Bradley, Jarrel, and Kim's (1984) model	Kim and Sorensen (1986), Auerbach (1985), Toy, Stonehill, Remmers, and Wright (1974)	Caglayan and Rashid (2010), Bokpin, Aboagye, and Osei (2010), Baum, Stephan, and Talavera (2009), Lemmon, Roberts, and Zender (2008), Antoniou, Guney, and Paudyal (2008),Lemmon, Roberts, and Zender (2008), Wald (1999), MacKie-Mason (1990), Titman and Wessels (1988), Bradley, Jarrell, and Kim (1984), Ferri and Jones (1979), Baxter (1967), this study
Macroeconomic risk	The Myers-Majluf's (1984) model	Dynamic capital structure models developed by Bhamra, Kuehn, and Strebulaev (2010) and Chen (2010) and The Gertler and Hubbard's (1993) model		Caglayan and Rashid (2010), Baum, Stephan, and Talavera (2009), Hatzinikolaou, Katsimbris, and Noulas (2002), this study

Chapter 4

Macroeconomic Dynamics, Idiosyncratic Risk, and Firms' Security Issuance Decisions: An Empirical Investigation of UK Manufacturing Firms

4.1 Key Findings

In this chapter, we empirically analyze how firms make financing decisions under risk using a large panel of UK manufacturing firms. Our results suggest that while incremental changes in debt are significantly negatively related to idiosyncratic risk, both the issuance of equity and the use of retained earnings are positively related to idiosyncratic risk. Our results also suggest that firms in periods of high macroeconomic risk are not only likely to reduce debt and equity financing but they are also likely to reduce their use of internally generated funds (i.e., retained earnings). We also find that changes in firms' target leverage are significantly negatively linked with these two types of risk. The results from the debt-equity choice regression suggest that firms are likely to reduce their debt-equity ratio in periods when they experience either type of risk.

4.2 Introduction

Capital structure theories offer a number of predictions relating to the effect of variation in firms' own business activities and macroeconomic conditions on corporate financing decisions. The trade-off theory postulates a negative relationship between idiosyncratic risk and the target level of firms' leverage. It is commonly believed that higher business risk, as measured by variations in firms' net earnings, increases the chance of bankruptcy. Hence, given the positive costs of bankruptcy, firms tend to reduce the level of debt in their capital structure when they face a large variation in their expected cash flow stream. However, according to the agency costs theory, firms' borrowing decisions are positively related to business risk. A potential explanation behind this is that higher idiosyncratic risk may decrease the agency cost of debt and firms therefore are likely to increase their debt borrowing (Myers (1977)).

Referring to the market timing theory of capital structure, one can predict a negative association between macroeconomic risks and firms' capital structure. The market timing theory suggests that firms significantly time their issues. In particular, firms are likely to issue equity when their shares are overvalued and repurchase equity when shares are undervalued.[81] Since the heightening of macroeconomic risks can lead to a sharp reduction

[81]See Hovakimian, Opler, and Titman (2001), Baker and Wurgler (2002), and Korajczyk and Levy (2003).

in the market value of equity, we would expect that firms are less likely to issue equity in times of macroeconomic risk. The effect of macroeconomic risk on new debt issuance is also expected to be negative. Since high debt increases the cost of financial distress and exposes firms to macroeconomic risk, firms are likely to reduce the level of debt in their capital structure as macroeconomic risk increases.[82]

On empirical grounds, several studies have successfully established the effects of risk on corporate capital structure (see, for example, Hatzinikolaou, Katsimbris, and Noulas (2002), Lemmon, Roberts, and Zender (2008), Antoniou, Guney, and Paudyal (2008), Baum, Stephan, and Talavera (2009), and Caglayan and Rashid (2010), among many others).[83] These studies have generally found that risk has a significant and negative impact on firms' capital structure. However, these studies mainly emphasize how risk affects the target leverage rather than the effects of risk on the change in leverage or firms' ability to use internally generated funds (i.e., retained earnings), debt borrowing, and equity financing.

In this chapter, we investigate the effects of risks relating to firms' own business activity and macroeconomic conditions on the corporate capital structure in three ways. First, in contrast to most prior studies, we examine how idiosyncratic and macroeconomic risk affect the annual change in leverage rather than the target level of leverage. This approach enables us to relate the dynamics of firms' leverage ratios to unpredictable variations in firms' own business activities as well as the overall macroeconomic environment.

Second, we decompose the aggregate change in leverage into three components relating to the change in debt financing, the change in equity financing, and the change in retained earnings, and we analyze how each component responds to uncertainty.[84] By doing so, we not only document the role of risk in the external financing decisions of firms (debt borrowing and equity financing) but we also provide evidence on how risk about firms' own business activity and macroeconomic conditions affects firms' use of internally generated funds (the newly retained earnings). This approach also enables us to determine whether risk affects leverage through a reduction in debt financing, as predicted by the bankruptcy

[82] See Gertler and Hubbard (1993) and Levy and Hennessy (2007). In particular, Levy and Hennessy (2007) examine firms' financing choices in a general equilibrium framework. They predict that firms issue equity pro-cyclically. They also document that financially constrained firms are likely to reduce their outstanding debt in periods of poor macroeconomic conditions.

[83] Titman and Wessels (1988) and MacKie-Mason (1990) are among the early studies that have provided evidence on the existence of the negative relationship between firms' leverage and idiosyncratic risk. However, we should note that prior studies estimating the effect of risk have largely focused on relating the target leverage to risk. Rather, the focus of this chapter is to examine how risk affects changes in leverage and the components of a change in leverage.

[84] Since firms' observed leverage reflects the history of firms' financing decisions, the historical tendencies of many firm-specific factors, such as profitability, stock returns, and the financing deficit, can significantly affect debt to assets ratios (Baker and Wurgler (2002), Welch (2004), and Kayhan and Titman (2007)). This could bias the estimates on the effect of risk on book leverage. By studying whether risk concerning firms' own business activity and the overall state of the economic has an effect on the issuance of financial instruments, we would be able to more effectively isolate the effect of risk on the capital structure of firms.

theory, or through other channels (equity financing, for example).[85] Furthermore, this investigation also provides us an opportunity to examine whether both idiosyncratic and macroeconomic risk have differential effects on the components of the change in leverage.

Finally, we study how risk affects the choice of firms between issuing debt and issuing equity. Examining the effect of risk on firms' debt-equity choice, we are likely to infer more explicitly whether firms prefer debt or equity financing in periods when firm-specific and macroeconomic risks are high.

We argue that firms in periods of heightened idiosyncratic risk are likely to reduce their outstanding debt as they become more cautious about bankruptcy costs. Furthermore, banks and other lending institutions might be reluctant to lend to risky firms or, at least, they would be inclined to lend such firms at a higher risk premium. Hence, risky firms are likely to either use more internally generated funds or issue new equity due to increased cost of financing. On the other hand, during periods of high macroeconomic volatility, firms not only reduce the level of existing debt but also are less likely to issue equity as the market value of firms sharply varies.

In order to test our claims, we focus on UK manufacturing firms and utilize an annual unbalanced panel dataset obtained from the WorldScope database via DataStream. The study covers the period 1981-2009. Given that our empirical models have a dynamic panel data context, we use the two-step system GMM dynamic panel estimator augmented by Blundell and Bond (1998). In our empirical investigation we use a set of firm-specific factors, which includes lagged leverage, the market-to-book value ratio, the 2-year stock return, the tangibility of assets, firm profitability, investment expenditures, firm size, and non-debt tax shields, to control for firm-specific effects.

Our results show that firms are likely to reduce their leverage when they operate in periods of heightened risk. These results are robust for both idiosyncratic and macroeconomic risk. The negative sensitivity of leverage to idiosyncratic risk is consistent with the notion that, given a positive cost of bankruptcy, risky firms reduce their use of debt due to the heightened likelihood of bankruptcy. The inverse relationship between macroeconomic risk and leverage also in line with the view that in periods of heightened risk, firms tend to reduce the level of debt in their capital structure as high debt makes firms more exposed to business-cycle risk.

Next, we examine the impact of risks on the components that affect the change in leverage. Following Baker and Wurgler (2002) and Chen and Zhao (2007), we decompose the aggregate annual change in leverage into the change in debt, the change in equity,

[85] Recent theoretical models such as Hackbarth, Miao, and Morellec (2006), Chen (2010), and Bhamra, Kuehn, and Strebulaev (2010) predict that macroeconomic risk also affects firms' leverage via its effects on equity issuance.

and the change in retained earnings. We then investigate the effects of both idiosyncratic and macroeconomic risk on these components. We find that idiosyncratic risk affects the incremental changes in debt negatively, while the effects of idiosyncratic risk on both the issuance of equity and the use of retained earnings are positive. This implies that the negative sensitivity of the change in leverage to idiosyncratic risk arises not only because of a reduction in debt but also due to a rise in net equity financing and newly retained earnings.

When we turn to the effects of macroeconomic risk, we find that macroeconomic risk affects negatively all three sources of financing: debt issues, retained earnings, and equity issues. In particular, we find that during times of heightened macroeconomic risk, not only external debt and equity issues fall but also firms' use of internally generated funds declines significantly. The negative sensitivity of both the issuance of debt and equity to variations in macroeconomic conditions suggests that firms time their equity and debt issues. In other words, firms are less likely to issue securities when macroeconomic prospects are not favorable. These observations are consistent with the findings of Korajczyk and Levy (2003) which indicate that macroeconomic conditions are of significance for securities issuance. Further, our results on the effects of macroeconomic risk are in line with the predictions of Hackbarth, Miao, and Morellec (2006).[86]

Two implications emerging from results related macroeconomic risks are worth noting. First, it turns out that the negative effects of macroeconomic risk on changes in leverage are purely the result of a reduction in debt financing. Second, firms in times when the overall macroeconomic environment is uncertain and unstable are likely to design their investment and financing policies propassively. To that end, we argue that during uncertain states of the economy, even cash-rich firms may prefer to hold cash in hand rather than investing it as buffer cash holdings safeguard them against financial distress.

The results, from the regression of the firms' debt-equity choice, confirm our findings on the effects of risk on leverage components and suggest that the effect of both firm-specific and macroeconomic risk is negative and significant statistically. Specifically, we find that firms tend to issue equity rather than debt when firm-specific risk is high. The same holds true for macroeconomic risk, suggesting that firms lower their debt-equity ratios when macroeconomic risk is high. However, this finding along with the evidence of the negative impact of macroeconomic risk on the issuance of both debt and equity suggests that although firms reduce their use of external financing (debt and equity) in periods of volatile macroeconomic conditions, they do a reduction in debt borrowing by a

[86]Hackbarth, Miao, and Morellec (2006) proposed a contingent claims model in which the cash flows of firms are conditional on both idiosyncratic risk and macroeconomic conditions. They predict that firms' borrowing capacity exhibits pro-cyclicity and that both the pace and the size of capital structure changes depend on macroeconomic conditions.

larger amount than they do in equity financing.

Our remaining results suggest that firm characteristics are also important in the determination of the components of the change in leverage. Specifically, we find that the effects of firm-specific variables are asymmetric across all three components. Firms' profitability is negatively related to the issuance of equity, while it is positively associated with the issuance of debt. On the other hand, firms having more tangible assets relative to their total assets are more likely to issue equity and less likely to use debt in their capital structure. Firms with high levels of non-debt tax shields are more likely to issue debt but tend to decrease the use of internal funds to finance their capital needs. We also find that the market-to-book value ratio is significantly positively linked with all three components of the change in leverage. Further, we find that large firms are less likely to issue equity but are more likely to issue debt. However, high-return firms have a large propensity to issue equity rather than debt. In contrast, firms that incur more investment expenditures are more likely to issue debt. We find that the effects of these traditional determinants of capital structure are generally similar to those reported in earlier research (see, for example, Baker and Wurgler (2002), Alti (2006), Chen and Zhao (2007), Lemmon, Roberts, and Zender (2008), and Chang and Dasgupta (2009)).

The chapter is organized as follows. In Section 2, we discuss in detail how risks concerning firms' own business activities as well as macroeconomic conditions influence firms' financing decisions. Section 3 discusses the data, variable construction, and the generation of proxies for risk. Section 4 presents summary statistics and correlations. Section 5 describes the empirical framework. Section 6 presents and discusses the empirical findings. Section 7 concludes the chapter.

4.3 Firms' Financing Decisions in the Presence of Risk

4.3.1 Idiosyncratic Risk Effects

According to the trade-off theory of capital structure, an increase in firm-level risk measured by vulnerability of the net earnings of the firm tends to heighten the likelihood of bankruptcy. Hence, the firm is likely to reduce its existing level of debt financing when the firm experiences a greater variation in net earnings. This idea is explained in Castanias (1983), who shows that with a given marginal tax rate and marginal default cost function, higher business risk results in a decline in the debt level of firms.

In line with bankruptcy cost theory, Bradley, Jarrell, and Kim (1984) present a single period corporate capital structure model and show the presence of an inverse relation between a firm's optimal level of debt and its earning volatility. It is also argued that financial distress is costly regardless of the presence or the absence of bankruptcy (Brealey and Myers (1981)). Firms therefore generally have a tendency to repress the probability of distress, hence, risky firms use less debt in their capital structure than the others.

Banks and other lending institutions also avoid the channeling of funds toward risky firms or they require a higher risk premium making debt costly to borrow. As a result, risky firms reduce their use of debt financing, while they are more likely to opt for raising funds from the equity markets. In this sense, the impact of idiosyncratic risk on firms' target leverage is negative as the likelihood of raising new debt relative to equity declines during periods of heightened idiosyncratic risk. In other words, firms tend to reduce the level of existing debt but issue equity in periods of internal unrest.

In contrast, Myers (1977) suggests that there is a positive relationship between the optimal level of firms' debt and idiosyncratic risk. It is argued that a large amount of risk associated with the firms' own business activities may tend to reduce the debt-related agency costs and these lower agency costs tend to induce firms to use more debt in their capital structure. Jaffe and Westerfield (1987) present a simple model, which incorporates both corporate taxes and bankruptcy costs to forge the link between firms' debt and the risk under which they operate. They show that neither the value of debt nor the ratio of debt to equity are negatively affected by the firms' earnings variability. Indeed, they predict a positive relationship between the two variables. Kale, Noe, and Ramirez (1991) predict a U-shaped relationship between idiosyncratic risk and the level of firm debt. They argue that an increase in firm-level risk initially causes firms to reduce the amount of debt outstanding. This relationship is, however, totally reversed as the debt level of a firm exceeds a threshold-level, implying a positive relationship between firm debt and idiosyncratic risk.

4.3.2 Macroeconomic Risk Effects

As argued by Gertler and Hubbard (1993), firms take into account both firm-specific risk and macroeconomic risk while making their production and financing decisions. However, firms can only manipulate the firm-level risk. Therefore, to extenuate the costs of financial distress, firms should share the risk with outside lenders by issuing equity. Hence, the optimal capital structure is comprised of a mix of debt and equity rather than of pure debt or equity. It is also argued that a high level of debt makes firms to heavily exposed to business-cycle risks (Gertler and Hubbard (1993)). Hence, one can predict a negative association between macroeconomic risks and the use of debt in firms' capital structure.

According to the market timing hypothesis, firms time their equity issues. In particular, firms are likely to issue equity when their shares are overvalued and repurchase equity when shares are undervalued (Hovakimian, Opler, and Titman (2001) and Baker and Wurgler (2002)). However, because an increase in risks relating to overall macroeconomic environment reduces the market value of equity, firms are less likely to do so (Korajczyk and Levy (2003)). Thus, macroeconomic risks should have a negative impact on firms' propensity to issue equity.

Finally, we also predict a negative impact of macroeconomic risk on the change in firms' retained earnings. This can be explained as follows. In periods of uncertain macroeconomic conditions, firms' managers become more cautious about financial distress costs. As a result, they might prefer cash in hand rather than investing it as they regard cash holdings as a buffer against any future insolvency. Thus, firms reduce the use of internally generated funds in financing their investments.

Recent theoretical studies more systematically relate firms' financing decisions to business-cycle risks. For instance, Hackbarth, Miao, and Morellec (2006) proposed a contingent claims model in which the cash flows of firms are conditional on both an idiosyncratic risk and macroeconomic conditions. They predict that firms' borrowing capacity exhibits pro-cyclicity and that both the pace and the size of capital structure changes depend on macroeconomic conditions. Levy and Hennessy (2007) examine firms' financing choices in a general equilibrium framework. They predict that firms issue equity pro-cyclically. They also document that firms are more likely to reduce their outstanding debt in periods of poor macroeconomic conditions.

Bhamra, Kuehn, and Strebulaev (2010) and Chen (2010) develop a dynamic capital structure model to examine how corporate financing policy responds to macroeconomic fluctuations. They show that unpredictable variations in macroeconomic conditions have a significant impact on firms' financing policies. Particularly, Chen (2010) predicts that higher macroeconomic risks increase discount rates (risk premia) and deteriorate future cash flows, which lessens the discounted value of expected tax benefits, which lowers the advantages related to the outstanding stock of debt. Hence, firms are likely to be low lever by reducing their outstanding amounts of debt in bad times. Bhamra, Kuehn, and Strebulaev (2010) explain the pro-cyclicality of leverage through state-contingent optimal coupon payments. In particular, they argue that firms are likely to choose lower optimal coupons in times of high macroeconomic risk in order to increase their financial flexibility. This renders firms to be conservative in their use of debt financing in a bad state of the economy, which leads leverage to be pro-cyclical.

The hypotheses regarding the effects of idiosyncratic risk and macroeconomic vulnerability on the source of financing are summarized in Table 4.1.

Table 4.1: How Risk Affects Firms' Financing Decisions: A Summary of the Hypotheses

Table 4.1 represents the summary of the hypotheses regarding the effects of risk on firms' financing resources. Net equity issue is the ratio of change in book equity less the change in retained earnings to book value of total assets. Newly retained earnings are the ratio of the change in balance sheet retained earnings during an accounting year period to the book value of total assets. Net debt issues are defined as the change in total assets to total assets less the sum of net equity issues and newly retained earnings. Idiosyncratic risk is drawn from firms' sales. Macroeconomic risk is proxied by the conditional variance of UK real GDP over the period under investigation. The sample consists of all UK manufacturing firms listed on the London Stock Exchange at any point over the period 1981-2009. The data are drawn from the WorldScope file via DataStream.

Risk	Hypothesis		
	Equity Issuance	Δ Retained Earnings	Debt Issuance
Idiosyncratic Risk	Positive	Positive	Negative
Macroeconomic Risk	Negative	Negative	Negative

4.3.3 Prior Empirical Evidence

A number of empirical studies provide evidence that is in accordance with the above predictions.[87] For example, Caglayan and Rashid (2010) find that an increase in uncertainty (both firm-specific and macroeconomic), proxied by several measures, leads to a decline in the target leverage for UK public and non-public manufacturing firms. Baum, Stephan, and Talavera (2009) also report a significant and negative impact of risk relating to firms' sales and the state of the economy on the optimal short-term leverage for US non-financial public firms. Lemmon, Roberts, and Zender (2008) report a negative effect of the firm's cash flow volatility measured by the standard deviations of historical operating income on both book and market leverage. Similarly, the findings of Antoniou, Guney, and Paudyal (2008) also confirm the negative association between the firm's earning volatility and its debt level. Taub (1975), Marsh (1982), Titman and Wessels (1988), and MacKie-Mason (1990) are among the early studies that have provided evidence on the existence of the negative relationship between firms' leverage and idiosyncratic risk.[88]

4.4 Data Description

In this section, we describe the sample and define our dependent as well as the firm-specific explanatory variables used in the empirical analysis. In addition, we discuss the approach which we use to generate our risk proxies.

[87] However, we should note that prior studies estimating the effect of risk have largely focused on relating the target leverage to risk. Rather, the focus of this chapter is to examine how risk affects changes in leverage and the components of a change in leverage.

[88] See Chapter 2 of the thesis for a comprehensive survey of the literature on the effects of risk on the target level of firms' leverage.

4.4.1 Sample Selection

We use a firm-level unbalanced annual panel manufacturing dataset for the United Kingdom. The data are drawn from the WorldScope file via DataStream and cover the period from 1981-2009.[89] We restrict our sample to include firms that have at least five years of data.[90] All the firm-specific variables are scaled by total assets. The variables in the ratio form are winzorised at the first and ninety-ninth percentile.[91] In order to generate macroeconomic risk, seasonally adjusted quarterly data spanning 1975Q1-2009Q4 on UK real GDP are obtained from the Office for National Statistics (ONS) database.

4.4.2 Variable Construction

The variables are defined as follows. Following prior empirical studies, including Baker and Wurgler (2002), Alti (2006), and Kayhan and Titman (2007), we define book equity as total assets minus total liabilities and preferred stock plus deferred taxes and convertible debt. Book debt is defined as total assets less book equity. Book leverage is defined as the ratio of book debt to total assets. Market equity is defined as common shares outstanding multiplied by the market price of each share. Market leverage is defined as book debt divided by the sum of the book value of debt and the market value of equity. As in Baker and Wurgler (2002) and Kayhan and Titman (2007), we drop the firm-year observations where the ratio of market leverage exceeds one or less than zero.

Net equity issues are defined as the ratio of change in book equity minus the change in retained earnings to total assets. Newly retained earnings are the change in balance sheet retained earnings during an accounting year period divided by the book value of total assets. Net debt issues are defined as the change in total assets to total assets less the sum of net equity issues and newly retained earnings.[92] Firm size is defined as the logarithm of total net sales deflated by the GDP deflator. Asset tangibility is defined as the ratio of net plant, property, and equipment to the book value of total assets. Profitability is the ratio of earnings before interest, taxes, and depreciation to the book value of total assets. The 2-year stock return is defined as the difference between share prices at time t and share prices at time $t-2$. The market-to-book value ratio is defined as the book value of

[89] As we allow both entry and exit in the sample, we arguably partly mitigate potential sample selection and survivor bias.

[90] We impose this restriction because at least four observations are needed for each underlying firm to generate a proxy for idiosyncratic risk using AR(1) and the implementation of the two-step system-GMM methodology as the system-GMM estimation required the second and higher lags of the variables included in the model as instruments.

[91] These data screening methods are quite common in the literature and the implementation of these methods is aimed at ensuring comparability with earlier studies (Baker and Wurgler (2002), Alti (2006), Kayhan and Titman (2007), Lemmon, Roberts, and Zender (2008), Baum, Stephan, and Talavera (2009), Brav (2009), and Caglayan and Rashid (2010).

[92] Our definitions of net equity issues, newly retained earnings, and net debt issues follow Baker and Wurgler (2002).

total assets less the book value of equity plus the market value of equity divided by the book value of total assets.[93] The non-debt tax shield is defined as the total depreciation expense divided by the book value of total assets.

4.4.3 Measuring Risk

Various statistical methods have been used in the literature to generate measures of risk. These methods generally include moving standard deviations, autoregressive (AR) specifications, state space models, ARCH/GARCH modelling, stochastic volatility models, the intra-annual variation approach, and survey-based methods. However, most of these methods suffer from statistical problems. For instance, a simple moving standard deviation measure of risk and survey-based measures suffer from the problem of serial correlation and measurement error, respectively. Specifications based on GARCH and state space models can be very complicated. Further, these specifications are likely to face a problem of very weak persistence of shocks in annual data. Time-invariance and measurement error in a proxy for risk may cause a significant bias in empirical inference. What follows in this sub-section is our brief discussion on methods that we use to generate risk proxies.

Here we use an autoregressive (AR) process to generate idiosyncratic risk for each underlying firm. Unlike most of the above-mentioned methods, this method allows us to generate a risk measures which is appropriate for all types of firms (small and large). Furthermore, this approach enables us to proxy risk using the unpredictable components of the movement of the underling variable rather than the variability of the variable per se. In doing this, we utilize firms' annual sales normalized by the book value of total assets. Specifically, the generalized autoregressive $AR(L)$ process is defined as follows:

$$\Gamma_{i,t} = \kappa_i + \phi(L)\Gamma_{i,t} + \epsilon_{i,t} \tag{4.1}$$

where $\Gamma_{i,t}$ is the ratio of sales to the book value of total assets for firm i at time t, κ_i is the constant for firm i, ϕ is the autoregressive parameter, L is the polynomial lag operator, and $\epsilon_{i,t}$ is the error term with zero mean and finite variance.

To generate our measure of idiosyncratic risk, we first estimate an autoregressive (AR) order one model for each firm over the period under investigation. Next, for each firm, we obtain one-period-ahead residuals (errors) from the estimated model. Finally, we use the residuals to calculate the risk proxy by computing the recursive variance using a one-year window for each firm over the examined period. Specifically, for the year 1982, we compute the variance of the residuals obtained from the $AR(1)$ model of sales over 1982 and 1981. Similarly, for year 1983, the residuals in 1983, 1982 and 1981 are used. The

[93] Baker and Wurgler (2002), Hovakimian, Hovakimian, and Tehranian (2004), and Kayhan and Titman (2007) also define the market-to-book ratio in similar way.

process is repeated for the remaining years. The square root of the estimated recursive variance, denoted by $Risk_{i,t}^{idio}$, is then used as a proxy for idiosyncratic uncertainty.

To generate macroeconomic risk, researchers have generally used three methods, namely the $ARCH/GARCH$ methodology, moving standard deviations, and survey-based methods. For example, Caglayan and Rashid (2010) estimate GARCH models for quarterly GDP and Treasury bill rates and utilize the conditional variance to construct a proxy for risk associated with the overall macroeconomic environment. Driver, Temple, and Urga (2005) and Baum, Stephan, and Talavera (2009) use the conditional variance obtained from the estimation of GARCH specifications for manufacturing output and the index of leading macroeconomic indicators, respectively, to gauge macroeconomic uncertainty. Analogously, Aizenman and Marion (1999) also utilize the conditional variance obtained by estimating a GARCH model for government expenditure, the nominal money supply and the real exchange rate to construct a proxy for macroeconomic risk. Ghosal and Loungani (2000) use the moving standard deviation of the Federal Funds Rate (FFR) and energy prices as a proxy for macroeconomic risks. Kaufmann, Mehrez, and Schmukler (2005) and Graham and Harvey (2001a) use survey-based methods based on the dispersion of forecast to proxy macroeconomic risk. Korajczyk and Levy (2003) utilize two-year equity market return and two-year aggregate domestic nonfinancial corporate profit growth to proxy macroeconomic conditions.

We estimate an $ARCH$ model for seasonally adjusted quarterly real GDP over the period 1975-2009 to generate a proxy for macroeconomic risk:

$$\Delta GDP_t = \omega + \eta(L)\Delta GDP_t + \delta(L)\epsilon_t + \epsilon_t \tag{4.2}$$

$$\sigma_t^2 = \alpha + \beta(L)\epsilon_t^2 \tag{4.3}$$

where ω is a constant term, η and δ are autoregressive and moving average parameters, respectively, and L is the polynomial lag operator. The estimated conditional variance, $\hat{\sigma}_t^2$, is the one-period-ahead forecast variance based on prior information. α is the constant and $\epsilon|\Delta GDP_{t-1} \sim N(0, \sigma_{t-1}^2)$ is the error term.

The quarterly conditional variance obtained from the $ARCH$ estimation is annualized by taking a 4-quarter average and denoted by $Risk_t^{macro}$, which we then use as a proxy for macroeconomic risk in our empirical analysis. The estimate on $ARCH$ (0.781) is less than one and it is statistically significant at the 1% level. The diagnostic test statistics indicate that there is no remaining $ARCH$ effects left in the standardized residuals.[94,95]

[94]The results for the ARCH estimation are not given because they are already presented in Table 3-C, Appendix C of Chapter 3.

[95]To examine the interdependence between the two types of risk measures we estimate the correlation between both uncertainties. The coefficient of correlation (0.02) is very small and not statistically different from zero, suggesting that both forms of risk are independent and cover a different aspect of the risk faced by firms.

4.5 Summary Statistics and Correlation Estimates

In this section, we present summary statistics for the firms' financing activities and the risk measures. We also present correlations of firms' financing decisions with risk. We observe that firms' financial decisions substantially vary across both types of risk as well as across different extents of risk. The estimates of correlation provide preliminary evidence, supporting the interlinkage between firms' financing decisions and our risk measures.

4.5.1 Financing Activities across Different Levels of Risk

Table 4.2 reports the mean and standard deviations of firms' financing instruments across low and high levels of both idiosyncratic and macroeconomic risk for the whole sample period as well as the three sub-periods, viz. 1981-1990, 1991-2000, and 2001-2009. The low level of risk is measured as the risk at or below the 25^{th} percentile and high risk is defined as the risk at or above the 75^{th} percentile. We observe several notable differences both across low and high levels of risk and across different time periods. These differences provide significant evidence that firms during low and high periods of risk do not exhibit the same patterns of financing activities.

The mean of the ratio of change in total debt to the book value of total assets is 0.004 (0.011) and -0.001 (-0.030) for periods of low and high idiosyncratic (macroeconomic) uncertainty over the entire sample period, respectively. This suggests that firms are likely to reduce the use of debt, on average, in their capital structure in response to an increase in either type of risk. However, the amount of debt declined by firms in periods when macroeconomic risk is high, on average, is greater than the amount when idiosyncratic risk is high.

With respect to the financing decisions of firms, we observe that over the whole sample period, the mean value of the ratio of net equity issues to the book value of total assets is 0.004 for periods of high macroeconomic risk, which is considerably lower than the average of net equity issues for periods of low macroeconomic risk, which is 0.011. This difference can also be observed for all three sub-periods, suggesting that firms are likely to issue less net equity during more uncertain macroeconomic conditions. In contrast to the case of macroeconomic risk, net equity issues have a higher mean value for the entire firm-year observations when idiosyncratic risk is relatively high. While the figures for the 1980s and 1990s are in line with this evidence, it is evident from the estimates that firms issue less net equity, on average, over 2001-09 when they operate under high levels of business risk. These differences suggest that firms' decisions to issue or repurchase equity are likely to relate not only to the extent of risk but also to the source of risk. However, the issuance of net equity generally seems more volatile in periods of high risk as compared to low risk

Table 4.2: Summary Statistics of Financing Activities across High and Low Risk

Table 4.2 reports the mean and standard deviations (S.D) of the change in the debt ratio, the newly retained earnings, net debt issues, and equity issues over low and high levels of both idiosyncratic and macroeconomic risk. Low risk is measured at or below the 25^{th} percentile and high risk is measured at or above the 75^{th} percentile. The change in debt is the ratio of the change in the book value of total debt to the book value of total assets. Net equity issue is the ratio of change in book equity less the change in retained earnings to book value of total assets. Newly retained earnings are the ratio of the change in balance sheet retained earnings during an accounting year period to the book value of total assets. Net debt issues are defined as the change in total assets to total assets less the sum of net equity issues and newly retained earnings. Idiosyncratic risk is drawn from firms' sales. Macroeconomic risk is proxied by the conditional variance of UK real GDP over the period under investigation. The sample consists of all UK manufacturing firms listed on the London Stock Exchange at any point over the period 1981-2009. The data are drawn from the WorldScope file via DataStream.

Variables	**Idiosyncratic Risk**				**Macroeconomic Risk**			
	Low		**High**		**Low**		**High**	
	Mean	S.D	Mean	S.D	Mean	S.D	Mean	S.D
ΔDebt/Book Assets								
1981-90	0.008	0.071	0.021	0.149	0.005	0.067	0.010	0.096
1991-00	-0.003	0.122	-0.036	0.266	-0.008	0.195	-0.007	0.241
2001-09	0.007	0.197	-0.009	0.424	0.024	0.288	-0.047	0.241
1981-2009	0.004	0.162	-0.001	0.374	0.011	0.250	-0.030	0.211
Net Equity Issues								
1981-90	0.013	0.039	0.022	0.062	0.200	0.012	0.016	0.048
1991-00	0.004	0.040	0.015	0.080	0.011	0.052	0.006	0.023
2001-09	0.012	0.117	0.009	0.182	0.012	0.109	0.002	0.124
1981-2009	0.009	0.091	0.011	0.157	0.011	0.090	0.004	0.111
Newly Ret. Earnings								
1981-90	0.046	0.093	0.020	0.195	0.100	0.134	0.013	0.141
1991-00	0.028	0.142	0.045	0.272	0.012	0.162	0.010	0.117
2001-09	0.008	0.269	-0.029	0.471	-0.014	0.366	-0.021	0.332
1981-2009	0.019	0.219	-0.007	0.419	-0.003	0.300	-0.013	0.298
Net Debt Issues								
1981-90	0.062	0.139	0.120	0.232	0.201	0.112	0.045	0.165
1991-00	0.024	0.121	0.020	0.284	0.028	0.202	-0.006	0.135
2001-09	0.036	0.169	0.033	0.328	0.039	0.233	0.024	0.224
1981-2009	0.034	0.151	0.038	0.314	0.035	0.221	0.023	0.209

periods regardless of the source of risk.

The newly retained earnings of firms show a monotonic decreasing trend during low levels of idiosyncratic as well as macroeconomic risk. For periods of low idiosyncratic (macroeconomic) risk, the mean value of the newly retained earnings has decreased from 0.046 (0.100) in the 1980s to 0.028 (0.012) in the 1990s, and further to 0.008 (-0.014) over the period 2001-09. Comparing across the low and high levels of risk, one can see that, on average, the newly retained earnings of firms, on average, have decreased substantially and even become negative during periods of high risk. This fact is robust across all three sub-periods as well as across both idiosyncratic and macroeconomic risk. The standard deviations provide evidence that, although the newly retained earnings have higher variability in later rather than in earlier years, the intensity of fluctuations remains the same across low and high levels of risk.

The mean value of net debt issues provides evidence that firms facing higher risk issue significantly less new debt, on average, particulary in the 1990s and the period 2001-09. For the full sample period, the average of net debt issues is 0.035 in the period when macroeconomic risk is low, whereas, this figure is only 0.024 for the times of high macroeconomic risk. This observation implies that firms are likely to be more cautious about the cost of financial distress and bankruptcy in times of high levels of risk. The issuance of the new debt displays a higher variation during periods of high than of low idiosyncratic risk. Yet, such differences are not observed across low and high level of macroeconomic uncertainty. Table 4.3 presents summary statistics for the risk measures.

Table 4.3: Summary Statistics of the Risk Measures

The second and last columns of the table report the mean and standard deviations (S.D) for firm-specific and macroeconomic risk, respectively. The third, fourth, and fifth columns report the 10^{th}, 50^{th} and 90^{th} percentiles, respectively, for both types of risk. Idiosyncratic risk is drawn from sales of firms, while macroeconomic risk is proxied by the conditional variance of UK real GDP over the period 1975Q1-2009Q4.

Risk		Percentile			
	Mean	P10	P50	P90	S.D
Idiosyncratic Risk	0.309	0.075	0.213	0.594	0.418
Macroeconomic Risk	1.779	0.995	1.412	5.531	4.631

4.5.2 Correlation between Financing Decisions and Risk

Table 4.4 presents the correlations, along with their p-values, between both measures of risk and the financing instruments for the sub-periods, in addition to the complete set of firm-year observations. Specifically, we divide the full sample period 1981-2009 into three sub-periods. The first two sub-periods cover a 10-year period each (1981-1990 and 1991-2000), while the third one covers the period 2001-2009. This division allows us to examine the correlation patterns over time.

The sign, the magnitude, and the significance of the correlations vary substantially across the sample periods as well as across both measures of risk. For instance, the correlation between the ratio of the change in total debt to the book value of assets and idiosyncratic risk is negative and statistically significant for the periods of the 1990s and 2001-09, while it appears with the opposite sign and statistically insignificant in the 1980s. Similarly, the change in the debt ratio is negatively and significantly correlated with macroeconomic risk in the 1980s and 2001-09, whereas, in the 1990s, a positive but statistically insignificant correlation is observed. For the entire set of firm-year observations, while negative and significant correlations with the change in the debt to book assets ratio are found for both types of risk, the correlation is relatively more powerful for firm-specific risk.

Table 4.4: Correlation Estimates between Risk and Financing Instruments
Table 4.4 reports the estimates of the correlation between the measures of risk and the change in the debt ratio, net equity issues, the newly retained earnings, and net debt issues. The second and fourth columns of the table report the coefficient of correlation and the third and fifth columns report the p-value. The change in debt is the ratio of the change in the book value of total debt to the book value of total assets. Net equity issue is the ratio of the change in book equity less the change in retained earnings to the book value of total assets. Newly retained earning is the ratio of the change in balance sheet retained earnings during an accounting year period to the book value of total assets. Net debt issues are defined as the change in total assets to total assets less the sum of net equity issues and newly retained earnings. Idiosyncratic risk is drawn from firms' sales. Macroeconomic risk is proxied by the conditional variance of UK real GDP over the period under investigation. The sample consists of all UK manufacturing firms listed on the London Stock Exchange at any point over the period 1981-2009. The data are drawn from the WorldScope file via DataStream.

Variables	**Idiosyncratic Risk**		**Macroeconomic Risk**	
	Coefficient	p-value	Coefficient	p-value
Δ Debt/Book Assets				
1981-90	0.012	0.691	-0.010	0.039
1991-00	-0.087	0.000	0.020	0.195
2001-09	-0.029	0.011	-0.030	0.009
1981-2009	-0.034	0.000	-0.028	0.001
Net Equity Issues				
1981-90	0.104	0.008	-0.028	0.477
1991-00	0.067	0.000	-0.038	0.017
2001-09	0.025	0.033	-0.027	0.023
1981-2009	0.029	0.001	-0.026	0.005
Newly Ret. Earnings				
1981-90	-0.037	0.340	-0.218	0.000
1991-00	0.069	0.000	-0.019	0.227
2001-09	0.056	0.000	-0.032	0.005
1981-2009	0.046	0.000	-0.044	0.000
Net Debt Issues				
1981-90	-0.134	0.000	-0.202	0.000
1991-00	0.027	0.082	-0.036	0.025
2001-09	-0.031	0.008	-0.063	0.000
1981-2009	-0.032	0.000	-0.052	0.000

It is important to note that there are positive and significant correlations between net equity issues and idiosyncratic risk in each sub-period and for the overall sample period as well. In contrast, the issuance of new equity is negatively correlated with macroeconomic risk. This suggests that firms are likely to issue more net equity when either the macroeconomic conditions are relatively stable or when firms are uncertain about their potential internal cash flow stream. Positive and significant correlations between the newly retained earnings and idiosyncratic risk are found, suggesting that firms may prefer to utilize internal funds over external resources when they face higher idiosyncratic risk.

On the other hand, negative and significant correlations for the newly retained earnings of firms are observed for macroeconomic risk for the whole sample period and in each sub-period with the exception of the 1990s where the correlation estimate is statistically insignificant. Regarding net debt issuance, the correlation estimates provide evidence that firms are likely to issue less new debt when they go through periods of either high idiosyncratic risk or macroeconomic risk. However, we can observe that an increase in macroeconomic risk seems to have a more severe effect on the issuance of debt as compared to idiosyncratic risk, particularly during the last 9-years of the sample period.

While the unconditional correlations reveal some interesting facts, they cannot provide a complete picture of the dynamic association between risk and firms' financing activities. However, it is of great importance to examine the effects of risk in a dynamic framework when other firm-specific factors are also part of the empirical model. Therefore, we model the change in leverage and its components as a function of both measures of risk and several firm-specific factors as described in the following section.

4.6 Empirical Framework

In this section, we present our specifications for analyzing changes in the leverage ratio and for the composition of the change in the leverage ratio. This section also discusses the estimation methods.

4.6.1 How Does Risk Affect the Change in Leverage?

We start our empirical analysis by investigating how risk affects the change in the leverage ratio. To formulate our empirical model, we augment a standard model that examines the change in leverage by incorporating both idiosyncratic and macroeconomic risk. In our investigation, we also use a number of variables to control for firm-specific effects. Specifically, the model can be explained as follows:

$$\Delta Leverage_{i,t} = \beta_0 + Z_{i,t-1}\beta_1 + \beta_2 Risk^{idio}_{i,t-1} + \beta_3 Risk^{macro}_{t-1} + \upsilon_i + \varepsilon_{i,t} \qquad (4.4)$$

In equation (4.4) above, Leverage$_{i,t}$ is a measure of the book (market) leverage of firm i in year t and Δ denotes the difference operator. $Z_{i,t}$ is a vector of firm-specific variables that includes one-period lagged leverage, the market-to book value ratio, capital investment expenditures-to-total assets ratio, profitability, tangibility, the 2-year stock return, the non-debt tax shield, and the log value of firms' sales as a proxy for firm size. $Risk_{i,t}^{idio}$ is a measure of time-varying idiosyncratic risk and $Risk_t^{macro}$ is a measure of time-varying macroeconomic risk. υ_i captures the effects of time-invariant unobservable firm-specific factors. $\varepsilon_{i,t}$ represents the time-varying residuals.

4.6.2 Which Component of the Change in Leverage is more Sensitive to Risk?

After establishing the impact of risk on the aggregate change in the leverage ratio, we test how risk affects the components of the change in leverage. As in Baker and Wurgler (2002), Alti (2006), and Chen and Zhao (2007), we decompose the annual change in the leverage ratio into three components by suing the following accounting identity:

$$A_{i,t} = A_{i,t-1} + \Delta D_{i,t} + \Delta E_{i,t} + \Delta RE_{i,t} \tag{4.5}$$

where $A_{i,t}$ = total assets of firm i in year t, $D_{i,t}$ = total debt of firm i in year t, $E_{i,t}$ = total equity of firm i in year t, $RE_{i,t}$ = retained earnings of firm i in year t, and Δ denote the difference operator.

Multiplying both sides of equation (4.5) by $D_{i,t-1}$ and dividing by $A_{i,t}(A_{i,t-1})$ yield the following:

$$\frac{D_{i,t-1}(A_{i,t})}{A_{i,t}(A_{i,t-1})} = \frac{D_{i,t-1}(A_{i,t-1})}{A_{i,t}(A_{i,t-1})} + \frac{D_{i,t-1}(\Delta D_{i,t})}{A_{i,t}(A_{i,t-1})} + \frac{D_{i,t-1}(\Delta E_{i,t})}{A_{i,t}(A_{i,t-1})} + \frac{D_{i,t-1}(\Delta RE_{i,t})}{A_{i,t}(A_{i,t-1})} \tag{4.6}$$

By subtracting $\frac{D_{i,t}(A_{i,t-1})}{A_{i,t}(A_{i,t-1})}$ from both sides of equation (4.6) and multiplying both sides by -1 we obtain the following:

$$\begin{aligned}\frac{D_{i,t}(A_{i,t-1})}{A_{i,t}(A_{i,t-1})} - \frac{D_{i,t-1}(A_{i,t})}{A_{i,t}(A_{i,t-1})} = \frac{D_{i,t}(A_{i,t-1})}{A_{i,t}(A_{i,t-1})} - \frac{D_{i,t-1}(A_{i,t-1})}{A_{i,t}(A_{i,t-1})} - \frac{D_{i,t-1}(\Delta D_{i,t})}{A_{i,t}(A_{i,t-1})} - \frac{D_{i,t-1}(\Delta E_{i,t})}{A_{i,t}(A_{i,t-1})} \\ - \frac{D_{i,t-1}(\Delta RE_{i,t})}{A_{i,t}(A_{i,t-1})}\end{aligned} \tag{4.7}$$

By simplifying both the left-hand and the right-hand sides of equation (4.7) we get the following:

$$\begin{aligned}\frac{D_{i,t}}{A_{i,t}} - \frac{D_{i,t-1}}{A_{i,t-1}} = \left(1 - \frac{D_{i,t-1}}{A_{i,t-1}}\right)\left(\frac{\Delta D_{i,t}}{A_{i,t}}\right) + \left(-\frac{D_{i,t-1}}{A_{i,t-1}}\right)\left(\frac{\Delta E_{i,t}}{A_{i,t}}\right) \\ + \left(-\frac{D_{i,t-1}}{A_{i,t-1}}\right)\left(\frac{\Delta ER_{i,t}}{A_{i,t}}\right)\end{aligned} \tag{4.8}$$

Finally, we re-write the above equation as follows:

$$\Delta Leverage_{i,t} = \beta_1\left(\frac{\Delta D_{i,t}}{A_{i,t}}\right) + \beta_2\left(\frac{\Delta E_{i,t}}{A_{i,t}}\right) + \beta_3\left(\frac{\Delta ER_{i,t}}{A_{i,t}}\right) \tag{4.9}$$

where $\Delta Leverage_{i,t} = \frac{D_{i,t}}{A_{i,t}} - \frac{D_{i,t-1}}{A_{i,t-1}}$. $\beta_1 = (1 - \frac{D_{i,t-1}}{A_{i,t-1}})$, $\beta_2 = (-\frac{D_{i,t-1}}{A_{i,t-1}})$, and $\beta_3 = (-\frac{D_{i,t-1}}{A_{i,t-1}})$ are weights on net debt issuance $\frac{\Delta D_{i,t}}{A_{i,t}}$, net equity issuance $\frac{\Delta E_{i,t}}{A_{i,t}}$, and newly retained earnings $\frac{\Delta RE_{i,t}}{A_{i,t}}$, respectively.

Equation (4.9) describes how these three components of leverage contribute to the overall change in leverage ratio. In order to examine their relation to risk, we regress each of these components on both risk measures and the firm-specific variables. This approach enables us to identify whether risk affects the leverage ratio through new debt issues, new equity issues or if its effects come via the newly retained earnings of the firms. Specifically, we estimate the following model:

$$Y_{i,t} = \beta_0 + Z_{i,t-1}\beta_1 + \beta_2 Risk^{idio}_{i,t-1} + \beta_3 Risk^{macro}_{i,t-1} + \upsilon_i + \varepsilon_{i,t} \tag{4.10}$$

where the dependent variable, $Y_{i,t}$, is net debt issues, net equity issues, and the newly retained earnings for firm i in year t. The rest is similar to that in equation (4.4).

4.6.3 Risk and Firms' Choice between Debt and Equity

To better understand the role of risk in firms' financing decisions, it is important to know what the effects of risk on firms' choice of a debt-equity ratio are. In this section, we therefore examine the effects of firm-specific and macroeconomic risk on a firm's choice between debt and equity financing by estimating the regression of the debt-equity ratio of the following form:

$$DER_{i,t} = \beta_0 + Z_{i,t-1}\beta_1 + \beta_2 Risk^{idio}_{i,t-1} + \beta_3 Risk^{macro}_{t-1} + \upsilon_i + \varepsilon_{i,t} \tag{4.11}$$

The dependent variable, $DER_{i,t}$, in equation (4.11) is the debt-equity ratio of firm i in year t, which is defined as the ratio of the book value of total debt to the book value of total equity. $Z_{i,t}$ is a vector of firm-specific variables used in prior empirical studies of the choice between debt and equity financing. $Risk^{idio}_{i,t}$ is a measure of time-varying firm-specific risk. $Risk^{macro}_{t}$ is a measure of time-varying macroeconomic risk. The term υ_i captures the effects of time-invariant unobservable firm-specific factors such as reputation and capital intensity. The term $\varepsilon_{i,t}$ represents the time-varying residuals. The subscripts i and t denote firm and time period, respectively.

The coefficients of interest to us are β_2 and β_3, the effect of firm-specific and macroeconomic risk on firms' debt-equity ratio, respectively. We predict a negative relation between firm-specific risk and the choice of firms between issuing debt and issuing equity (i.e., $\frac{\partial DER_{i,t}}{\partial Risk^{idio}_{i,t-1}} = \beta_2 < 0$). We expect this because given that a firm with a low debt-equity is less likely to be bankrupt, the firm lowers its debt-equity ratio when firm-specific risk is high. We also expect that the effect of macroeconomic risk on firms' debt-equity ratio is negative (i.e., $\frac{\partial DER_{i,t}}{\partial Risk^{macro}_{t-1}} = \beta_3 < 0$). That is, all else equal, a higher level of macroeconomic risk leads firms to lower their debt-equity ratio. Firms may do this by paying off their existing debts because the higher the level of debt, the higher the likelihood of being exposed to aggregate risk.

4.6.4 Estimation Approach

Since in equation (4.4) υ_i is unobservable and it is likely to be correlated with our regressors in the model, the ordinary least square (OLS) estimates would yield biased results. Furthermore, the coefficient estimates would be inconsistent because of the correlation of the lagged value of the dependent variable with υ_i. Even though an instrumental variable (IV) approach would yield consistent coefficients in the absence of serial correlation, the coefficient estimates might be inefficient because of the partial use of available moment conditions by the IV estimator.

The GMM technique provides a good solution to the problem. It exploits all the linear moment conditions specified by the model. Another feature of the GMM estimators is that they are robust with respect to non-normality of the dependent variable (Blundell and Bond (1998)). Furthermore, the GMM estimator uses additional instruments in estimation which are obtained by utilizing the existing orthogonal conditions between $\Delta Leverage_{i,t-2}$ and $\varepsilon_{i,t}$. Antoniou, Guney, and Paudyal (2006) suggest that if the residuals ($\varepsilon_{i,t}$) are not serially correlated, it is very likely that the first-differenced residuals ($\Delta\varepsilon_{i,t}$) are orthogonal to the historical values of the dependent variable as well as the explanatory variables, so that the second and higher lags of the dependent and the explanatory variables can be used as valid instruments for $\Delta\varepsilon_{i,t}$.

Although the Arellano-Bond difference GMM estimator is superior to many other estimation methods, it suffers with a problem of weak instruments. To overcome this, Arellano and Bover (1995) suggest the use of the first-differenced instruments for equations in levels and instruments in levels for equations in first differences. However, Blundell and Bond (1998) point out that the augmented version of the Arellano-Bover GMM estimator, known as system-GMM, produces more efficient estimates as compared to the difference GMM estimator. In particular, system-GMM estimators yield more efficiency than the standard difference GMM estimator for the case where the coefficient of the one-period lagged dependent variable tends to be closer to unity[96] and when the ratio of the variance of the time-invariant unobservable firm-specific factors (υ_i) to the variance of the time-varying residuals ($\varepsilon_{i,t}$) has a tendency to increase over time. Furthermore, Blundell and Bond (1998) suggest that the finite sample bias would be mitigated by including lagged first-differenced and lagged levels instruments in the instrument set. Although the system-GMM technique effectively controls for individual heterogeneity, it retains variations among firms as this technique estimates the model both in levels and first differences

[96]This implies that the dependent variable is likely to follow either a unit root or near-unit root process.

and differenced lagged regressors are utilized as instruments for level equations.

Though the system-GMM estimator is ranked above many other estimators, there are some caveats associated with the system-GMM approach. For instance, in general, two-step system-GMM estimation yields more efficient estimates as compared to the one-step estimation. However, one cannot always be sure of the superiority of the two-step estimators over the one-step. Further, since there is no well-established process to choose the optimal instrument set, the blind use of instruments may lead to the problem of "many instruments". This problem would be even more severe if the sample size has a relatively short-horizon.

To cope with this problem, we use the J test of overidentifying restrictions to evaluate the validity of the instruments used in our estimation. However, the validity of instruments is only assured if the residuals do not exhibit second-order serial correlation. Although, it is likely that first-order serial correlation is present because the model has a dynamic context, it is essential to ensure that there is no second-order serial correlation in the residuals. This can be achieved by applying the test for autocorrelation. Specifically, we use the Arellano-Bond test for AR(2) to investigate the presence of serial correlation for each underlying model.

4.7 Empirical Findings

We begin our empirical analysis by estimating the effects of idiosyncratic risk and macroeconomic risk on changes in the leverage ratio. Once we establish the effects of these two types of risk on the change in leverage, we decompose the annual change in leverage into three components and investigate how each of these components of leverage relates to risk.

4.7.1 The Validity of the Instruments

The validity of the instruments used in system-GMM estimation is confirmed by the J test of overidentifying restrictions. We also apply the Arellano-Bond AR(2) test to examine the presence of second-order serial correlation in the residuals. The estimates from these diagnostic tests, the number of firms, and the firm-year observations in each model are reported in Panel B of each table presented below. The J statistics reveal that the instruments used for the system-GMM estimator are valid and satisfy the orthogonality conditions. The estimates of the serial correlation test provide strong evidence of the absence of second-order serial correlation in the residuals. This evidence confirms the validity of the instruments used in the estimation of each model and thus our system-GMM estimation results are efficient and consistent. For the purpose of brevity and readability, we do not comment further on these aspects when we discuss our empirical results below.

4.7.2 How Does the Change in Leverage Respond to Risk?

We regress both the change in book leverage and market leverage on idiosyncratic risk, macroeconomic risk, and firm-specific factors used in previous studies that study the determinants of the change in the leverage ratio. Further, following Hovakimian (2006) and Baker and Wurgler (2002), one-period lagged leverage is included in the set of explanatory variables to control for high-leverage and low-leverage effects. Since the leverage ratio is strictly confined between zero and one, a negative change in the leverage ratio is more likely to occur for high-leveraged firms, whereas, a positive change in the leverage ratio for low-leveraged firms is more likely to occur. Controlling for this effect by the inclusion of the lagged leverage in the regression, we may yield more explicit estimates of the effects of the other regressors.

Table 4.5 presents the results. Consider first the regression in which the dependent variable is the change in book leverage. Although our main emphasis is on the effects of risk, it is useful to briefly discuss how changes in the leverage ratio respond to the firm-specific variables employed in our models. We find that the change in leverage is significantly negatively associated with the market-to-book value, asset tangibility, and firms' stock returns. In contrast, the effects of investment expenditures, firm size, profitability and the non-debt tax shield on the change in leverage are significantly positive. These findings are generally similar to the findings reported in Brav (2009), Chang and Dasgupta (2009), Lemmon, Roberts, and Zender (2008), Chen and Zhao (2007), Alti (2006), Hovakimian (2006), and Baker and Wurgler (2002), who also investigate the change in the leverage ratio.

The negative effects of the market-to-book value and the firm's stock returns on the change in leverage are in line with the idea that firms generally have a tendency to decline their leverage ratio during the hot-periods of equity markets. The positive coefficient of firm size is in support of the view that larger firms are more likely to use debt in their capital structure as they face lower costs of bankruptcy, harvest more benefits of tax offsets per pound of total assets, and have easy access to borrowing markets (perhaps due to less asymmetric information problems). The positive response of the change in leverage to investment spending supports the prediction of the pecking order theory that increases in expenditures on investment may lead to increase financial deficit directly and thus, firms prefer debt over equity while borrowing from external resources to fund their financial deficits (See Shyam-Sunder and Myers (1999)).

The reduction in leverage in response to an increase in firms' tangibility indicates that firms that hold more tangible assets as a percentage of total assets are less reliant on debt financing. This is because firms with high tangibility are less likely to experience

Table 4.5: Robust Two-step System-GMM Estimates for the Determinants of Change in Leverage

Table 4.5 reports the robust two-step system-GMM estimation results of the impact of risk on the change in leverage for the following model:

$$\Delta Leverage_{i,t} = \beta_0 + Z_{i,t-1}\beta_1 + \beta_2 Risk^{idio}_{i,t-1} + \beta_3 Risk^{macro}_{t-1} + \upsilon_i + \varepsilon_{i,t}$$

where Leverage$_{i,t}$ is the book (market) leverage of firm i in year t and Δ denotes the difference operator. $Z_{i,t}$ is a vector of firm-specific variables. $Risk^{idio}_{i,t}$ is a measure of time-varying firm-specific risk. $Risk^{macro}_{t}$ is a measure of time-varying macroeconomic risk. The term υ_i captures the effects of time-invariant unobservable firm-specific factors such as reputation and capital intensity. The term $\varepsilon_{i,t}$ represents the time-varying residuals. The subscripts i and t denote firm and time period, respectively. Book leverage is the ratio of the book value of total debt to the book value of total assets. Market leverage is defined as the book value of total debt divided by the sum of the book value of debt and the market value of equity. The market-to-book value ratio is defined as the book value of total assets less the book value of equity plus the market value of equity divided by the book value of total assets. Investment is the ratio of total expenditures to purchase fixed tangible assets to the total book assets. Profitability is the ratio of earnings before interest, taxes, and depreciation to total assets. Tangibility is the ratio of net plant, property, and equipment to total assets. 2-year stock return is the difference between share prices at time t and share prices at time $t-2$. Firm size is defined as the logarithm of net sales. The non-debt tax shield is defined as total depreciation expense divided by total assets. One-period lagged leverage is included in the regression to control for persistent effects (not reported). Idiosyncratic risk is drawn from firms' sales. Macroeconomic risk is proxied by the conditional variance of UK real GDP over the period under investigation. The sample consists of all UK manufacturing firms listed on the London Stock Exchange at any point over the period 1981-2009. The data are drawn from the WorldScope file via DataStream. Panel B reports the number of firms, the firm-year observations, the J statistics, which is a test of the overidentifying restrictions, the Arellano-Bond test, AR(2), for second-order autocorrelation in the first-differenced residuals, and firm-year observation. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

Panel A: Estimation results				
Regressors	**ΔBook Leverage**		**ΔMarket Leverage**	
	Coeff.	Std. Error	Coeff.	Std. Error
Market-to-Book$_{i,t-1}$	-0.012	(0.005)**	-0.034	(0.012)***
Investment$_{i,t-1}$	0.230	(0.110)**	1.269	(0.329)***
Profitability$_{i,t-1}$	0.439	(0.118)***	0.217	(0.099)**
Tangibility$_{i,t-1}$	-0.299	(0.091)***	-0.427	(0.089)***
Firm Size$_{i,t-1}$	0.016	(0.007)**	0.019	(0.007)**
2-year Stock Return$_{i,t-1}$	-0.104	(0.013)***	-0.089	(0.015)***
Non-debt Tax Shield$_{i,t-1}$	0.983	(0.281)***	0.207	(0.091)**
Risk$^{idio}_{i,t-1}$	-0.095	(0.024)***	-0.453	(0.143)***
Risk$^{macro}_{t-1}$	-0.010	(0.001)***	-0.007	(0.003)**
Constant	-0.079	(0.065)	0.251	(0.153)
Panel B: Diagnostic tests				
Firm-years	10,208		10,943	
Firm	989		944	
AR(2)	-0.810		-1.480	
p-value	0.419		0.139	
J-statistic	70.140		54.610	
p-value	0.198		0.188	

information asymmetric conflicts with outside lenders and thus, the cost of equity issues is less for them (Myers and Majluf (1984)). Hence, firms having a higher proportion of tangible assets to total assets are more likely to issue equity when they finance their needs, which results in a reduction in their leverage ratio. The positive relationship between firms' performance (profitability) and changes in leverage is consistent with the idea that profitable firms have more ability to negotiate borrowing at favorable terms and thus, they borrow more. Further, banks do not hesitate to rollover the loans of profitable firms as they consider lending to them is relatively secure.

Our estimates relating to the effects of risk provide strong evidence that both idiosyncratic and macroeconomic risk are significant in explaining the change in leverage. These findings hold for both book and market leverage. Specifically, we observe that idiosyncratic risk enters the model with a negative and significant coefficient, implying that firms are less engaged in changing their leverage ratios when they go through periods of heightened firm-level risk. This observation implies that risk increases the probability of bankruptcy and thus, risky firms are less inclined to have debt financing. Another rationale for the negative sensitivity of the leverage ratio to idiosyncratic risk is that since the greater variability of firms' sales limits their ability to meet their obligations, banks and other financial institutions may be reluctant to lend to those firms who are not certain about their potential future cash flow stream.

Macroeconomic risk also enters into the model with a negative and significant coefficient for both book and market leverage, which gives evidence of the pro-cyclical behavior of leverage. This implies that the greater variability of macroeconomic conditions leads to firms making less use of debt borrowing in their capital structure. This is consistent with the fact that firm managers would be more cautious about the costs of financial distress during periods of high macroeconomic volatility as high debt further exposes firms to macroeconomic (aggregate) risk. Thus, they are likely to reduce their outstanding stock of debt.

An alternative rationale for this finding is that during uncertain states of the economy, firms are likely to share at least some of the macro-level risk with outside lenders. Hence, they may finance their capital needs and investment opportunities through equity financing rather than debt financing and reduce their leverage ratio (Gertler and Hubbard (1993) and Hackbarth, Miao, and Morellec (2006)). Bhamra, Kuehn, and Strebulaev (2010) explain the negative relationship between macroeconomic risk and firms' leverage through state-dependent optimal coupon payments. In particular, they argue that firms are likely to choose lower optimal coupons in times of high macroeconomic risk in order to increase their financial flexibility. This renders firms to be conservative in their use of debt financing in a bad state of the economy, which leads leverage to be pro-cyclical.

In sum, the results in Table 4.5 provide strong evidence that both idiosyncratic risk and macroeconomic risk are significantly and negatively associated with adjustments in leverage. These results hold for both the book and market value debt ratios. However, these results are too general and do not enable us to draw inferences on whether the reduction in firms' leverage in response to an increase in risk is the result of a decline in debt borrowing, a rise in equity financing, or/and the use of more internally generated funds (retained earnings). Yet, an understanding of the response of these financial instruments to both idiosyncratic risk and macroeconomic volatility is important for understanding how firms choose their capital structure in periods of risk, as these financing instruments have quite different implications for firms' capital structure.

Therefore, we decompose the annual change in the leverage ratio into three components and run each of the components separately on both measures of risk and a set of firm-specific factors. This exercise allows us to comment on how changes in firm-specific or macroeconomic risk affect the choice of financing mix made by firms as we can examine whether this impact of risk differs across the available financing instruments. The analysis also helps us to ascertain whether different types of risk affect each financing instrument differently.

4.7.3 How Do the Components of the Change in Leverage Respond to Risk?

Here, our main focus is to quantify the effects of idiosyncratic risk and macroeconomic risk on the choice of financing mix. We include several other variables into our models to control for firm-specific factors of firms' financing decisions. These firm-specific variables include the market-to-book value, the investment expenditures of firms, firm size, the profitability of firms, asset tangibility, the non-debt tax shield, and the 2-year stock return, which are commonly used in the literature that explores the firm-specific determinants of the components of the change in firm's leverage.[97]

Table 4.6 reports the results obtained from all three models. We observe that firm-specific variables affect the components of the change in leverage quite differently. Regarding risk, the estimates show that the effects of idiosyncratic risk substantially differ across the components. Yet, the impacts of macroeconomic risk are same for all three components of the change in leverage. Prior to discussing the impact of risk in detail, it is interesting to discuss the differential effects of firm-specific variables.

The market-to-book value ratio enters with a positive sign in all three regressions given in the table, namely the regression of net equity issues, the regression of newly retained earnings, and the regression of net debt issues. The positive impact on equity issues is consistent with the view that firm managers use equity financing when their shares

[97] See, for example, among others, Baker and Wurgler (2002), Alti (2006), and Chen and Zhao (2007).

Table 4.6: Robust Two-step System-GMM Estimates for the Components of the Change in Leverage

Table 4.6 reports the robust two-step system-GMM estimation results of the impact of risk on the components of the change in leverage for the following model:

$$Y_{i,t} = \beta_0 + Z_{i,t-1}\beta_1 + \beta_2 Risk^{idio}_{i,t-1} + \beta_3 Risk^{macro}_{t-1} + \upsilon_i + \varepsilon_{i,t}$$

where $Y_{i,t}$ is net debt issues, net equity issues, and the newly retained earnings for firm i in year t. $Z_{i,t}$ is a vector of firm-specific variables. $Risk^{idio}_{i,t}$ is a measure of time-varying firm-specific risk. $Risk^{macro}_{t}$ is a measure of time-varying macroeconomic risk. The term υ_i captures the effects of time-invariant unobservable firm-specific factors such as reputation and capital intensity. The term $\varepsilon_{i,t}$ represents the time-varying residuals. The subscripts i and t denote firm and time period, respectively. Net equity issues are defined as the ratio of change in book equity minus the change in retained earnings to total assets. Newly retained earnings are the change in balance sheet retained earnings during an accounting year period divided by the book value of total assets. Net debt issues are then defined as the change in total assets to total assets less the sum of net equity issues and newly retained earnings. The market-to-book value ratio is defined as the book value of total assets less the book value of equity plus the market value of equity divided by the total book assets. Investment is the ratio of total expenditures to purchase fixed tangible assets to the total book assets. Profitability is the ratio of earnings before interest, taxes, and depreciation to total assets. Tangibility is the ratio of net plant, property, and equipment to total assets. The 2-year stock return is the difference between share prices at time t and share prices at time $t-2$. Firm size is defined as the logarithm of net sales deflated by the GDP deflator. The non-debt tax shield is defined as total depreciation expense divided by total assets. One-period lagged leverage is included in the regression to control for persistent effects (not reported). Firm-specific risk is drawn from firms' sales. Macroeconomic risk is proxied by the conditional variance of UK real GDP over the period under investigation. The sample consists of all UK manufacturing firms listed on the London Stock Exchange at any point over the period 1981-2009. The data are drawn from the WorldScope file via DataStream. Panel B reports the number of firms, the firm-year observations, the J statistics, which is a test of the overidentifying restrictions, the Arellano-Bond test, AR(2), for second-order autocorrelation in the first-differenced residuals, and firm-year observations. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

Panel A: Estimation results

Regressors	Net Equity Issues		ΔRet. Earnings		Net Debt Issues	
	Coeff.	Std.Error	Coeff.	Std.Error	Coeff.	Std.Error
Market-to-Book$_{i,t-1}$	0.005	(0.001)***	0.033	(0.007)***	0.086	(0.004)***
Investment$_{i,t-1}$	-0.029	(0.065)	-0.066	(0.148)	0.369	(0.147)***
Profitability$_{i,t-1}$	-0.079	(0.026)***	0.342	(0.122)***	0.431	(0.109)***
Tangibility$_{i,t-1}$	0.038	(0.022)*	0.336	(0.085)***	-0.336	(0.090)***
Firm Size$_{i,t-1}$	-0.003	(0.001)***	0.019	(0.008)**	0.013	(0.006)**
2-year Stock Return$_{i,t-1}$	0.009	(0.003)***	0.035	(0.013)***	-0.079	(0.012)***
Non-debt Tax Shield$_{i,t-1}$	-0.094	(0.158)	-0.808	(0.274)***	0.516	(0.235)**
Risk$^{idio}_{i,t-1}$	0.015	(0.007)**	0.084	(0.029)***	-0.110	(0.027)***
Risk$^{macro}_{t-1}$	-0.002	(0.001)***	-0.004	(0.002)**	-0.026	(0.004)***
Constant	0.037	(0.017)**	-0.167	(0.082)**	-0.073	(0.066)

Panel B: Diagnostic tests

	Net Equity Issues	ΔRet. Earnings	Net Debt Issues
Firm-years	8282	10322	9340
Firm	902	988	952
AR(2)	1.290	-1.420	-1.300
p-value	0.196	0.154	0.192
J-statistic	84.090	90.000	80.510
p-value	0.385	0.256	0.183

are overvalued. This observation is also in line with the findings of Baker and Wurgler (2002), Alti (2006), Hovakimian (2006), and Chen and Zhao (2007), who show that the issuance of equity is significantly related to higher market-to-book value ratios. The positive association of the market-to-book value ratio with firms' newly retained earnings suggests that firms with high market-to-book values tend to rely on their internal funds to finance their investment and other needs. This finding is inconsistent with the results of Baker and Wurgler (2002), who report a positive but relatively weaker association between the market-to-book value of the company and its newly retained earnings.

The results from the regression of net debt issues show that the effect of the market-to-book value ratio on the issuance of new debt is positive and significant. This suggests that high-growth firms are more likely to issue debt to finance their capital needs. Growing firms may not have enough internal resources to finance all their positive net present value (NPV) investments and may require external borrowing. According to the pecking order theory, firms prefer, first, to issue debt and then turn into equity issuance when external financing is required. In this context, firms' debt borrowing increases with their growth (see, for example, Jensen (1986), Myers (1984), and Myers and Majluf (1984)). Further, the positive effect of the market-to-book value ratio on the issuance of debt is consistent with the findings of Baker and Wurgler (2002) and Alti (2006) that indicate that the market-to-book value ratio affects debt issues positively. Overall, the estimates relating to the effects of the market-book value ratio on firms' choice of financing instruments support the view that firms are likely to increase their use of external financing when their market value is higher relative to their book value.

Firms' capital expenditures are negatively associated with both net equity issues and newly retained earnings. However, capital expenditures are positively associated with the issuance of debt. That is firms that carry out investment expenditures are more likely to issue debt and repurchase equity. This is consistent with the view of Shyam-Sunder and Myers (1999), who argue that the investment expenditures of a firm directly cause a deficit in the firm's cash balances and the firm prefers debt over equity to finance its deficit.

Looking at the coefficient associated with firms' profitability in all three regressions together, we find that more profitable firms are more likely to repurchase equity and issue debt. The positive effect of firms' profitability on debt issues is in line with the prediction of the free cash flow theory. Firms with high profitability are likely to face more agency costs. Thus, profitable firms use debt as a device to mitigate the problem of management-shareholder conflict regarding firm managers' own interests as debt adding bankruptcy risk ensures that firm managers select the most efficient investment projects and do not pursue their personal goals (Jensen (1986)). It is interesting to note that firm profitability has a significant and positive effect on the use of internally generated funds (retained earnings). The positive sensitivity of newly retained earnings to firms' profitability is in line with what is argued by Myers (1984) and Myers and Majluf (1984) that firms prefer the use of internal funds over external financing to mitigate the problem of information asymmetry. Further, this finding is consistent with the findings of Baker and Wurgler (2002) and Alti (2006) which indicate that there is a positive relationship between firms' profitability and the use of internal funds.

Consistent with the findings of Baker and Wurgler (2002), Hovakimian (2006), and Alti (2006), we find that the large firms have a greater tendency to issue less equity as a percentage of the book value of their total assets. Further, the estimates show that the effect of firm size on the issuance of debt is positive and significant, suggesting that larger firms do more debt financing. The positive impact of firm size on the issuance of new debt is in accordance with the prediction of the trade-off theory of capital structure. In particular, the trade-off theory predicts that larger firms are more diversified and likely to have a low probability of default and thus, they are more inclined to issue debt. Finally, there is statistically significant evidence that large firms use more internally generated funds to finance their capital requirements. Given these findings, it turns out that the net effects of firm size on changes in leverage mainly come through debt financing.

The estimates of the coefficient of the non-debt tax shield show that firms with more depreciation expense tend to decrease the use of internally generated funds but increase debt financing. Finally, the results relating to the firm-specific determinants of firms' choices for the financing mix indicate that returns on firms' shares play an important role in explaining the change in leverage. Firms having increasing trends in their share prices issue more equity and less net debt. These findings are consistent with the evidence in Hovakimian, Opler, and Titman (2001) that firm managers prefer to repurchase their equity when share prices are low and issue new equity when share prices are high. In addition, these results are in line with Chen and Zhao (2007), who also report a positive association between share prices and equity issuance. Our results relating to the relationship of firm-specific variables with the components of leverage are generally consistent with the theoretical predictions and prior empirical findings.

Turning to the effects of idiosyncratic risk across different components of the change in leverage, we observe the following patterns. The decision to issue net debt is negatively and significantly associated with idiosyncratic risk, which accords with our predictions. This implies that firms experiencing higher levels of idiosyncratic risk are more likely to reduce the level of debt in their capital structure. The reduction of debt financing in response to an increase in risk is indeed another indicator of the negative association of target leverage with idiosyncratic risk.

In contrast to net debt issues, there is a positive and statistically significant impact of firm-specific risk on both newly retained earnings and the issuance of net equity. This indicates that risky firms are prone to reduce the use of debt in their capital structure, whereas, they are more likely to add internally generated funds (retained earnings) to their capital stock. In addition, firms with high variability in their business activities are inclined to opt for equity financing while they finance their needs from external resources. These findings suggest that the negative effects of idiosyncratic risk on changes in the leverage ratio arise not only because of a reduction in the existing level of debt but also due to a rise in net equity financing and newly retained earnings. These findings provide further insight to understand the negative relationship between firm-level risk and firms' target level of leverage.

The effects of idiosyncratic risk on leverage components can be rationalized as follows. The reduction of debt in response to an increase in idiosyncratic risk is consistent with the tax shelter-bankruptcy (TS-BC) hypothesis that a rise in the extent of firm risk tends to decrease the level of firm debt. Another reason why firms are likely to reduce their outstanding debt when they face more idiosyncratic risk is that banks are generally reluctant to rollover the loans of the firms who are uncertain about their expected cash flow streams.

The positive relationship between equity issues and idiosyncratic risk can be explained as follows. Since unpredictable variations in sales and earnings restrict firms' ability to meet the fixed charges of debt borrowing, risky firms issuing equity may tend to avoid fixed interest payments on debt and thus, they can limit their indebtedness. In addition, given a highly uncertain business environment, firms may find that equity issues are an appropriate way to maintain their flexibility and preserve their capacity of debt financing for the future.[98] Finally, an increase in newly retained earnings during times of high idiosyncratic risk is in line with the view that since risk increases the likelihood of bankruptcy, risky firms have a strong tendency to rely on their internal resources and reduce the use of external financing, particularly debt financing, to limit the chance of being bankrupt.

In contrast to idiosyncratic risk effects, we observe that macroeconomic risk attains a significant and negative coefficient for all three components of the change in leverage, changes in debt, retained earnings, and equity. Yet, the effects of macroeconomic risk appear more prominent for changes in debt financing than for changes in retained earnings or equity financing. This negative sensitivity of both equity and debt issues indicates that during times of high macroeconomic risk, firms significantly decrease their external

[98] The positive effect of firm-specific risk on equity issues is consistent with the findings of Marsh (1982). In particular, using data on equity and debt issues by UK firms over the period 1959-1970, Marsh (1982) shows that firms are more likely to make equity issues rather than debt in periods when firm-specific risk is high.

financing. In addition, this reflects the fact that the negative impact of macroeconomic risk on the change in leverage appears to be largely owing to significant reductions in a firm's outstanding debt rather than a rise in new equity financing or newly retained earnings.

The negative impact of macroeconomic risk on debt issues is consistent with the following arguments. Since variations in macroeconomic conditions increase firm-level risk and make the expected flow stream of firms more uncertain, macroeconomic risk reduces the tax shield benefits related with the use of debt. The loss of debt-related tax benefits lessens the wealth of the firms' equityholders. As a result, the firms reduce the use of debt in their capital structure as debt tends to make them more exposed to macroeconomic risk.

The coefficient of macroeconomic risk in the regression of newly retained earnings has the expected sign and is highly statistically significant. This implies that during periods of macroeconomic turmoil firms become more cautious about the cost of financial distress and they reduce the use of retained earnings in financing their capital needs. This is because macroeconomic risk makes firms unsure about their potential cash flows and hence, they prefer to hold cash rather than investing it as firms consider cash holdings as a safeguard against any financial hinderance.

The negative association between macroeconomic risk and the use of internally generated funds (retained earnings) as well as external financing sources (equity and debt financing) suggests that during periods of high macroeconomic risk, firms are likely to cutback their investment expenditures. Because, a rise in the extent of risk, regardless of whether the economy is prospering or slumping, leads to a decline in the real payoff from an investment project by increasing the discount rate at which firms discount their future cash flows. Thus, the low net present value of a project induces firms to be reluctant about making investments.

To summarize the results in Tables 4.5 and 4.6 , first, both idiosyncratic risk and variations in macroeconomic conditions have negative and significant impacts on the annual change in firms' target leverage, suggesting that the adjustment in leverage is significantly related to both types of risk. These results hold for both the book and market leverage. Further, these findings are robust to controlling conventional capital structure determinants (the market-to-book value, investment expenditures, profitability, tangibility, stock returns, firm size, and non-debt tax shields).

Second, as expected, we find significant evidence of the differential effects of idiosyncratic risk across different components of the change in leverage. Yet, we do not observe such differences for the effects of macroeconomic risk on the composition of the change in leverage. We also find that the effects of firm-specific variables are statistically significant and asymmetric across all three components of the change in leverage.

4.7.4 How Does Risk Affect Firms' Debt-Equity Ratio?

The results presented so far show decisively that risk about firms' own business activity and macroeconomic conditions affects the change in leverage negatively and that the components of the change in leverage, namely net debt issues, new equity issues, and the change in retained earnings, are affected by risk quite differently. However, it is also of significance to examine the role of risk in determining firms' references for equity finance and debt borrowing. Examining the effect of risk on the choice between debt and equity would enhance our understanding of how firms choose their optimal financial structure when they experience high risks in their operations. We therefore estimate the regression of the debt-equity choice depicted in equation (4.11) to explore how firm-specific and macroeconomic risk influence firms' debt-equity ratio. In particular, we are interested in this section to examine whether firms tend to reduce the debt-equity ratio when they face higher risk in their own business activity or when they go through periods of high macroeconomic risk.

Given that firms with a higher level of debt are more likely to experience bankruptcy, firms are most likely to reduce their use of debt in high-risk periods. We would thus expect firms' debt-equity ratio to be negatively associated with risk. While estimating the effects of risk on a firm's debt-equity ratio we control for several firm-specific variables.[99] The choice of these variables is based on the prior cross-section studies of capital structure that examine the determinants of the firms' choice of financing instruments (see, for example, Hovakimian, Opler, and Titman (2001), Hovakimian (2006), and Huang and Ritter (2009)).

Table 4.7 shows results for the regression of firms' debt-equity ratio. The estimates on firms-specific variables reveal that while investment expenditures, firms' profitability, firm size, and non-debt tax shields are positively related to a firm's debt-equity ratio, the market-to-book value ratio, asset tangibility, and stock returns are negatively related to the firm's choice of a debt-equity ratio. The effects of these firm-specific variables are significant statistically and generally consistent with those reported in Hovakimian, Opler, and Titman (2001), Hovakimian (2006), Brav (2009), and Huang and Ritter (2009). In particular, the results show that firms with high market-to-book ratios tend to decrease their debt-equity ratio, which is consistent with the notion that the stocks of growing firms are generally overvalued and thereby they tend to finance their capital needs by issuing equity rather than issuing debt, reducing their debt-equity ratio. The negative effect of

[99] Since we here are not interested in testing the target adjustment hypothesis we do not control for deviations from the target ratio. Rather, one-period lagged debt-equity ratio is included in the regression to control for persistent effects.

asset tangibility on firms' debt-equity ratio is consistent with the prediction of pecking order theory that since firms with more tangible assets are likely to face less asymmetric information problems, they issue more equity. The negative coefficient estimate for 2-year stock returns confirms previous findings that firms with high stock returns have a larger tendency to issue equity and thus, they lower their debt-equity ratios (see, for example, Hovakimian (2006) and Huang and Ritter (2009)).

The results in Table 4.7 also reveal that profitable firms are most likely to increase their debt-equity ratio. This findings confirms the Jenson's (1986) prediction: high-growth firms are most likely to incur free cash-flow related agency costs and they thus increase their use of debt financing, considering debt as a device to reduce these costs. The positive effect of profitability on firms' debt-equity ratio is consistent with the findings of Huang and Ritter (2009), who find that more profitable firms are more likely to issue debt rather than equity. However, it is in contrast to the findings of Hovakimian (2006), who finds a positive but statistically insignificant effect of profitability on firms' choice of debt versus equity issuance.

The results also suggest that a firm's investment expenditures are positively related to firms' debt-equity ratio, conforming the findings of Shyam-Sunder and Myers (1999) that firms that do more investment expenditures tend to issue debt and repurchase equity. We find that, consistent with the findings of Hovakimian (2006), large firms appear to prefer debt borrowing over equity finance when making decisions to finance their financing needs from external resources. The same is true for firms which have high non-debt tax shields. That is, non-debt tax shields affect the choice of firms between debt and equity positively.

Turning to our central interest, risk effects on firms' debt-equity choice, we observe the following results. The effect of firm-specific risk is significant and negative, suggesting that firms are likely to have low debt-equity ratios when firm-specific risk is high. The same holds true for macroeconomic risk, evidence that firms lower their debt-equity ratios when they go through periods of high macroeconomic risk.

The negative effect of firm-specific risk on firms' debt equity choice is consistent with the idea that since banks and other lending institutions charging higher risk premiums to risky firms make debt financing costly and, since debt increases the likelihood of bankruptcy, firms are most likely to issue equity and retire their outstanding debt during a periods of heightened firm-specific risk.[100] This finding also confirms our earlier findings reported in Table 4.6 that indicate that while the issuance of equity is positively related to firm-specific risk, the issuance of debt is negatively affected by heightened firm-specific risk. In other words, increased uncertainty about firms' own business activity is most

[100] Taub (1975) also presents evidence of a negative relationship between the uncertainty of firms' earnings and firms' debt-equity ratio for US firms.

Table 4.7: Robust Two-step System-GMM Estimates for the Debt-Equity Ratio

Table 4.7 reports the robust two-step system-GMM estimation results of the impact of risk on the debt-equity ratio for the following model:

$$DER_{i,t} = \beta_0 + Z_{i,t-1}\beta_1 + \beta_2 Risk^{idio}_{i,t-1} + \beta_3 Risk^{macro}_{t-1} + \upsilon_i + \varepsilon_{i,t}$$

where $DER_{i,t}$ is the ratio of the book value of total debt (short + long term debt) to the book value of total equity for firm i in year t. $Z_{i,t}$ is a vector of firm-specific variables. $Risk^{idio}_{i,t}$ is a measure of time-varying firm-specific risk. $Risk^{macro}_{t}$ is a measure of time-varying macroeconomic risk. The term υ_i captures the effects of time-invariant unobservable firm-specific factors such as reputation and capital intensity. The term $\varepsilon_{i,t}$ represents the time-varying residuals. The subscripts i and t denote firm and time period, respectively. The market-to-book value ratio is defined as the book value of total assets less the book value of equity plus the market value of equity divided by the total book assets. Investment is the ratio of total expenditures to purchase fixed tangible assets to the total book assets. Profitability is the ratio of earnings before interest, taxes, and depreciation to total assets. Tangibility is the ratio of net plant, property, and equipment to total assets. The 2-year stock return is the difference between share prices at time t and share prices at time $t-2$. Firm size is defined as the logarithm of net sales deflated by the GDP deflator. The non-debt tax shield is defined as total depreciation expense divided by total assets. One-period lagged debt-equity ratio is included in the regression to control for persistent effects (not reported). Firm-specific risk is drawn from firms' sales. Macroeconomic risk is proxied by the conditional variance of UK real GDP over the period under investigation. The sample consists of all UK manufacturing firms listed on the London Stock Exchange at any point over the period 1981-2009. The data are drawn from the WorldScope file via DataStream. Panel B reports the number of firms, the firm-year observations, the J statistics, which is a test of the overidentifying restrictions, the Arellano-Bond test, AR(2), for second-order autocorrelation in the first-differenced residuals, and firm-year observations. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

	Panel A: Estimation results	
Regressors	Coefficient	Std. Error
Market-to-Book$_{i,t-1}$	-0.026	(0.010)**
Investment$_{i,t-1}$	0.220	(0.103)**
Profitability$_{i,t-1}$	0.429	(0.089)***
Tangibility$_{i,t-1}$	-0.180	(0.081)**
Firm Size$_{i,t-1}$	0.004	(0.002)**
2-year Stock Return$_{i,t-1}$	-0.069	(0.025)***
Non-debt Tax Shields$_{i,t-1}$	0.774	(0.365)**
Risk$^{idio}_{i,t-1}$	-0.059	(0.024)**
Risk$^{macro}_{t-1}$	-0.007	(0.002)***
Constant	0.514	(0.043)
	Panel B: Diagnostic tests	
Firm-years	9,343	
Firm	945	
AR(2)	-1.640	
p-value	0.130	
J-statistic	58.950	
p-value	0.207	

likely to make firms shun debt borrowing, and rely instead on new equity financing.

The negative relationship between macroeconomic risk and the debt-equity ratio of firms is in line with the idea that high levels of debt make firms more exposed to macroeconomic risk, firms are likely to reduce their outstanding debts when macroeconomic conditions worsens. This findings is also consistent with the findings of Hatzinikolaou, Katsimbris, and Noulas (2002), who show that firms that listed in the Dow Jones Industrial Index tend to have lower debt-equity ratio in periods when inflation uncertainty is high. The finding that macroeconomic risk affects the firm's debt-equity ratio negatively, in combination with those reported in Table 4.6, suggests that although firms reduce their use of both debt and equity financing when macroeconomic risk is high, they do a reduction in debt issues by a larger amount than equity issues. Thus, they lower their debt-equity ratio.

4.7.5 Do Data Provide Support for the Effects of Risk on Financing Decisions?

Given the evidence presented in the chapter so far, we conclude that the capital structure decisions of firms are significantly affected by both firm-specific and macroeconomic risk. In this section, we present the frequency distribution of firm-year observations related to firms' financing decisions across low and high levels of risk. The objective of this simple exercise is to examine whether the data provide support to the regression results regarding the effects of firm-specific and macroeconomic risk on corporate financial structure. Alternatively, this attempt may be observed as a robustness check of the effects of risk. The figures reported in Table 4.8 are in percentages of the firm-year observations where firms take the particular decision in times of both lower and higher risk. We consider a firm as increasing (decreasing) security issuance if the change in the security is positive (negative) during an accounting year period. We define the high and low level of risk based on the mean value of underlying risk series. In Particular, low risk is measured below the 50^{th} percentile, while high risk is measured above the 50^{th} percentile.

The figures presented in the table reveal that the data strongly support the evidence on the effects of risk on firms' financing decisions. Comparing the firm-year observations where firms issue debt across both low and high levels of risk, one can observe a larger propensity of firms to increase debt issuance in times of low risk than in times of high risk. This observation holds for both types of risk. For instance, while around 62% (60%) of the time firms issue debt in periods when firm-specific (macroeconomic) risk is low, firms issue debt only 38% (40%) of the time when the risk is relatively higher. In contrast, the number of firm-year observations where firms do a reduction in debt issuance are more in periods of high risk than in periods of low risk, irrespective of the type of risk.

Table 4.8: Distribution of Financing Decisions across Low and High Risk
Table 4.8 reports the distributions of the financing decisions of firms about external financing across low and high levels of risk. Low risk is measured below the 50^{th} percentile and high risk is measured above the 50^{th} percentile. The figures are in percentages of the firm-year observations where firms increase (decrease) the issuance of the particular financial security during both low and high risk. Net equity issues are defined as the ratio of change in book equity minus the change in retained earnings to total assets. Newly retained earnings are the change in balance sheet retained earnings during an accounting year period divided by the book value of total assets. Net debt issues are then defined as the change in total assets to total assets less the sum of net equity issues and newly retained earnings. For a given firm-year, we consider a firm as increasing (decreasing) security if the change is positive (negative). Firm-specific risk is drawn from firms' sales. Macroeconomic risk is proxied by the conditional variance of UK real GDP over the period under investigation. The sample consists of all UK manufacturing firms listed on the London Stock Exchange at any point over the period 1981-2009. The data are drawn from the WorldScope file via DataStream.

Panel A: Firm-Specific Risk				
	Increase		**Decrease**	
	Low Risk	**High Risk**	**Low Risk**	**High Risk**
Debt Issues	62	38	45	55
Equity Issues	33	67	58	42
Newly R. Earnings	51	49	48	52
Panel B: Macroeconomic Risk				
	Increase		**Decrease**	
	Low Risk	**High Risk**	**Low Risk**	**High Risk**
Debt Issues	60	40	43	57
Equity Issues	61	39	45	55
Newly R. Earnings	60	40	47	53

Specifically, around 57% (55%) of the time firms reduce their outstanding debts in periods when macroeconomic (firm-specific) risk is high, whereas, they do so only about 43% (45%) of the time when the risk is high. These figures suggest that firms are more (less) likely to decrease (increase) their debt financing when either the overall state of the economy becomes uncertain or when firms experience high uncertainty about their own business activity.

It is also worth noting that the fraction of the firm-year observations where firms issue equity is significantly larger in periods when firm-specific risk is high (i.e., around 67% of the time compared with 33%) and when macroeconomic risk is low (i.e., around 61% of the time compared with 39%) than in periods when firm-specific uncertainty is low and when macroeconomic risk is high. It turns out that firms may appear to face lower cost of equity issuance relative to debt issues when firm-specific risk is high and when macroeconomic risk is low and thereby they have more tendency to issue equity. Further, while around 55% of the time firms decrease equity issues when macroeconomic risk is high, they do so only 45% of the time when macroeconomic risk is high. Conversely, firms repurchase equity around 58% of times when firm-specific risk is low and only 42% of times when firm-specific risk is high.

As seen in the table, in periods of low macroeconomic risk, about 60% of the time firms increase the use of internal funds (retained earnings) to finance their capital needs, whereas, in periods of high macroeconomic risk, firms do so only 40% of the time. On the other hand, there is no considerable difference in the corresponding figures across low and high levels of firm-specific risk. Another aspect to note from figures presented the table is that the percentage of the firm-year observations where firms decrease the use of internal funds in their capital structure is around 53% of the time when macroeconomic risk is high, while this figure is about 47% during the low level of macroeconomic instability. Regarding firm-specific risk, about 52% of the time firms appear to make a reduction in their use of internally generated funds when the risk is high compared with about 48% when the risk is low. In sum, the figures given in the table provide support to our results on the effects of risk on the capital structure decisions of firms and suggest that firms give substantial considerations to the extent as well as the type of risk while either deciding to increase or decrease security issuance and the use of internally generated funds.

4.8 Conclusions

In this chapter, we examine the effects of risk on firms' financing decisions focusing on changes in leverage and its components. Our results suggest that firms tend to reduce the level of leverage when they operate in periods of high risk. Specifically, we find that the effects of both firm-specific and macroeconomic risk on changes in leverage are negative and significant, even after controlling for firm-specific determinants of leverage identified in the existing literature. These findings hold true regardless leverage is measured as a ratio of the market or book value of total debt to total assets.

When we examine how the components of the change in leverage respond to risk we find that the negative effects of idiosyncratic risk arise not only because of a reduction in debt but also due to the use of equity financing and newly retained earnings. These results suggest that given that banks and other lending institutions would charge higher risk premiums to risky firms, these firms are likely to finance their operations through issuing equity and hence preserve their capacity of debt financing for the future.

Regarding the effects of macroeconomic risk on firms' financing decisions, we find that firms not only reduce their total external financing (debt borrowing and equity issues) but also reduce their use of internal funds (retained earnings) during more uncertain times. The negative sensitivity of both the issuance of debt and equity to macroeconomic risk implies that firms significantly time their issues, i.e., firms are more likely to issue securities when macroeconomic prospects are favorable.

Two important implications arise from these findings: (i) the negative effect of macroeconomic risk on the change in leverage, the opposite to what we observe in the case of idiosyncratic risk, is largely due to the reduction in debt financing rather than a rise in new equity financing or newly retained earnings and (ii) even those firms that are rich in earnings may prefer to hold cash rather than investing it. Firms do so because during an uncertain state of the economy they increase their cash holdings as a buffer against any financial distress they may face in future.

The results regarding the effect risk on the firms' debt-equity choice suggest that both firm-specific and macroeconomic risk have a negative, sizable, and statistically significant effect on firms' debt-equity ratio. The results also suggest that the effects of firm-specific variables are asymmetric across all three components. Firms' profitability is negatively related to the issuance of equity, while it is positively associated with the issuance of debt. On the other hand, firms having more tangible assets relative to their total assets are more likely to issue equity and less likely to use debt in their capital structure. Firms with high levels of non-debt tax shields are more likely to issue debt but tend to decrease the use of internal funds to finance their capital needs. Further, the results reveal that the market-to-book value ratio is significantly positively linked with all three components of the change in leverage. Finally, our results indicate that large firms are less likely to issue equity but are more likely to issue debt. However, we also find evidence that high-return firms have a large propensity to issue equity rather than debt while firms that incur more investment expenditures are more likely to issue debt.

Chapter 5

Conclusions

5.1 Thesis Background

Most of the existing empirical research on corporate capital structure has mainly focused on the role of firm characteristics in firms' financing decisions. Previous empirical studies that have taken into account risks experienced by firms have mainly examined how risk affects the optimal level of firms' leverage. However, they have ignored the role of risk in both firms' security issuance decisions and firms' capital structure adjustment strategies. Further, these studies have largely investigated the risk-leverage relationship for only publicly traded firms. Thus, we do not have any empirical evidence of the effect of risk on firms' capital structure based on privately owned firms' data. Furthermore, almost none of the existing studies on the relationship between risk and corporate capital structure have explored the indirect effect of risk on firms' financing policies.

In this dissertation, we hypothesize that if the costs and benefits of financing choices of firms vary across different types and across different levels of risk, so does the optimal capital structure of firms. We have tested our hypothesis in several ways in this study. Specifically, we have focused our analysis on how risks affect firms' leverage targets, the speed of adjustment of firms toward those targets, the security issuance decisions of firms, and the debt-equity choice of firms. In particular, we first examined whether the sensitivity of firms' optimal leverage to risks associated with firms' own business activity and macroeconomic conditions differs across publicly listed and privately owned (non-public) firms. We focused on asymmetry in the effect of risk on leverage between public and non-public firms for the simple reason that these two types of firms are substantially different with respect to their access to external capital markets, size, opaqueness, and ability to absorb the negative business shocks.

Unlike the existing empirical studies on the effect of risk on leverage, we have given particular attention to the indirect effect of risk as well. Specifically, we have explored the implications of cash reserves-risk interactions for firms' leverage decisions. In exploring this, we have examined how the effect of risk on leverage changes when firms change their cash holding levels. If the cash hoards of firms serve as a safeguard against any financial insolvency, it is likely that firms with different levels of cash holdings respond to risks differently. Doing this investigation, we have utilized UK manufacturing firms' data covering the period 1999-2008 obtained from the FAME database. We favour these data because they allow us to sort out the firms by their legal form.

We then study how firm-specific and macroeconomic risk influences the capital structure rebalancing activities of firms over a relatively longer time span. In particular, we have conditioned the speed of adjustment at which firms move toward their leverage targets on both the level and the type of risk. We have controlled for several firm-specific factors known to affect the costs and benefits of adjusting toward the target capital structure while estimating the effect of risk on adjustment speeds. The reason why we study asymmetry in the speed of adjustment is that if risk increases risk premia, deteriorates potential cash flow streams, and raises the likelihood of bankruptcy, it is likely that risk affects various costs and benefits of both movements toward and away from the target capital structure. Accordingly, one would expect to find asymmetry in the rate at which firms adjust toward their leverage targets across different types and levels of risk. In this investigation, we have used data spanning the period 1981-2009 on a fairly large panel of UK manufacturing firms listed on the London Stock Exchange. These data are assembled from the WorldScope files accessed via DataStream.

Using the same dataset, we next have examined the interlinkages between the two types of risk and firms' financing sources, namely retentions, debt borrowing, and equity financing. This exercise has enabled us to identify the channels through which risks affect firms' target leverage. We have also analyzed how the dynamics of firms' target leverage respond to risks. Finally, we have studied the effect of firm-specific and macroeconomic risk on firms' choice of debt versus equity issuance which has allowed us to examine more explicitly whether firms prefer debt borrowing or equity financing when they experience risks.

Given the structure of our dataset and the nature of our empirical models, we have applied the Blundell and Bond (1998) two-step system dynamic panel data (DPD) estimator. We have preferred the use of this estimator because (1) it effectively mitigates potential endogeneity problems and control for heterogeneity across individual firms; (2) it retains variations among firms as this estimator estimates the model both in levels and first differences, and differenced lagged regressors are utilized as instruments for level equations; (3) it allows researchers to make use of different instruments with different lag structure for both the levels and the first-differenced equations; (4) it improves the estimation over others GMM estimators, such as first differenced estimator, particularly in the case when the underlying series are moderately persistent; and (5) it utilizes all available moment conditions by combining moment conditions for the model in first differences and moment conditions for the model in levels.

We have applied a battery of diagnostic tests to the estimated models to confirm that the system-GMM process is correctly specified, the instruments used in the estimation are valid, and the residuals do not exhibit the second-order serial correlation, confirming the instruments are strictly exogenous. Further, we have examined the robustness of our findings in several alternative ways. Specifically, the strategies used for testing the robustness are: 1) re-estimate the effect of risk using alternative measures of firm-specific and macroeconomic risk; 2) re-examine the impact of risk on the adjustment speed of firms toward the target using an alternative measure of target leverage; 3) quantify the effect of firm-specific risk and unpredictable variations in macroeconomic conditions on leverage separately; and 4) seek out whether data provide support to the regression results on the effect of risk on firms' financing decisions.

In what follows, we present a brief summary of our empirical findings, discuss the policy implications of the findings, identify strengths and limitations of the study, and highlight potential areas for further (future) research on the role of risk in firms' financing decisions.

5.2 Summary of Findings

In Chapter 2, we study how risk associated with firms' own business activity and macroeconomic conditions affect the financing decisions of public and non-public manufacturing firms in the United Kingdom. In the first part of the chapter, we review both the theoretical and empirical studies that have tried to establish the interlinkages between risk and firms' optimal leverage. From theoretical prospectives, while studies, such as Castanias (1983) and Bradley, Jarrell, and Kim (1984), have shown that idiosyncratic risk negatively affects firms' ability to use debt financing, other studies, such as Myers (1977) and Jaffe and Westerfield (1987), have documented that the relationship between idiosyncratic risk and firms' use of debt is positive.

Prior empirical evidence also leads to conflicting conclusions on the relationship between idiosyncratic risk and leverage. For instance, papers by Marsh (1982), Titman (1984), and Baum, Stephan, and Talavera (2009) have provided evidence of the negative effect of risk on firms' capital structure. However, the findings of Kim and Sorensen (1986), Kale, Noe, and Ramirez (1991), and Chu, Wu, and Chiou (1992) have suggested that firms appear to use more debt in their capital structure when face high idiosyncratic risks. Overall, we conclude that in the case of theoretical models, results are related to the underlying assumptions, and in the case of empirical studies, results differ based on the sample and measure of risk used in the investigation. We also observe that none of the existing studies on the relationship between risk on capital structure have examined this relationship for privately owned firms.

Regarding the effect of macroeconomic risk on firms' capital structure, several recent theoretical studies, such as Bhamra, Kuehn, and Strebulaev (2010), Chen (2010), Levy and Hennessy (2007), and Hackbarth, Miao, and Morellec (2006), have documented that variations in macroeconomic conditions are significant for firms' financing choices. On empirical grounds, nevertheless, we have limited evidence because only few studies have examined the effect of macroeconomic risk on leverage empirically.

Prior to focus on our empirical investigation, we also survey some recent studies that have generated proxies for firm-specific and macroeconomic risk. We find that most of these studies favour time-varying measures of risk such as ARCH/GARCH models and autoregressive specifications. In the empirical section, we first estimate the effect of firm-specific and macroeconomic risk on leverage for our full sample of firms, using two different measures for each type of risk. We find that there is a negative and significant relationship between these two types of risk and firms' leverage ratio measured by the ratio of the book value of short-term debt to total assets. This evidence is robust to alternative measures of both firm-specific and macroeconomic risk. This finding suggests that firms reduce the amount of short-term debt in their capital structure in periods when either firm-specific or macroeconomic risk is high. Firm-specific factors that affect leverage significantly in our this regression are the investment spending of firms, the ratio of cash & equivalent to total assets, firms' growth opportunities proxied by net sales/total assets, and the one-period lagged leverage.

Having established the impact of both firm-specific and macroeconomic risk on leverage for our full sample of firms, we next study the effect of these two types of risk on leverage for public *versus* non-public firms. First, we establish the fact that both idiosyncratic and macroeconomic risks exert a significant and negative impact on the leverage of both public and non-public firms, indicating that when a firm regardless of its type experiences risks, it tends to decrease its leverage ratio. Second, we find that the impact of idiosyncratic risk on non-public firms' leverage is significantly stronger than that on public firms' leverage. This finding is in line with our expectation that non-public firms' financing decisions are more sensitive to idiosyncratic risk as compared to public firms. However, we do not find any statistically significant asymmetry in the effect of macroeconomic risk on leverage between both categories of firms. This finding suggests that both groups of firms experience negative effects due to macroeconomic risk of similar intensity.

For several reasons, we think that the relatively greater sensitivity of non-public firms to idiosyncratic risk that we document makes sense. First, since non-public firms are more informationally opaque to their external financiers, and since banks are likely to be more cautious about adverse selection and moral hazard problems in an environment where business risk is high, non-public firms will be unable to attract external financing in periods of heightened risk. Second, since the evaluation and monitoring costs are fixed, and since privately owned firms are small in size as compared to their publicly listed counterparts, bankruptcy is relatively costly for private firms than public firms. Relatedly, in order to repress the probability of bankruptcy, private firms are likely to reduce their outstanding debt by a relatively greater amount than do public firms in periods when firm-specific risk is high. Another point worth noting about the non-public firms is that their ability to absorb the negative business shocks is generally less than that of their public counterparts. As a result, the leverage of non-public firms is very likely to be more sensitive to idiosyncratic risk.

Our results also suggest that the effects of the underlying firm-specific factors are similar for both publicly listed and privately owned firms with an exception of firms' fixed investment which appears statistically significant for only public firms. Another noticeable finding emerged from our investigation is that the leverage of non-public firms exhibits a greater persistence than the leverage of public firms does.

The final innovative aspect of Chapter 2 is our investigation of how the effect of risk on leverage changes when firms increase their cash buildups. In particular, we study whether the sensitivity of public and non-public firms' leverage to both firm-specific and macroeconomic risk differs across different levels of firms' cash holdings. This exercise has also provided us an opportunity to examine asymmetry in response of public and non-public firms to risks when both types of firms hold equal percentiles of cash holdings. We find that the sensitivity of leverage to both types of risk significantly varies depending on the level of cash holdings of firms. In particular, we show that the negative effect of idiosyncratic risk on leverage increases monotonically as firms accumulate their cash stocks. This finding suggests that in response to higher business-risk, firms with more cash in their hands tend to reduce their leverage by a greater amount as compared to those firms which have relatively lower levels of cask holdings.

Our results also suggest that the effect of macroeconomic risk on leverage is significantly negative at lower levels of cash holdings; however, it becomes statistically insignificant as firms accumulate higher levels (at around or more than 75^{th} percentile) of cash. This finding is the opposite to that for the case of idiosyncratic risk. It should also be noted that while these observations hold true for both publicly listed and privately owned firms, they are more pronounced for the latter one. When we compare the effect of risk on leverage conditional on the level of cash holdings across both non-public and public firms, we find that the negative sensitivity of leverage to variations in firms' earnings (macroeconomic conditions) at lower levels of cash reserves is higher for non-public (public) firms than for public (non-public) firms. However, when both categories of firms hold very high levels of cash, the effect of both types of risk on leverage is almost the same across the two types of firms. One potential explanation of why public firms tend to reduce their leverage by a larger amount in times of higher macroeconomic risk than their non-public counterparts do is as follows. Since public firms have the broadest menu of financing choices–such as bank borrowing, equity financing, and commercial papers, they can afford to reduce their reliance on sort-term borrowing easily as compared to non-public firms.

Overall, the results presented in Chapter 2 suggest that both types of risk are important in determining the optimal level of firms' leverage. The results also suggest that while the negative impact of macroeconomic risk is larger for public firms than that for non-public firms, non-public firms' leverage appears to be affected more adversely by firm-specific risk than the leverage of public firms. Taken as a whole, the results provide strong evidence that the cash holdings of firms are significantly related to both types of risk, and risks thus potentially affect the optimal level of firms' leverage through this channel, besides their direct impact on firm leverage decisions.

In Chapter 3, we empirically examine the role of risk in the capital structure adjustment decisions of publicly listed UK manufacturing firms over the period 1981-2009. Specifically, we condition the speed with which firms adjust their leverage toward their targets on the level and the type of risk, firms' financing needs, and leverage deviations from the target to analyze asymmetry in the speed of adjustment.

In the beginning of the chapter, we review previous studies that have estimated the rate of adjustment with a specific focus on the papers that have conditioned the speed of adjustment on firm-specific characteristics. We then rationalize why firms are expected to adjust asymmetrically when they go through periods of different extents and types of risk. Most of the existing studies on the capital structure adjustment provide convincing evidence that firms tend to adjust their capital structure toward their leverage targets. Yet, it is apparent from the literature that the speed with which firms move toward their targets is not a settle issues. In fact, several recent studies have documented asymmetry in the adjustment patterns of firms, conditioning on the characteristics of the underlying firms, such as surpluses and deficits in cash flows, positive and negative deviations of leverage with respect to the target, firm size, equity market timing, and macroeconomic conditions. Examples of these studies include Baker and Wurgler (2002), Flannery and Hankins (2007), Kayhan and Titman (2007), Byoun (2008), Cook and Tang (2010), Elsas and Florysiak (2011), Faulkender, Flannery, Hankins, and Smith (2011), and Warr, Elliott, Koëter-Kant, and Öztekin (2011).

In principle, firms adjust their capital structure only if the costs of doing so are less than the benefits of achieving the target capital structure (Fischer, Heinkel, and Zechner (1989)). We expect, as various costs and benefits of adjusting toward and moving away from a leverage target vary with changes in the degree of risk that a firm experiences, so does the speed of adjustment. Further, we also hypothesize that whether risk accelerates or decelerates the speed of adjustment toward the target leverage depending on whether firms have positive or negative financing deficits and whether firms' actual leverage ratios are above or below their targets.

In the empirical section of the chapter, we first quantify the effect of firm-specific and macroeconomic risk on firms' target leverage while controlling for several firm-specific factors that are known to affect firm leverage. Our results suggest that there is a significant and negative relationship between both forms of risk and firms' target leverage ratio, confirming our earlier findings on the adverse effect of risk on the leverage of both public and non-public firms. Regarding the firm-specific determinants of firms' target leverage, we find that while leverage is positively related to firms' investment spending, the profitability of firms, firm size and the non-debt tax shield, it is negatively affected by an increase in firms' market-to-book value, tangibility, and returns on equity.

When we turn to analyze the impact of risk on adjustment speeds, we first estimate the partial-adjustment model of capital structure, which does not allow for asymmetries in capital structure adjustments across firms. We find significant evidence of asymmetry in adjustment speeds across different levels of risks. We indicate that firms tend to adjust slowly toward the target when they experience higher risk–regardless of the source of risk–than when we suppose that they do not face any sort of risk in their operations. In particular, we find that firms tend to adjust faster toward their target leverage (with a speed of 45.2% per year) in periods when both types of risk are set to zero. In contrast, we show that the adjustment in leverage is relatively slower (35.7% per year) when both types of risk are high.

Our these findings suggest that both the trade-off model and the market timing model have a significant role to play in explaining the dynamics of capital structure. In periods of low risk, the observation of fast adjustment supports the trade-off models in that firms quickly shake-off the effects of a shock to trace back to their target capital structure. In periods of high risk, however, the low speed of adjustment provides evidence that firms do not immediately adjust their capital structure toward the target, supporting the market timing theory's predictions. In other words, firms time both equity and debt markets as firms are more likely to issue or retire their financial securities during periods of stable economic environment.

We further analyze this heterogeneity in speeds of adjustment across the level of risk by taking into account the deviations of firms' observed (actual) leverage from their target leverage. In particular, we estimate the the modified version of the standard adjustment model of capital structure which not only relates the speed of adjustment to risk but it also allows asymmetry in the rate of adjustment between over-levered and under-levered firms. The results provide strong evidence that both over-levered and under-levered firms respond to risk very differently when adjusting their capital structure toward their leverage targets. In particular, the estimated estimates of the speed of adjustment indicate that firms having leverage above the target adjust their capital structure faster toward the target when firm-specific risk is high and when macroeconomic risk is low. On the contrary, firms with below-target leverage are likely to adjust their capital structure quickly toward their targets in times of low firm-specific risk and high macroeconomic risk.

Another finding of interest is that in the absence of both types of risk, while firms that are above target leverage adjust their leverage toward the target with a relatively rapid speed (around 32.2% per year), firms that are below target leverage do so with the speed of only around 24.7% per year. Overall, the estimates of the speed of adjustment that we present here suggest that firms adjust their actual leverage toward their targets at different speeds as they face different levels of risk when the actual leverage is above or below the target. This implies that firms consider the levels of firm-specific and macroeconomic risk as well as positive and negative deviations of actual leverage from their targeted leverage ratios when adjusting their capital structure. The asymmetrical response of both over-levered and under-levered firms to risk while adjusting their leverage could probably be reflecting the differences in various costs and benefits of adjusting at different levels of risk for both categories of firms.

Last, but certainly not least, we study the effect of risk on the speed of adjustment of firms by controlling for both firms' cash flow imbalances and leverage deviations simultaneously. Controlling for financing deficits and surpluses provides further insight into asymmetry in adjustment patterns across different types and across different levels of risk. Specifically, our this investigation provides us an opportunity to infer whether the impact of risk on firm leverage adjustments differs when firms have financial surpluses and deficits with above-target and below-target leverage. This analysis provides several interesting evidence. We find that UK manufacturing firms appear to increase their leverage regardless of whether they have financial deficits or surpluses. This finding is in line with the statistics that we present in this study, showing that firm leverage in the UK has been increasing over the period of investigation. However, this observation is in contrast to that of Byoun (2008) which shows that US firms with a financial surplus reduce their leverage. Another point worth noting is that firms with a financial surplus tend to increase their leverage more than those that experience a financial deficit. One possible explanation of the positive relationship between leverage and positive cash flows is that firms rich in cash might prefer to hold cash in their hands as a safeguard against any financial hinderance rather than using it to pay back debt. Instead, they increase their use of debt as financially strong firms can borrow without any hardship and at their favorable terms as banks and other financial institutions consider relatively safe providing funds to these firms.

Regarding firm leverage adjustments, we show that when there is no risk, firms that have a financial surplus with above-target leverage attain the lowest speed of adjustment in contrast to the cases when there is risk. Our results suggest that firms with a financial surplus and above-target leverage adjust their capital structure faster when macroeconomic risk is high, whereas the speed of adjustment declines with a decline in macroeconomic risk. In contrast, firm-specific risk exerts a negative effect on the adjustment process. However, the impact of firm-specific risk is minor compared to that of macroeconomic risk. For instance, when macroeconomic uncertainty is high and firm-specific uncertainty is low, the speed of adjustment is 82.5%. The speed of adjustment drops to 67.4% if macroeconomic risk is low and firm-specific risk is high. This implies that firms that hold a financial surplus with above-target leverage reduce their outstanding debt faster as macroeconomic risk heightens the cost of holding more leverage. Further, given the level of macroeconomic risk, these firms also prefer to lower their debt in periods when firm-specific risk is low as they are sure of their cash inflows.

For firms with financial surpluses and below-target leverage, we come across with an interesting phenomena that these firms do not significantly adjust their capital structure when they experience risk. Rather, the estimates of the speed of adjustment indicate that these firms deviate even further from their leverage targets by paying off their outstanding debts. This is an interesting observation. But we are not able to comment why these firms do so. This remains a mystery and warrants further investigation.

When we consider the speed of adjustment of firms that have financial deficits with above-target leverage, we find that these firms are likely to make the most significant adjustments toward the target capital structure when we set both types of risk to zero. When we take the impact of risk on the speed of adjustment of these firms into account, the estimates suggest that these firms adjust with the fastest speed when macroeconomic risk is low and when firm-specific risk is high. The slowest adjustment will occur when macroeconomic risk is high and firm-specific risk is low. A potential explanation behind this finding is that the adjustment toward the target leverage for these firms requires issuing equity as they are above the targeted leverage and have financial deficits. This is because having financing deficits, reducing outstanding debt in order to close the gap between the targeted and observed leverage is a hard task for these firms. In this context, perhaps these firms find it easier to issue equity to meet their financial obligations and to adjust their leverage toward their target when macroeconomic risks are lower than when they are higher. Our these results are in contrast with the prediction of the simple pecking order model that firm managers, always and strictly, prefer to raise funds by issuing debt whenever they visit external financing markets. However, our observations firmly support the market timing theory, which predicts that firms managers are opportunist and they time their equity issues.

Focusing on the case when firms have financial deficits with below-target leverage, we show that firms in this category adjust their capital structure most quickly when there is no risk. When considering the effects of risk, it is apparent that such firms adjust the quickest when both firm-specific and macroeconomic risk are low where the speed of adjustment is about 30% per year. Our results also suggest that the slowest adjustment takes place when both types of risk are high as the speed of adjustment falls to around 24% per year. As the adjustment of capital structure toward the target for this category of firms requires issuance of debt, these firms are more likely to issue debt when they are relatively less uncertain about their potential cash flow stream and when macroeconomic prospects are good. This is in line with the fact that firms are less cautious about the cost of financial distress and bankruptcy in periods of low risk, and thus tend to increase their use of debt in their capital structure.

The results that we present in this chapter, on the whole, indicate that the interlinkages between risks, the imbalances in a firm's cash flows, and the level of a firm's actual leverage relative to its target leverage are important in explaining the dynamics of firm leverage adjustments. The crux of the findings is that there is a pronounced heterogeneity in adjustment speeds depending on the magnitude and the type of risk, even after controlling the factors known to affect the rebalancing behavior of firms. Our robustness tests confirm that the effects of risks on capital structure adjustments are neither driven by the specific measure of risk nor by the specific estimate of firms' leverage targets.

In Chapter 4, we study how risk affects the security issuance decisions of firms using data on quoted UK manufacturing firms, covering the period 1981-2009. Specifically, we decompose the aggregate change in leverage into three components, namely the change in debt financing, the change in equity financing, and the change in retained earnings, and we analyze how each component responds to firm-specific and macroeconomic risk. We also examine how these two types of risk influence the choice of firms between issuing debt and issuing equity.

After reviewing the studies that have tried to formalize the theoretical interlinkages between risks and corporate security issuance decisions, we conjecture that while firms are likely to reduce the amount of debt in their capital structure, they are expected to increase their use of internally generated funds and equity financing when they experience firm-specific risk. On the other hand, we expect that all these three financing options are negatively affected by macroeconomic risk.

We begin our empirical investigation by investigating how the dynamics of firms' leverage respond to risk. Our results suggest that the effects of both firm-specific and macroeconomic risk on changes in leverage are negative and significant, suggesting that firms tend to reduce the level of leverage when they operate in periods of high risk. Our this observation holds true regardless leverage is measured as a ratio of the market or book value of debt to total assets.

The results on the effect of risk on the components of the change in leverage suggest that firm-specific risk affects the incremental changes in debt negatively and significantly, while its impacts on both the issuance of equity and the use of retained earnings are positive and statistically significant. This implies that the negative sensitivity of changes in leverage to idiosyncratic risk arises not only because of a reduction in debt but also due to a rise in net equity financing and newly retained earnings.

Risky firms prefer to pay back their debt obligations and to use internally generated funds and equity issues–when they are required to raise capital from external sources–in their capital structure because of two reasons. First, since debt is positively related to the likelihood of bankruptcy, firms with volatile earnings reduce their outstanding debts possibly to repress the risk of bankruptcy. Second, since banks and other lending institutions perceive volatility in earnings as a risk, they are less willing to channel funds to risky firms, unless they are compensated with higher risk premium (interest rate). Given this, firms find bank borrowing relatively expensive when they experience variations in their income, and thus, they prefer equity financing.

With regard to the impact of macroeconomic risk on firms' financing instruments, we find evidence indicating that during times of heightened macroeconomic risk, firms not only reduce external debt and equity issues in their capital structure but they also appear to decrease their use of internally generated funds. The negative sensitivity of both the issuance of debt and equity to variations in macroeconomic conditions suggests that firms time their equity and debt issues. That is, firms are less likely to issue securities when macroeconomic prospects are not favorable. These observations are consistent with the findings of Korajczyk and Levy (2003) which indicate that macroeconomic conditions are of significance for securities issuance. Further, our results on the effects of macroeconomic risk are in line with the predictions of Hackbarth, Miao, and Morellec (2006), Levy and Hennessy (2007), Bhamra, Kuehn, and Strebulaev (2010), and Chen (2010). Two implications emerging from these results are worth noting. First, it turns out that the negative effects of macroeconomic risk on changes in leverage are purely the result of a reduction in debt financing. Second, firms in times when the overall macroeconomic environment is uncertain and unstable are likely to design their investment and financing policies propassively. One of the plausible explanation of this is that during uncertain states of the economy, even those firms that are rich in earnings may prefer to hold cash in hand rather than investing it, considering the cash holdings as a buffer to shield themselves against financial distress.

We also find that firms tend to issue equity rather than debt when they experience firm-specific risk, suggesting that firms lower debt-equity ratios when the risk is high. The same holds true for macroeconomic risk: the higher the level of macroeconomic risk, the lower the debt-equity ratio of firms. However, the results suggest that although firms reduce their use of external financing (debt and equity) in periods of volatile macroeconomic conditions, they do a reduction in debt borrowing by a larger amount than they do in equity financing. Our results also suggest that firm characteristics are also important in the determination of the components of the change in leverage, yet the effects of the underlying firm-specific variables are asymmetric across all three components of the change in leverage. Profitability is negatively related to the issuance of equity, while it is positively associated with the issuance of debt. On the other hand, firms having more tangible assets relative to their total assets are more likely to issue equity and less likely to use debt in their capital structure. Firms with high levels of non-debt tax shields are more likely to issue debt but tend to decrease the use of internal funds to finance their capital needs. We also find that the market-to-book value ratio is significantly positively linked with all three components of changes in leverage. Further, we find that large firms are less likely to issue equity but are more likely to issue debt. However, high-return firms have a large propensity to issue equity rather than debt. In contrast, firms that incur more investment expenditures are more likely to issue debt.

5.3 Policy Implications

This dissertation attempts to provide insight into the security issuance decisions and the capital structure rebalancing behavior of firms when firms face different types and different levels of risk. This study is also unique in terms of allowing for asymmetries in adjustment speeds, because we condition the speed of adjustment of firms both on the level and the type of risk over and above firm-specific characteristics which are known to cause heterogeneity in firm leverage adjustments. In addition, this study provides an interesting comparison by focusing on the differences in the sensitivity of leverage to risks between publicly traded and privately owned firms. Finally, we examine asymmetry in sensitivities of leverage to risk across different levels of firm cash holdings.

For policy prospective, the findings of the dissertation have several important implications. Specifically, we expect that our findings will be of interest to academic scholars, policy-makers, and firm managers. We also expect that the findings of the analysis are useful for active and potential financial investors as well as stakeholders including banks and other credit-providing organizations. Our findings indicate that firms considerably take into consideration both firm-specific and macroeconomic risk when deciding their leverage targets and when making adjustments in their capital structure to achieve these targets. Specifically, our findings suggest that both publicly traded and privately owned firms reduce their leverage during periods of high risk. As well, the findings suggest that firm-specific risk has a relatively stronger negative impact on private firms' leverage than on public firms' leverage, while macroeconomic risk exerts similar impacts on the leverage of both types of firms. Our results also indicate that for both types of firms, the sensitivity of leverage to risk differs at different levels of firm cash holdings (see Chapter 2).

Our finding that private firms' leverage is more sensitive to firm-specific risk may imply that there is need to commence financial reforms and other legal changes that are conducive to offer funding to private firms, particularly when they experience variations in their potential earnings. Our findings also suggest that the authorities should have to come with measures that positively affect firms' confidence level regarding their own business activity as well as the overall economic conditions. Our findings that risky firms with high cash holding levels are likely to reduce their debt borrowing by a larger amount have important implications for firm managers. Specifically, these findings imply that those firms that have higher level of cash holdings are more able to reduce their debt obligations in periods when they face risk in their operations, and hence, they may well minimize the risk of bankruptcy. Our findings on the implication of macroeconomic risk-cash holdings interactions for firm leverage decisions have also important implications. Firms may mitigate the effects of unpredictable variations in macroeconomic conditions on their capital structures by holding more cash. We suggest this because our findings indicate that the adverse effect of macroeconomic risk on the leverage of both public and non-public firms decreases monotonically with the increase in cash holdings of firms.

Our findings suggest that risks have significant impacts on the leverage adjustment decisions of publicly traded UK manufacturing firms. However, we also find that there is a profound asymmetry in the rate at which firms correct the deviation of their observed leverage ratio from their targeted leverage, depending on the type as well as the extent of risk. Further, we show that the firm characteristics, namely cash flow imbalances and the level of a firm's observed leverage relative to its leverage targets have also a significant role to play in generating asymmetries in leverage adjustment speeds (see Chapter 3).

All of these findings have important implications and are useful for understanding the rebalancing behavior of firms: when, how, and at what speed firms adjust their capital structure toward their targets when they deviate from them. These findings would also greatly help investors in designing their investment plans efficiently as a firm's value is significantly related to its financing policy. These findings would also assist firm managers in devising effective strategies to prevent firms from the adverse effects of variations in firms' own business activity and overall macroeconomic conditions. Broadly speaking, our findings would help firms–particularly in periods of high risk–to economize on the costs of issuing securities and deviating from or moving toward their targeted capital structure, and thereby to optimize on the benefits of maintaining leverage targets. Based on the evidence of a significant influence of risk on firms' financing decisions, stakeholders could lay out their priorities and interests by taking into consideration the instability of the overall macroeconomic environment and the variability of the firm's underlying potential future income stream.

The findings presented in Chapter 4 of the dissertation suggest that firms design their external financing policy propassively, particularly bank borrowing, instead they increase their use of internally generated funds when they go through periods of internal unrest. In periods of macroeconomic instability, however, firms appear to reduce not only external financing but also the use of internal funds in their capital structure. This propasive behavior of firms has important implication on economic growth. Specifically, this implies that if firms lessen their reliance on external financing, and reduce their uses of internal funds perhaps they cut back their investment expenditures. This in turn affects the production capacity of firms adversely and thereby influences economic growth negatively. However, by extending firms' due debt payments (renewing firm loans) and making easy availability of further funds, banks and other credit providers would prevent - or at least make relatively slower - a fall in economic growth and help markets to be out of an episode of bearish caused by unpredictable variations in economic activities. The results of this study, on the whole, suggest that authorities should take into account the sensitivity of firms' capital structure to risks when formulating economic and financial policies.

5.4 Areas for Future Research

The prime focus of this dissertation is to examine the impact of risks on corporate financing decisions. Although we explicitly (and squarely) investigate firms' responses to high, medium, and low levels of risk when they rebalance their capital structure to achieve their leverage targets, for the sake of simplicity and consistency, we do not study whether firms respond differently to risks when the economy is thriving than when the economy is slimming down. However, the effects and implications of risks on firms' values and capital structures during expansionary periods are expected to be different from those in contractionary periods. Therefore, it would be worthwhile to study and find out whether the impacts of risk on corporate financing decisions differ across business-cycle phases (i.e., expansion, peak, contraction, and trough).

In principle, firms take into consideration various costs and benefits associated with capital structure adjustments when correcting any deviations from their targeted capital structure. Indeed, we have hypothesized in this dissertation that if the costs, such as the relative costs of external financing, equity valuations, and financial constraints, and benefits, such as the expected value of tax shields and the potential costs of distress, of adjusting toward the target vary across the types and the extents of risk, so does the speed of adjustment of firms. And we have documented strong evidence of asymmetry in adjustment speeds, depending on both the magnitude and the type of risk. One possibility to extend our work will be to examine – more explicitly and directly – how risk about firms' own business activity and macroeconomic conditions interacts with these costs and benefits of capital structure adjustments. This sort of analysis would help in obtaining an in-depth understanding of what exactly causes firms to adjust their capital structure asymmetrically when they experience different types or different extents of risk in their operations.

Since different industries have a different nature of business, it is likely that the impacts of risk on leverage vary across industries. In the interest of brevity and for the purpose of our analysis, in this dissertation, we explore the differential effects of risk on firms' capital structure across firms rather than industries. However, this could be another interesting issue for further research on risk-leverage relationship. Examination of whether the effects of risk on firms' financing policy are same or different across the industries would be useful to further understand the differential effects of risk on firms' leverage across firms that we reported in this dissertation. The analysis of cross-industry differences would also help identify the industries where the optimal level of firms' leverage is relatively more affected by either the uncertain state of the economy (macroeconomic risk) or variations in firms' potential earnings (idiosyncratic risk).

Another fascinating area for future work will be to study how risk affects the financial health of firms. Indeed, recent theoretical studies, such as Chen (2010) and Bhamra, Kuehn, and Strebulaev (2010), argue that the interactions between variations in macroeconomic conditions and default rates, default losses, and default probabilities are important for corporate financing decisions. Thus, it would be worth exploring how risks, particularly about macroeconomic conditions, affect firms' financing policy and the pricing of corporate securities through these channels. It would be also interesting to explore the interactions between macroeconomic conditions and firms' financial flexibility and how variations in macroeconomic conditions affect the behavior of financial intermediaries regarding the holding of corporate securities.

Our study is based on UK data. However, it would be good to examine whether our findings that both firm-specific and macroeconomic risks have significant impacts on the capital structure adjustment and security issuance decisions of firms hold for other countries those have a similar structure of financial markets, such as the USA (market-oriented economies) as well as for countries those have a different financial market structure, such as Germany, France, and Japan (bank-oriented economies). A more interesting and useful investigation would involve comparing firms' responses to risks between market- and bank-oriented economies as firms operating in these two different financial structures have to overcome different hurdles when acquiring their financing needs. Further, we have mainly focused to examine the impact of risk on the financing decisions of publicly listed and privately owned UK manufacturing firms. However, it might be useful to extend this investigation to other sectors of the economy.

In this dissertation, we have examined the relationship between risks and firms' capital structure for a large panel of UK manufacturing firms. While estimating the effects of risk, we do not take into account whether firms are involved in international trade or not. However, it would be nice to examine the impact of risk on the financing decisions of exporter and non-exporter firms separately. This is important and would be interesting, because it is well established in the literature that firms are likely to diversify their shocks by exporting (see, for example, Maloney and Azevedo (1995) and Garcia-Vega, Guariglia, and Spaliara (2012)). Thus, risks about firms' earnings and the state of the economic possibly will affect firms that sell a significant part of their productions globally and firms that do not do business across borders differently.

With regard to firm adjustment decisions, for the purpose of this dissertation, we have restricted our attention to study the influence of risk on the capital structure adjustment behavior of firms. However, for future research prospective, another enlightening area of interest will be to evaluate the cash holding behavior of firms in response to risks. Indeed, papers by Almeida, Campello, and Weisbach (2004) and Baum, Caglayan, Stephan, and Talavera (2008) provide rich evidence of the impact of risk on firms' cash holding levels (liquid assets). On the other hand, studies by Ozkan and Ozkan (2004), Dittmar and Duchin (2010), and Venkiteshwaran (2011) document evidence that firms have a tendency to re-adjust their cash holding levels when they deviate from their cash holding targets. Given such empirical evidence, the analysis of whether risks about firms' earnings/cash flows and macroeconomic conditions influences the cash holding adjustment decisions of firms may be of interest and it will provide further insight to understand the role of risk in firm decisions.

Despite the findings of this dissertation provide a prima facie evidence for the importance of risks in explaining the dynamics of corporate capital structure, examination of the above mentioned unexplored issues would be of significance to prove our knowledge further about the role of risks in corporate financing decisions. The in-depth understanding of the interactions of various types of risk that firms face with the financing behavior of firms would undoubtedly sharp our ability to perceive what exactly going inside the black box.

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