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

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Abstract

This paper 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 manufacturing firms use less short-term debt during periods of high risk. However, the leverage of non-public manufacturing firms is more sensitive to firm-specific risk in comparison to their public counterparts while macroeconomic risk affects both types of firms similarly. Our investigation also shows that firms with high liquid assets reduce their leverage more (less) during periods of heightened firm-specific (macroeconomic) risk.

Keywords: Leverage; Cash holdings; Public *versus* Non-public manufacturing firms; Firm-specific *versus* Macroeconomic risks; Spillover effects; System-GMM
JEL classification: C23, G32

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1 Introduction

Since the seminal work of Modigliani and Miller (1958), researchers have expended considerable effort to understand firms' financing decisions. This has led to an extensive literature on the role of firm-specific factors, such as profitability, investment opportunities, firm size, and asset structure, in explaining firms' capital structure.[1] More recently, researchers have also begun to examine the movements in firms' capital structures as the economy evolves over the business cycle. As a consequence, we now know that the optimal capital structure of a firm changes over time affecting the value of the firm as well as its survival, while the firm's manager considers i) the state of the company and that of the industry within which the firm operates; ii) the health of the financial markets and the economy; and iii) the regulatory restrictions prior to making a decision on the use of debt, equity, or retained earnings to finance the firm's operations.

When we examine the literature regarding the impact of firm-specific (idiosyncratic) and macroeconomic risks on firms' leverage decisions, we find that the empirical evidence on this matter is rather scarce. However, the influence of risk on firm leverage could be quite substantial. This is so because, due to asymmetric information problems, the ability of potential lenders to accurately evaluate the firm's creditworthiness will be affected as the extent of business or macroeconomic risk changes over time. In return, as lenders demand a higher risk premium, the capacity of the firm's manager to raise external funds will be compromised, ultimately affecting the firm's capital structure.

Surveying the literature, we see that most of the empirical observations regarding the impact of the factors that affect firms' capital structure are based on large, publicly traded companies.[2] Yet, researchers focusing on non-public firms have shown that these firms are generally financially constrained and exhibit a greater reliance on retained earnings and bank borrowing as they are small, young, and lack adequate collateral to borrow.[3] Given these reported differences between public and non-public firms and that non-public firms are more opaque to outside investors, one would expect that under uncertainty the leverage of non-public firms would be more adversely affected than that of publicly traded firms because their relative cost of borrowing will be higher as lenders demand higher spreads.[4]

In this paper, we empirically investigate the impact of firm-specific and macroeconomic risk on public and non-public firms' leverage and hypothesize that the sensitivity of leverage to risks would differ across the public and non-public firms. Given that asymmetric information problems affect non-public firms more than their public counterparts due to the above discussed differences and that they have less potential to absorb negative shocks (Gertler and Gilchrist (1994)), we expect to find that an increase in risk would have a more adverse impact on non-public firms' capital structure than that of public firms. Furthermore, because firms generally experience a shortfall in their expected cash flow as the economy or the business goes through a period of turmoil, we argue that non-public firms, which generally have limited access to external sources of funds, will suffer the most.

In our investigation, we also consider the possibility that changes in risk may exert an indirect effect on firms' leverage through firms' financial strength. That is, we investigate whether the sensitivity of leverage to risk differs as the firm's financial strength changes. It should be noted that earlier research has only considered the role of indirect effects of risk on firms' fixed investment behavior and found it to be significant.[5] Therefore, given the state of the literature, this paper examines the direct and indirect influence of macroeconomic and firms-specific risks on public and non-public firms' leverage.

In our empirical analysis, we employ an unbalanced panel of public and non-public manufacturing firms for the 1999-2008 period drawn from the FAME database. We estimate a dynamic model, similar to Baum et al. (2009), using the system generalized method of moments estimator (Blundell and Bond (1998)). Our investigation provides evidence that an increase in firm-specific risk leads to a reduction in both public and non-public firms' leverage. More specifically, we find that the leverage sensitivity to changes in idiosyncratic risk is higher for non-public firms in comparison to their public counterparts. This is consistent with the view that non-public firms depend more on their retained earnings as their ability to raise external funds would be limited during periods of firm-specific turmoil due to the presence of frictions. When we turn to investigate the effects of macroeconomic risk on leverage, we observe that public firms reduce their leverage more than non-public firms. Yet, we find no significant difference in the sensitivity of leverage to macroeconomic risk between the two firm categories.

When we examine the indirect effects of risk on leverage, we find that both types of risk have significant indirect effects on public manufacturing firms' leverage. However, we do not observe such effects for non-public manufacturing firms. We next quantify the full impact of risk on leverage by jointly considering direct and indirect effects of risk. We find that although the full impact of idiosyncratic risk on leverage is negative, this negative effect becomes stronger as the financial strength of the firm improves. In other words, during periods of higher idiosyncratic risk, financially stronger firms, which we measure in relation to the firm's cash holdings, reduce their leverage more than those firms which are financially weaker, i.e., those firms that hold lower levels of cash stocks. In the case of macroeconomic risk, we observe that the adverse effect of macroeconomic risk on leverage is stronger when firms' cash holding is low. Furthermore, the negative effect of macroeconomic risk on leverage becomes weaker and insignificant as firms accumulate more cash reserves. These findings show that financial strength plays an important role in determination of optimal leverage under uncertainty.

To check the robustness of our findings, we estimate a battery of additional models as we augment our models with additional firm-specific variables and use a different proxy (size) for the firm's financial strength. The results from these models are qualitatively similar to our earlier findings verifying our observations. Overall, our findings complement and expand the earlier literature.

The remainder of the study proceeds as follows. Section 2 provides a brief survey of the literature regarding the impact of macroeconomic and idiosyncratic risk on firms' financing behavior. Section 3 presents information on the dataset and explains variable construction. Section 4 discusses the empirical models. Section 5 provides the empirical results. Section 6 concludes the study.

2 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 as we refer to the theoretical and empirical findings in the literature.

2.1 Macroeconomic Risk and Firm Leverage

There is an extensive empirical literature that examines the effects of macroeconomic volatility on firm behavior. These effects are explained by the financial propagation mechanism which suggests that macroeconomic volatility influences the borrowers' collateralizable net worth, and therefore affects their risk premium for external funds. Changes in the risk premium in return influence the ability of the firms to borrow funds from potential lenders.[6] Several researchers, including Leahy and Whited (1996), Ghosal and Loungani (1996), and Baum et al. (2010) provide empirical evidence that firms significantly reduce their fixed capital investment expenditures during periods of high risk as these firms will be financially constrained to carry out their capital investment projects. As discussed in Almeida et al. (2004) and Baum et al. (2008), firms increase their cash stock to overcome the adverse effects of an increase in macroeconomic volatility. Along the same lines, Bartram (2002) presents evidence that liquidity is significantly associated with interest rate risk.

Recently several researchers have also begun to examine the movements in firms' capital structures as the economy evolves over the business cycle. For instance, Hackbarth et al. (2006) propose a model in which firms' cash flows are conditional on both idiosyncratic risks and macroeconomic conditions. They predict that firms' borrowing capacity exhibits pro-cyclicality and that both the pace and the size of capital structure changes depending on macroeconomic conditions. Levy and Hennessy (2007) examine firms' financing choices in a general equilibrium framework. They document that firms are more likely to reduce their outstanding debt in periods of poor macroeconomic conditions. Several other studies, including Choe et al. (1993), Gertler and Gilchrist (1994), Korajczyk and Levy (2003), Drobetz et al. (2007), Cook and Tang (2010), and Akhtar (2011) arrive at the same conclusion that firms' capital structure is affected over the business cycle. Nevertheless, these studies do not investigate the risk sensitivity of firms' leverage.

Gertler and Hubbard (1993), in their study, examine the impact of idiosyncratic and macroeconomic risk in firms' production and financial decisions. They show that although firms can mitigate the effect of idiosyncratic risks, they are not able to overcome the impact of macroeconomic risks. As a consequence, firms opt for equity rather than debt contracts to shift at least some of the business-cycle risk to their lenders during periods of higher macroeconomic risk. More recently, Bhamra et al. (2010) and Chen (2010) using a dynamic capital structure framework show that unpredictable variations in macroeconomic conditions have a significant impact on firms' financing policies. Chen (2010) predicts that higher macroeconomic risks lead to a decline in discounted value of expected tax benefits. As the advantages of an outstanding debt stock fall, firms reduce their debt in bad times. Bhamra et al. (2010) argue that firms become more conservative in their use of debt financing during bad states of the economy to have financial flexibility rendering leverage to be pro-cyclical.

When we further sift through the literature, we find only two studies which empirically examine the link between leverage and macroeconomic risk. Baum et al. (2009) show for a set of large US nonfinancial firms drawn from the COMPUSTAT database that an increase in macroeconomic risk leads to a significant decrease in firms' optimal short-term leverage. Hatzinikolaou et al. (2002) examine the impact of inflation risk on debt-equity ratio of firms included in the Dow Jones Industrial Index and they find that inflation uncertainty has a significant negative effect on a firm's debt-equity ratio. To our knowledge, the literature does not present us any study that focuses on the sensitivity of leverage of non-public firms to changes in macroeconomic risk.

2.2 Firm-Specific Risk and Firm Leverage

When we review the literature on the sensitivity of leverage to idiosyncratic risk, we find several papers, some of which arrive at opposing conclusions. Several researchers argue that higher business risk as measured by an increase in the volatility of cash flows heightens the probability of bankruptcy. Given the positive bankruptcy costs, firms use less debt in their capital structure when they face variations in their earnings. Another strand of literature argues that business risk may reduce the agency cost of debt inducing managers to use more debt in their capital structure. A third strand of studies show that the link between firm-specific volatility and leverage is weak or non-existent at all.

Bradley et al. (1984) present a single period model to show that there is a negative association between a firm's earnings volatility and optimal debt. Subsequently, Titman and Wessels (1988) report a negative association between earnings volatility and leverage. Crutchley and Hansen (1989) provide evidence that there is a significant negative relationship between firms' earnings volatility and leverage for a panel of US manufacturing firms. Baum et al. (2009) report a significant and negative impact of idiosyncratic risk on the optimal short-term leverage for US non-financial public firms. They also show that highly leveraged firms and smaller firms are more sensitive to firm-specific risk as compared to relatively low leveraged or large firms.

Lemmon et al. (2008) find a negative effect of cash flow volatility, measured by the standard deviations of historical operating income, on the leverage decisions of firms. 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. Graham and Harvey (2001b), based on a survey of US Chief Financial Officers (CFOs), report that firm managers seriously consider earnings volatility prior to issuing debt contracts. Similar results are reported based on surveys of European CFOs (see, for example, Bancel and Mittoo (2004) and Brounen et al. (2004)).

There are several other studies in the literature that show that the link between firm-specific risk and leverage is weak or non-existent. For instance, Wald (1999) presents evidence that firm-level risk affects the debt-to-asset ratio of US and German firms, yet he does not find such effects for firms in France, Japan and the UK. Cassar and Holmes (2003) document evidence of a negative but weak influence of operating risk proxied by variations in earning streams on leverage for small and medium sized Australian firms. Flath and Knoeber (1980) show that the firm's earning volatility has no significant impact on firm 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.

In contrast to the above cited studies, Myers (1977), in his seminal paper, predicts a positive relationship between firm-specific risk and debt. He argues that large business risk may reduce the agency cost of debt and thus, cause firms to use more debt in their capital structure. Jaffe and Westerfield (1987) also suggest a positive association between risk and the optimal debt level. Several other empirical studies, including Kim and Sorensen (1986) and Chu et al. (1992), report a significant and positive impact of firm-level risk on firm leverage. In an earlier study, Toy et al. (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 et al. (1991) show that although an increase in business risk initially leads to a decline in debt, when the debt of a firm exceeds a certain limit, the firm uses more debt in its capital structure as business risk increases. Michaelas et al. (1999) find for a panel of UK SMEs that firm-specific risk positively affects the use of debt in the short- and long-run. Mueller (2008) shows that exposures to idiosyncratic risk increases the cost of equity capital and make bank borrowing more attractive.

Heyman et al. (2008) examine the determinants of financial structure of small, privately held Belgian firms and report that firms which are exposed to higher credit risk are likely to increase their use of short-term borrowing.

Overall, empirical research has mixed conclusions on the association between idiosyncratic risk and public firms' leverage. Also, given the literature, we know little about how non-public firms would adjust their leverage under idiosyncratic risk. Since non-public firms' financing options significantly differ from that of public firms and they play an important role in production of goods and services, it is important to examine the leverage sensitivity of non-public firms to changes in idiosyncratic risks as well as macroeconomic risks. Furthermore, no earlier study has examined the possibility that risk may have an indirect effect on firm leverage. In what follows, we investigate the direct and indirect effects of firm-specific and macroeconomic risks on public *versus* non-public firms' leverage using a large panel of UK manufacturing firms.

3 Data and Variable Construction

To carry out our investigation, we construct an annual panel dataset for public and non-public manufacturing firms using the FAME database which provides firm-level information for a 10-year window. Time series data on macroeconomic variables are extracted from International Financial Statistics (IFS). Our study examines the period from 1999 to 2008.

3.1 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.[7]

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. The Companies Act of 1981, which modified the 1967 Act, allowed small firms to file an abbreviated balance sheet without a profit and loss statement and medium sized companies to submit an abbreviated financial statement.[8] 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. If a company's annual turnover happens to exceed one million pounds, then it is required that the company must be audited by a qualified professional auditing firm. After a company files its accounting statements, Companies House carefully investigates and checks this information and makes it available to the general public. Hence, the information provided by the Companies House is compatible and consistent across public and non-public firms. Jordans, one of the leading providers of legal information in the UK, collects this data from Companies House. Finally, Bureau van Dijk acquires the data from Jordans and makes it available 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 window. Over 99% of the companies in the database are small and they are not traded on the stock exchange. 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 flow statements, profit and loss accounts, and information on public or private ownership.

3.2 Sample Selection Criteria, Initial Screening, and Variable Construction

In this paper, we only focus on manufacturing firms. We construct leverage as a ratio of the book value of the short-term debt to total assets. Following previous empirical studies, we include several firm-specific control variables in our empirical model. Investment is defined as expenditure on purchase of fixed tangible assets during a year. Cash is set equal to cash and equivalents. Sales is 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.[9] The dataset refers to 12-month accounting periods for all companies.[10] Further details on the variables are given in the Appendix.

As an initial screening, we exclude companies that have less than three years of consecutive data on debt, investment, cash and equivalent, or sales. There are two reasons why we require a minimum of three observations per company. First, we need a reasonable number of observations to generate a meaningful measure of firm-specific uncertainty for each firm. Second, one must be able to properly instrument the endogenous variables to implement the two-step system-GMM method. Note that this requirement does not necessarily imply any entry restrictions. Also, following Baum et al. (2009), we consider negative values of debt, total assets, investment, and sales in the sample as missing.[11]

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.

3.3 Measuring Firm-Specific Risk

Researchers have implemented different approaches 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. Ghosal and Loungani (2000) measure the firm-level risk by the standard deviation of the firm's unpredictable profit. Bo and Lensink (2005) use stock price volatility as well as the volatility of the number of employees to measure firm-level uncertainty. Baum et al. (2009) estimate idiosyncratic risk by calculating the standard deviation of the closing price of the firm's shares.

Most of the measures described above are well-suited for cases where the focus is on large publicly traded firms.[12] Given that the focus of our paper is on the behavior of public *versus* non-public manufacturing firms, and non-public firms are much smaller than the public firms, we follow Morgan et al. (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):

$$S_{it} = f_i + f_t + \psi_{it} \tag{1}$$

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

As an alternative measure of risk, we estimate an AR(1) model for sales normalized by total assets as in Bo (2002). Using the one-period ahead residuals, 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.

3.4 Measuring Macroeconomic Risk

Researchers have also implemented different methodologies to construct measures of macroeconomic risk. One common approach is to use ARCH/GARCH class models in generating a measure of macroeconomic risk. For instance, Aizenman and Marion (1999), Driver et al. (2005), Baum et al. (2009) are among others who use this approach. Another possibility is to use the moving standard deviation of a variable as in Ghosal and Loungani (2000), Korajczyk and Levy (2003) or survey based methods as in Kaufmann et al. (2005) and Graham and Harvey (2001a). However, the standard deviation based measures suffer from substantial serial correlation problems in the constructed series and the survey data based measures potentially contain sizable measurement errors.

For our purposes, we implement ARCH/GARCH models using the T-bill rate and real GDP series to generate two separate measures of macroeconomic risk. These models are estimated over 1996-2008 using monthly data for the T-bill rate and quarterly data for the real GDP. Once the conditional variances for each series are obtained, we annualize them by averaging over four quarters in the case of GDP and over twelve months in the case of the T-bill rate series to match the frequency of the firm-level data.[13] Details for both models are provided in Table A.2 in the Appendix.[14]

3.5 Summary Statistics and Correlations

Table 1 provides descriptive statistics for the full sample as well as public and non-public firms. We apply nonparametric equality tests to examine if the mean, median, and standard deviation of the underlying variables differ across public and non-public firms.

We observe that the mean leverage for non-public firms is significantly higher than their public counterparts. This observation makes sense as debt financing is the main source of external finance for non-public firms, and supports Brav (2009) who shows that non-public manufacturing firms use relatively more debt to finance their fixed capital investments than public manufacturing firms in the UK. We also observe that the leverage of non-public firms has a wider variance as compared to that of public firms. Similarly, there is a significant difference between public and non-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 public firms. This ratio is also significantly more volatile for non-public firms as compared to that for public firms. The statistics on the ratio of cash and equivalent-to-total assets do not yield any significant difference between the two groups. Non-public manufacturing firms have an average cash and equivalent-to-total assets ratio of 12.2%, while this figure is 11.1% for public firms. We should also note that, on average, public firms have higher investment rates compared to their non-public counterparts. Also public firms' investment rates are slightly more variable than that of non-public firms over the period under consideration.

Insert Table 1 about here

Table 2 presents summary statistics of the macroeconomic and idiosyncratic risk measures. The table reports the mean, standard deviation as well as the 25^{th}, 50^{th}, and 75^{th} percentiles of each proxy. The mean and 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-bill rates and real GDP. We also examine the correlation between our macroeconomic and idiosyncratic risk to see whether these two measures exhibit any similarities. The correlation coefficients, presented in Table 3, are very low and they are not significant at any reasonable level of significance allowing us to conclude that each measure captures a different aspect of risk.

Insert Table 2 and Table 3 about here

In Table 4, we report simple correlation coefficients between our risk measures and leverage for public and non-public firms. We observe that there is 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. To properly examine the causal effects of both types of risk on firm leverage, we next present a dynamic model which also incorporates several firm-specific variables that are shown to be important in the literature.

Insert Table 4 about here

4 Econometric Framework

4.1 Specification of the Baseline Empirical Model

To examine the association between risk and leverage, we estimate several models for public and non-public firms. We incorporate risk measures into a standard leverage model that includes several firm-specific factors. We include one-period lagged leverage in the model to control persistence in leverage. Specifically, we estimate the following model which is similar to that in Baum et al. (2009):

$$Lev_{it} = \lambda_0 + \lambda_1 Lev_{it-1} + \lambda_2 Sales_{it} + \lambda_3 Cash_{it} + \lambda_4 Invt_{it} + \lambda_5 \sigma^{firm}_{it-1} + \lambda_6 \sigma^{macro}_{t-1} + f_i + \varepsilon_{it} \quad (2)$$

where subscript i indexes the firm, and t indexes the year. Lev_{it} is the leverage in year t for firm i and it 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. Each variable is normalized by total assets to remove the scale effects. In our model, the risk measure enters the model with a lag, where σ^{firm}_{it-1} and σ^{macro}_{t-1} represent firm-specific and macroeconomic risk measures, respectively. f_i denotes firm-specific fixed effects, and ε_{it} is the error term. All estimations are carried out for the period 1999-2008. In this specification, the key coefficients of interest are λ_5 and λ_6 which capture the effects of firm-specific and macroeconomic risk on the leverage decisions of firms.

4.2 Differential Effects of Risk

We next estimate a more complicated model to test whether the impact of risk on public manufacturing firms is statistically different from that of non-public firms. In this model, we interact all variables in the previous model by the public (D_i^{public}) and the non-public dummy ($D_i^{nonpublic}$) variables as we allow public and non-public firms to assume different coefficients within the same framework. The (non-)public dummy is equal to one if the firm is categorized as (non-)public and zero otherwise. The extended model takes the following form:

$$\begin{aligned} Lev_{it} = \phi_0 &+ \phi_1 Lev_{it-1} D_i^{public} + \phi_2 Lev_{it-1} D_i^{nonpublic} + \phi_3 Sales_{it} D_i^{public} + \phi_4 Sales_{it} D_i^{nonpublic} \\ &+ \phi_5 Cash_{it} D_i^{public} + \phi_6 Cash_{it} D_i^{nonpublic} + \phi_7 Invt_{it} D_i^{public} + \phi_8 Invt_{it} D_i^{nonpublic} \\ &+ \phi_9 \sigma_{it-1}^{firm} D_i^{public} + \phi_{10} \sigma_{it-1}^{firm} D_i^{nonpublic} + \phi_{11} \sigma_{t-1}^{macro} D_i^{public} \\ &+ \phi_{12} \sigma_{t-1}^{macro} D_i^{nonpublic} + f_i + \varepsilon_{it} \end{aligned} \tag{3}$$

We should note that this approach is preferred over estimating leverage models on separate sub-samples of public and non-public firms as we can properly test the differential effects of risk on leverage for both groups of firms:[15] In particular, we test if i) the impact of σ_{it-1}^{firm} on Lev_{it} is the same for public and non-public firms ($\phi_9 = \phi_{10}$); and ii) the impact of σ_{t-1}^{macro} on Lev_{it} is the same for public and non-public firms ($\phi_{11} = \phi_{12}$).

4.3 Indirect Effects of Risk

Baum et al. (2008) develop a partial equilibrium model of precautionary demand for liquid assets to examine how macroeconomic and idiosyncratic risks affect firms' cash holdings. Their empirical results demonstrate that risk has a significant impact on non-financial US firms' optimal liquidity. They also show that firms increase their demand for liquid assets in response to an increase in macroeconomic or firm-specific risk.[16] Since a firm's financing policy markedly depends on the firm's investment opportunities and the availability of internal funds, risk is likely to have indirect effects, possibly through changes in the firm's financial strength, in addition to its direct impact on the firm's borrowing behavior. To see whether risk exerts an indirect effect on firms' leverage through firms' financial strength, we augment our basic specification with cash-holding-risk interactions as follows:

$$
\begin{aligned}
Lev_{it} = {} & \beta_0 + \beta_1 Lev_{it-1} D_i^{public} + \beta_2 Lev_{it-1} D_i^{nonpublic} + \beta_3 Sales_{it} D_i^{public} + \beta_4 Sales_{it} D_i^{nonpublic} \\
& + \beta_5 Cash_{it} D_i^{public} + \beta_6 Cash_{it} D_i^{nonpublic} + \beta_7 Invt_{it} D_i^{public} + \beta_8 Invt_{it} D_i^{nonpublic} \\
& + \beta_9 \sigma_{it-1}^{firm} D_i^{public} + \beta_{10} \sigma_{it-1}^{firm} D_i^{nonpublic} + \beta_{11} \sigma_{t-1}^{macro} D_i^{public} + \beta_{12} \sigma_{t-1}^{macro} D_i^{nonpublic} \\
& + \beta_{13} Cash_{it} \sigma_{it-1}^{firm} D_i^{public} + \beta_{14} Cash_{it} \sigma_{it-1}^{firm} D_i^{nonpublic} \\
& + \beta_{15} Cach_{it} \sigma_{t-1}^{macro} D_i^{public} + \beta_{16} Cash_{it} \sigma_{t-1}^{macro} D_i^{nonpublic} + f_i + \varepsilon_{it}
\end{aligned} \tag{4}
$$

We assess the indirect effects of idiosyncratic risk (macroeconomic risk) on public and non-public firms' leverage by investigating the significance of β_{13} and β_{14} (β_{15} and β_{16}), respectively. Significance of these coefficients suggests that idiosyncratic and macroeconomic risk affect leverage as firms' cash holdings vary.

4.4 Estimation Procedure

To estimate the models discussed above, one must use an instrumental variable (IV) approach due to endogeneity problem. We use the system generalized method of moments (system-GMM) estimator developed by Blundell and Bond (1998). This methodology allows us to combine equations in differences of the variables with equations in levels as we use the lags of levels and the first-differences of the relevant variables in the model. 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. Under the null hypothesis, the instruments are orthogonal to the errors.

We employ the Arellano and Bond (1991) test for autocorrelation to examine the presence of serial correlation in the residuals. Under the null of no serial correlation, the test asymptotically follows a standard normal distribution. 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. Hence, this test provides a further check on the correct specification of the system-GMM process.

Each table we present below provides the estimates for the J test. These estimates show that the instruments used in the system-GMM estimations are appropriate and satisfy the orthogonality conditions. The Arellano-Bond AR(2) test does not provide any evidence for the presence of second-order serial correlation in the residuals. For brevity, we do not make further comments on these aspects when we discuss the results.

5 Empirical Results

We start our empirical analysis by estimating Equation (2) to examine the role 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 public *versus* non-public firms as depicted in Equation (3). Finally, we estimate Equation (4) to scrutinize the indirect effects of risk on leverage and comment on the total impact of risk on firms' leverage.

5.1 The Impact of Risk on Leverage

The results for Equation (2) are given in Table 5. The first two columns use the GDP-based macroeconomic risk measure and the volatility in the level of sales or the cumulative volatility in sales as idiosyncratic risk measures. The third and fourth columns use our macroeconomic risk measure based on the T-bill rate while firm-specific risks are the same as before.

Before we discuss the impact of risk on leverage, observe that the coefficient of lagged leverage is positive and significant, providing evidence on the persistence of leverage: firms that borrowed in the previous period continue to use debt financing in the current period. Inspecting the firm-specific variables, we see that 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 Titman and Wessels (1988), Fama and French (2002), and Brav (2009).

When we examine the impact of risk on leverage, Table 5 shows that both types of risk exert a significant and negative effect on leverage. The negative effect of idiosyncratic risk on firms' leverage is consistent among others with Titman and Wessels (1988) and Baum et al. (2009). Table 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 regarding the effects of macroeconomic risk on leverage are consistent with the findings of Hatzinikolaou et al. (2002) and Baum et al. (2009).

These results so far provide support for the claim that manufacturing firms in the UK reduce their leverage when macroeconomic or firm-specific risk increases. Next, we examine whether the effects of risk on leverage differ across public and non-public firms.

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

To test whether the impact of risk differs across public *versus* non-public firms, we estimate Equation (3). Table 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 this coefficient for non-public firms is significantly larger than that of public firms, implying that non-public firms' leverage has a greater persistence. This observation is meaningful as non-public firms depend more on short-term debt to carry out their daily business activities while public firms have a wider choice to finance their capital needs. 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 suggesting that non-public manufacturing firms depend more on internally generated funds and cannot reduce their dependence on loans as much as their public counterparts can do. We also find that the effect of investment on leverage is insignificant for non-public firms, whereas, it is significant for public firms. Overall, our results regarding the role of firm-specific variables on leverage are in line with the literature. Hence, we do not further comment on these variables.

When we inspect the role of risk on firms' leverage decisions, we see from Table 6 that both idiosyncratic and macroeconomic risks exert a significant and negative impact on the firm's leverage regardless of the type of the firm. Here, we observe that the impact of idiosyncratic risk on non-public firms is significantly stronger than that on public firms as equality test results given in Panel B show.[17] This confirms that non-public firms' leverage is more sensitive to idiosyncratic risk as compared to public firms' leverage. In contrast, the magnitude of the estimate on macroeconomic risk is larger for public firms in comparison to that of non-public firms, yet there is no statistical difference between the two coefficients.

In summary, the results presented in Table 6 indicate that both groups of firms exhibit a negative sensitivity to idiosyncratic and macroeconomic risk. However, the leverage of non-public firms is more sensitive to idiosyncratic risk than that of public firms. The greater sensitivity of non-public firms to idiosyncratic risk is sensible as these firms are informationally more opaque to their external financiers. Since banks are likely to be more cautious about asymmetric information problems, in an environment where business risk is high, it will be more difficult for non-public firms to attract external funds in periods of heightened firm-specific risk.

5.3 Indirect Effects of Risk: Does Risk Affect Firms' Leverage through Cash Holdings?

We next investigate whether the sensitivity of leverage to risk differs as the financial strength of the firm changes. To examine this possibility, we estimate Equation (4) where cash holdings is used as a measure of the firm's financial strength. Table 7 presents 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.[18] Specifically, Models 1 and 2 quantify the indirect effects of idiosyncratic risk and macroeconomic risk separately, while Model 3 presents the results when both types of risk are present. Note that the direct effects of risk in this set of regressions are similar to those reported earlier and we do not further comment along these lines.

Table 7 shows that the coefficient on the interaction of idiosyncratic risk and cash holdings is negative for both public and non-public firms. However, this coefficient 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. In contrast, the estimates on the interaction of macroeconomic risk and cash holdings are positive for both groups of firms while it is statistically meaningful 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 firm's leverage in times of high macroeconomic risk: given that the public firm's cash stocks are high, the firm's manager can raise more short-term credit in times of high macroeconomic risk. That is, higher macroeconomic risk would not prevent a firm rich in cash holdings to borrow more funds in the short run. Alternative one can suggest that public firms which are rich in cash stocks would prefer to use external funds to finance their operations rather than depleting their internal funds as firms are more likely to face volatility in their retained earnings. The results suggest that non-public firms do not have this option.

5.4 The Full Impact of Risk on Leverage

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

$$\frac{\partial Lev}{\partial \sigma_{firm}} = \hat{\Psi}_{\sigma_{firm}} + \hat{\Psi}_{\sigma_{firmCash}} \times Cash^{*} \quad (5)$$

$$\frac{\partial Lev}{\partial \sigma_{macro}} = \hat{\Psi}_{\sigma_{macro}} + \hat{\Psi}_{\sigma_{macroCash}} \times Cash^{*} \quad (6)$$

where $\hat{\Psi}_{\sigma_{firm}}$ and $\hat{\Psi}_{\sigma_{firmCash}}$ 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 $10th$, $25th$, $50th$, $75th$, $80th$, and $90th$ percentiles. The results of these total derivatives are reported in Tables 8 and 9 for public and non-public firms separately while we plot these estimates in Figures 1–4 along with the 95% confidence interval.

Panel A of Table 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 the firm holds low levels of cash. This finding suggests that idiosyncratic risks do not affect the leverage of those public firms that operate with very low cash holdings (around or less than the $10th$ percentile). However, as cash stocks increase, the public firm's leverage declines with an increase in idiosyncratic risk. In Panel B of the same table, we present the estimates of total derivatives of leverage with respect to macroeconomic risk. Although the total effect is significantly negative at lower levels of cash holdings, it becomes insignificant as public firms accumulate higher levels (at around or more than the $75th$ percentile) of cash.[19] This suggests that those firms which hold low levels of cash during uncertain states of the economy tend to reduce their leverage more than others holding higher levels of cash. In fact, macroeconomic risk does not affect the capital structure of the firm that holds high levels of cash. This observation is opposite of the case for idiosyncratic risk.

Next, we calculate the same set of derivatives for non-public firms and report these estimates in Table 9. Panel A of the table shows that the aggregate effect of idiosyncratic risk is negative and significant at all levels of cash holdings. Furthermore, this effect intensifies as firms increase their cash holdings, implying that those firms that hold more cash tend to reduce their leverage by a greater amount as compared to others that have relatively lower levels of cash holdings when business risk increases. Looking at Panel B of Table 9 we see that the total derivative of leverage with respect 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 more pronounced.

Figures 1 to 4 plot the estimates and the corresponding 95% confidence intervals given in Tables 8 and 9, helping us to visually compare the effects of both types of risk for public and non-public firms. Figures 1 and 3 show that the effect of risk on leverage for both types 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 more than public firms. At low levels of cash, public firms do not respond much to idiosyncratic risk. Perhaps this is due to the fact that public firms have a track record and they can raise short-term funds 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 borrow less due to financial frictions. Interestingly, when firms carry very high levels of cash, the effect of risk on leverage is intensified for both public and non-public firms. This is perhaps managers prefer to use internal funds instead of loans from banks as lenders would demand high risk premiums when firms experience idiosyncratic risk.

Comparing Figures 2 and 4, we see that the effect 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 figures also show that the adverse effects of macroeconomic risk for both types of firms become 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 borrowing in comparison to non-public firms as they can raise funds from the financial markets. Whereas non-public firms are constrained to borrow from the banks. Furthermore, the figure shows, when the cash holdings of companies improve the overall impact of macroeconomic risk on leverage disappears. This is perhaps companies rich in cash can borrow at better terms as they are considered less likely to default in times of heightened macroeconomic risk.

Our investigation suggests that risk does not only exert a direct impact on leverage but it also exerts indirect effects through the firm's financial strength. In particular we show that i) there are (significant) differences on the size of the impact of risk across public and non-public manufacturing companies; ii) the effect of risk on leverage depends on the source of risk and the financial strength of the firm. These observations indicate that models that do not take into account the source of risk as well as the interactions between risk and firms' financial strength are likely to yield biased conclusions.

5.5 Robustness Tests

Our baseline model, Equation (2), is similar to that in Baum et al. (2009) which is driven from a generalized Q model. However, one may argue that omitting various other firm-specific factors which are shown to affect firms' capital structure leads to model misspecification and may bias our findings. Therefore, we re-estimate our models by introducing several additional control variables including the profitability of firm, firm size, tangibility, firm growth, sales-to-total assets, investment, and cash-to-total assets.

To conserve space, in Table 10, we present results for two models only: Model 1 considers the direct impact of risks on firm leverage and Model 2 includes the interaction terms between risk measures and the firm's cash stocks.[20] Similar to our earlier observations, Table 10 shows that both firm-specific and macroeconomic risk affect the firm's leverage negatively. In fact results in this set are stronger: the impact of macroeconomic (idiosyncratic) risk on public firms' leverage is significantly higher (lower) than that of non-public firms. We also find that all interaction coefficients are significant and they have the same sign structure as before. Furthermore, we observe that the coefficients associated with firm-specific variables are similar to the findings reported in the literature.

Last, we use firm-size as an alternative measure of financial strength.[21] The results presented in Table 11 supports our earlier claims that risk affects firms' leverage decision directly on its own and indirectly through the financial strength of firms. Inclusion of firm-specific variables, industry specific dummies, and use of size as an alternative proxy for the firm's financial strength do not affect our claims regarding the impact of risk on firm leverage.

6 Conclusions

In this paper, we investigate the direct and indirect effects of idiosyncratic and macroeconomic risk on public and non-public manufacturing firms' leverage using a panel of UK manufacturing firms. Our data are collected from the FAME database and cover the period between 1999-2008. To quantify the effects of risk on firms' leverage, we estimate several models implementing system generalized method of moments estimator (Blundell and Bond (1998)). In our examination, we use two different proxies for both firm-specific and macroeconomic risk. Our models allow for several firm-specific factors and show that their impacts on leverage are similar to findings reported in the literature.

Our investigation provides evidence that public and non-public UK manufacturing firms' leverage is negatively and significantly affected by macroeconomic and idiosyncratic risks. Particularly, we find that non-public firms' leverage exhibits a greater sensitivity to idiosyncratic risk as compared to that of public firms. This observation is in line with the view that an increase in business risk causes non-public firms to depend more on their retained earnings as external finance is restricted due to the presence of financial frictions. When examine the impact of macroeconomic risk on leverage, we find that there is no significant difference across public *versus* non-public firms. It appears that firms in each category become cautious about financial distress costs during periods of high macroeconomic risk and carry less debt. These results hold true for different risk proxies for either type of risk.

We next examine the possibility that risk may affect leverage indirectly through firms' financial strength. Our investigation finds that the impact of risk on leverage differs with respect to the firm's financial strength which we measure by the firm's cash holdings. 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 observation and provides evidence that the total effect of risk on leverage is not constant but varies with respect to its source and the financial strength of the firm.

We check the robustness of our findings by carrying out a battery of additional regressions. In particular, we check to see whether our investigation yields similar results as we augment our model with additional firm-specific variables. We also check if the results differ when we use firm-size as a measure of financial strength. On the whole, these models provide further support for our earlier findings.

Our investigation suggests that researchers should consider the effects of both macroeconomic and idiosyncratic risks while studying firms' optimal leverage over and above the other factors that have been examined in the literature. Furthermore, the indirect effects of risk on firms' leverage decisions should not be overlooked. Last but not the least, for completeness and comparison purposes, it would be useful to examine the response of non-financial firms' capital structure to changes in macroeconomic and idiosyncratic risk.

Notes

[1]See, for instance, among several others, Titman and Wessels (1988), Rajan and Zingales (1995), Hovakimian et al. (2001), Fama and French (2002), Hall et al. (2004), Hennessy and Whited (2005), De Jong et al. (2008), Frank and Goyal (2009), and Huang and Ritter (2009) on the empirical validity of these factors. Several researchers, including Marsh (1982), Bennett and Donnelly (1993), Lasfer (1995), Chittenden et al. (1996), Walsh and Ryan (1997), Jordon et al. (1998), Ozkan (2001), and Antoniou et al. (2008) have also examined the empirical determinants of capital structure using firm-level data from the UK. These studies have ignored the role of risk in determining firms' capital structure.

[2]See Kolasinski (2009) and Graham and Leary (2011) for an excellent survey of the empirical literature on capital structure.

[3]See, for instance, Frank and Goyal (2008), Brav (2009), Goyal et al. (2011), and Saunders and Steffen (2011) on how non-public firms differ from public firms. Also see Stulz (1988), Amihud et al. (1990), Morellec (2004), and Faulkender and Petersen (2006) on the leverage and firms' access to external sources of funds.

[4]See Klein et al. (2002) for a review on the effects of information asymmetry on firms' financing choice, and Saunders and Steffen (2011), Berger and Udell (1995), and Petersen and Rajan (1994) on the cost of borrowing and credit rationing across the two types of firms. Also see Chittenden et al. (1996) who show that unlisted firms depend more on their use of short-term debt due to lack of access to external capital markets. Likewise, Mayer and Alexander (1991) document that non-public firms invest less and grow slowly than public firms.

[5]See Baum et al. (2010) for more along these lines.

[6]See, for instance, Bernanke and Gertler (1989), Calomiris and Hubbard (1990), Gertler (1992), Greenwald and Stiglitz (1993), Gertler and Gilchrist (1993), and Kiyotaki and Moore (1997).

[7] See http://www.companieshouse.gov.uk/ for more information about Companies House.

[8] According to the Companies Act, a company is classified into "medium" ("small") category based on 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).

[9]See, for instance, Brav (2009), who applies similar screening methods.

[10]We removed those companies whose accounting year-end date have changed over the duration of the investigation.

[11]It should be noted that there are only a handful of such observations. To be more precise, this restriction led us to drop 3 observations for sales; 2 observations for total assets; 8 for short-term debt; and 76 for fixed investment.

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

[13]Baum et al. (2009) follow a similar approach.

[14]The diagnostic tests provide evidence that our models are well-specified and there are no remaining ARCH effects in the residuals.

[15] 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.

[16]Almeida et al. (2004) also show that macroeconomic conditions have a significant impact on financially constrained firms' cash holdings.

[17]The equality of coefficients is rejected in all four models for idiosyncratic risk.

[18]The results from other combinations are qualitatively similar to those in Table 7 and are available from the authors on request.

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

[20]We also estimate these models by including industry dummies to account for industry-specific fixed effects. The results are similar to those in Table 10 and are available from the authors.

[21]Several researchers have used firm size as an indicator of financial constraints.

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References

Aizenman, J. and N. Marion (1999). Volatility and investment: Interpreting evidence from developing countries. *Economica 66*(262), 157–179.

Akhtar, S. (2011). Capital structure and business cycles. *Accounting & Finance*, forthcoming.

Almeida, H., M. Campello, and M. S. Weisbach (2004). The cash flow sensitivity of cash. *Journal of Finance 59*(4), 1777–1804.

Amihud, Y., B. Lev, and N. G. Travlos (1990). Corporate control and the choice of investment financing: The case of corporate acquisitions. *Journal of Finance 45*(2), 603–616.

Antoniou, A., Y. Guney, and K. Paudyal (2008). The determinants of capital structure: Capital market-oriented versus bank-oriented institutions. *Journal of Financial and Quantitative Analysis 43*(1), 59–92.

Arellano, M. and S. Bond (1991). Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *Review of Economic Studies 58*(2), 277–297.

Bancel, F. and U. Mittoo (2004). Cross-country determinants of capital structure choice: A survey of European firms. *Financial Management 33*(1), 103–132.

Bartram, S. (2002). The interest rate exposure of nonfinancial corporations. *Europen Financial Review 6*(1), 101–125.

Baum, C. F., M. Caglayan, A. Stephan, and O. Talavera (2008). Uncertainty determinants of corporate liquidity. *Economic Modelling 25*(5), 833–849.

Baum, C. F., M. Caglayan, and O. Talavera (2010). On the sensitivity of firms' investment to cash flow and uncertainty. *Oxford Economic Papers 62*(2), 186–306.

Baum, C. F., A. Stephan, and O. Talavera (2009). The effects of uncertainty on the leverage of nonfinancial firms. *Economic Inquiry 47*(2), 216–225.

Baxter, N. D. (1967). Leverage, risk of ruin and the cost of capital. *Journal of Finance 22*(3), 395–403.

Bennett, M. and R. Donnelly (1993). The determinants of capital structure: Some UK evidence. *British Accounting Review 25*(1), 43–59.

Berger, A. N. and G. F. Udell (1995). Small firms, commercial lines of credit, and collateral. *Journal of Business 68*(3), 351–382.

Bernanke, B. and M. Gertler (1989). Agency costs, net worth, and business fluctuations. *American Economic Review 79*(1), 14–31.

Bhamra, H. S., L. A. Kuehn, and I. A. Strebulaev (2010). The aggregate dynamics of capital structure and macroeconomic risk. *Review of Financial Studies 23*(12), 4187–4241.

Blundell, R. and S. Bond (1998). Initial conditions and moment restrictions in dynamic panel data models. *Journal of Econometrics 87*(1), 115–143.

Bo, H. and R. Lensink (2005). Is the investment-uncertainty relationship nonlinear? An empirical analysis for the Netherlands. *Economica 72*(286), 307–331.

Bradley, M., G. A. Jarrell, and E. H. Kim (1984). On the existence of an optimal capital structure: Theory and evidence. *Journal of Finance 39*(3), 857–878.

Brav, O. (2009). Access to capital, capital structure, and the funding of the firm. *Journal of Finance 64*(1), 263–308.

Brounen, D., A. De Jong, and K. Koedijk (2004). Corporate finance in Europe: Confronting theory with practice. *Financial Management 33*(1), 71–101.

Calomiris, C. W. and R. G. Hubbard (1990). Firm heterogeneity, internal finance, and credit rationing. *Economic Journal 100*(399), 90–104.

Cassar, G. and S. Holmes (2003). Capital structure and financing of SMEs: Australian evidence. *Accounting & Finance 43*(2), 123–147.

Chen, H. (2010). Macroeconomic conditions and the puzzles of credit spreads and capital structure. *Journal of Finance 65*(6), 2171–2212.

Chittenden, F., G. Hall, and P. Hutchinson (1996). Small firm growth, access to capital markets and financial structure: Review of issues and an empirical investigation. *Small Business Economics 8*(1), 59–67.

Choe, H., R. W. Masulis, and V. Nanda (1993). Common stock offerings across the business cycle: Theory and evidence. *Journal of Empirical Finance 1*(1), 3–31.

Chu, P. Y., S. Wu, and S. F. Chiou (1992). The determinants of corporate capital structure choice: Taiwan evidence. *Journal of Management Science 9*(2), 159–177.

Comin, D. and T. Philippon (2005). The rise in firm-level volatility: Causes and consequences. *NBER Macroeconomics Annual*, 167–201.

Cook, D. O. and T. Tang (2010). Macroeconomic conditions and capital structure adjustment speed. *Journal of Corporate Finance 16*(1), 73–87.

Crutchley, C. E. and R. S. Hansen (1989). A test of the agency theory of managerial ownership, corporate leverage, and corporate dividends. *Financial Management 18*(4), 36–46.

De Jong, A., R. Kabir, and T. Nguyen (2008). Capital structure around the world: The roles of firm-and country-specific determinants. *Journal of Banking & Finance 32*(9), 1954–1969.

Driver, C., P. Temple, and G. Urga (2005). Profitability, capacity, and uncertainty: A model of UK manufacturing investment. *Oxford Economic Papers 57*(1), 120–141.

Drobetz, W., P. Pensa, and G. Wanzenried (2007). Firm characteristics, economic conditions and capital structure adjustments. Working paper 16/07, Wirtschaftswissenschaftliches Zentrum (WWZ) Der Universitate Basel.

Fama, E. F. and K. R. French (2002). Testing trade-off and pecking order predictions about dividends and debt. *Review of Financial Studies 15*(1), 1–33.

Faulkender, M. and M. Petersen (2006). Does the source of capital affect capital structure? *Review of Financial Studies 19*(1), 45–79.

Ferri, M. G. and W. H. Jones (1979). Determinants of financial structure: A new methodological approach. *Journal of Finance 34*(3), 631–644.

Flath, D. and C. R. Knoeber (1980). Taxes, failure costs, and optimal industry capital structure: An empirical test. *Journal of Finance 35*(1), 99–117.

Frank, M. Z. and V. K. Goyal (2008). Trade-off and pecking order theories of debt. *in B.E. Eckb., Ed. Handbook of Corporate Finance: Empirical Corporate Finance* (2), 135–202.

Frank, M. Z. and V. K. Goyal (2009). Capital structure decisions: Which factors are reliably important? *Financial Management 38*(1), 1–37.

Friend, I. and L. H. P. Lang (1988). An empirical test of the impact of managerial self-interest on corporate capital structure. *Journal of Finance 43*(2), 271–281.

Gertler, M. (1992). Financial capacity and output fluctuations in an economy with multi-period financial relationships. *Review of Economic Studies 59*(3), 455–472.

Gertler, M. and S. Gilchrist (1993). The role of credit market imperfections in the monetary transmission mechanism: Arguments and evidence. *Scandinavian Journal of Economics 95*(1), 43–64.

Gertler, M. and S. Gilchrist (1994). Monetary policy, business cycles, and the behavior of small manufacturing firms. *Quarterly Journal of Economics 109*(2), 309–340.

Gertler, M. and R. G. Hubbard (1993). Corporate financial policy, taxation, and macroecononmic risk. *Rand Journal of Economics 24*(2), 286–303.

Ghosal, V. and P. Loungani (1996). Product market competition and the impact of price uncertainty on investment: Some evidence from US manufacturing industries. *Journal of Industrial Economics 44*(2), 217–228.

Ghosal, V. and P. Loungani (2000). The differential impact of uncertainty on investment in small and large businesses. *Review of Economics and Statistics 82*(2), 338–343.

Goyal, V. K., A. Nova, and L. Zanetti (2011). Capital market access and financing of private firms. *International Review of Finance 11*(2), 155–179.

Graham, J. and C. Harvey (2001a). Expectations of equity risk premia, volatility and asymmetry from a corporate finance perspective. NBER working paper, USA.

Graham, J. R. and C. R. Harvey (2001b). The theory and practice of corporate finance: Evidence from the field. *Journal of Financial Economics 60*(2-3), 187–243.

Graham, J. R. and M. T. Leary (2011). A review of empirical capital structure research and directions for the future. *Annual Review of Financial Economics 3*(1), forthcoming.

Greenwald, B. C. and J. E. Stiglitz (1993). Financial market imperfections and business cycles. *Quarterly Journal of Economics 108*(1), 77–114.

Hackbarth, D., J. Miao, and E. Morellec (2006). Capital structure, credit risk, and macroeconomic conditions. *Journal of Financial Economics 82*(3), 519–550.

Hall, G. C., P. J. Hutchinson, and N. Michaelas (2004). Determinants of the capital structures of European SMEs. *Journal of Business Finance & Accounting 31*(5-6), 711–728.

Hatzinikolaou, D., G. M. Katsimbris, and A. G. Noulas (2002). Inflation uncertainty and capital structure: Evidence from a pooled sample of the Dow-Jones industrial firms. *International Review of Economics & Finance 11*(1), 45–55.

Hennessy, C. A. and T. M. Whited (2005). Debt dynamics. *Journal of Finance 60*(3), 1129–1165.

Heyman, D., M. Deloof, and H. Ooghe (2008). The financial structure of private held Belgian firms. *Small Business Economics 30*(3), 301–313.

Hovakimian, A., T. Opler, and S. Titman (2001). The debt-equity choice. *Journal of Financial and Quantitative Analysis 36*(1), 1–24.

Huang, R. and J. R. Ritter (2009). Testing theories of capital structure and estimating the speed of adjustment. *Journal of Financial and Quantitative Analysis 44*(2), 237–271.

Huizinga, J. (1993). Inflation uncetainty, relative price uncertainty and invesment in U.S. manufacturing. *Journal of Money, Credit and Banking 25*(3), 521–549.

Jaffe, J. F. and R. Westerfield (1987). Risk and the optimal debt level. *Modern Finance and Industrial Economics: Papers in Honour of I. Weston, Oxford: Blackwell, UK*.

Jordon, J., J. Lowe, and P. Taylor (1998). Strategy and financial policy in UK small firms. *Journal of Business Finance & Accounting 25*(1-2), 1–27.

Kale, J. R., T. H. Noe, and G. G. Ramirez (1991). The effect of business risk on corporate capital structure: Theory and evidence. *Journal of Finance 46*(5), 1693–1715.

Kaufmann, D., G. Mehrez, and S. L. Schmukler (2005). Predicting currency fluctuations and crises: Do resident firms have an informational advantage? *Journal of International Money and Finance 24*(6), 1012–1029.

Kim, W. S. and E. H. Sorensen (1986). Evidence on the impact of the agency costs of debt on corporate debt policy. *Journal of Financial and Quantitative Analysis 21*(2), 131–144.

Kiyotaki, N. and J. Moore (1997). Credit cycles. *Journal of Political Economy 105*(2), 211–248.

Klein, L., T. O'Brien, and S. Peters (2002). Debt vs. equity and asymmetric information: A review. *Financial Review 37*(3), 317–349.

Kolasinski, A. C. (2009). Subsidiary debt, capital structure and internal capital markets. *Journal of Financial Economics 94*(2), 327–343.

Korajczyk, R. A. and A. Levy (2003). Capital structure choice: Macroeconomic conditions and financial constraints. *Journal of Financial Economics 68*(1), 75–109.

Lasfer, M. A. (1995). Agency costs, taxes and debt: The UK evidence. *European Financial Management 1*(3), 265–285.

Leahy, J. and T. Whited (1996). The effect of uncertainty on investment: Some stylized facts. *Journal of Money, Credit and Banking 28*(1), 64–83.

Lemmon, M. L., M. R. Roberts, and J. F. Zender (2008). Back to the beginning: Persistence and the cross-section of corporate capital structure. *Journal of Finance 63*(4), 1575–1608.

Levy, A. and C. Hennessy (2007). Why does capital structure choice vary with macroeconomic conditions? *Journal of Monetary Economics 54*(6), 1545–1564.

MacKie-Mason, J. K. (1990). Do taxes affect corporate financing decisions? *Journal of Finance 45*(5), 1471–1493.

Marsh, P. (1982). The choice between equity and debt: An empirical study. *Journal of Finance 37*(1), 121–144.

Mayer, C. and I. Alexander (1991). Stock markets and corporate performance: A comparison of quoted and unquoted companies. Working No. 571, Centre for Economic Policy Research, London, UK.

Michaelas, N., F. Chittenden, and P. Poutziouris (1999). Financial policy and capital structure choice in UK SMEs: Empirical evidence from company panel data. *Small Business Economics 12*(2), 113–130.

Modigliani, F. and M. H. Miller (1958). The cost of capital, corporation finance and the theory of investment. *American Economic Review 48*(3), 261–297.

Morellec, E. (2004). Can managerial discretion explain observed leverage ratios? *Review of Financial Studies 17*(1), 257–294.

Morgan, D. P., B. Rime, and P. E. Strahan (2004). Bank integration and state business cycles. *Quarterly Journal of Economics 119*(4), 1555–1584.

Mueller, E. (2008). How does owners exposure to idiosyncratic risk influence the capital structure of private companies? *Journal of Empirical Finance 15*(2), 185–198.

Myers, S. C. (1977). Determinants of corporate borrowing. *Journal of Financial Economics 5*(2), 147–175.

Ozkan, A. (2001). Determinants of capital structure and adjustment to long run target: Evidence from UK company panel data. *Journal of Business Finance & Accounting 28*(1-2), 175–198.

Petersen, M. and R. Rajan (1994). The benefits of lending relationships: Evidence from small business data. *Journal of Finance 49*(1), 3–37.

Rajan, R. G. and L. Zingales (1995). What do we know about capital structure? Some evidence from international data. *Journal of Finance 50*(5), 1421–1460.

Saunders, A. and S. Steffen (2011). The costs of being private: Evidence from the loan market. *Review of Financial Studies 24*(12), 4091–4122.

Stulz, R. M. (1988). Managerial control of voting rights: Financing policies and the market for corporate control. *Journal of Financial Economics 20*, 25–54.

Titman, S. and R. Wessels (1988). The determinants of capital structure choice. *Journal of Finance 43*(1), 1–19.

Toy, N., A. Stonehill, L. Remmers, and R. Wright (1974). A comparative international study of growth, profitability, and risk as determinants of corporate debt ratios in the manufacturing sector. *Journal of Financial and Quantitative Analysis 9*(5), 875–886.

Wald, J. K. (1999). How firm characteristics affect capital structure: An international comparison. *Journal of Financial Research 22*(2), 161–187.

Walsh, E. J. and J. Ryan (1997). Agency and tax explanations of security issuance decisions. *Journal of Business Finance & Accounting 24*(7-8), 943–961.

Table 1: Descriptive Statistics of Firm-Specific Variables

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 of public and non-public firms are reported in brackets. * denotes statistical significance at the 1% level of significance.

Table 2: Summary Statistics of Proxies for Risk

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. Dev.	2.023	7.707	0.046	3.142
P25	0.033	0.007	0.011	1.988
P50	0.069	0.024	0.011	1.988
P75	0.185	0.087	0.026	8.017

Notes: Firm-specific risk measures (σ_{it}^{level} and $\sigma_{it}^{cumulative}$) are computed from firms' sales. Macroeconomic risk measures (σ_t^{T-bill} and σ_t^{GDP}) are based on T-bill rates and real GDP.

Table 3: Correlations of Idiosyncratic and Macroeconomic Risk Proxies

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

Notes: See notes to Table 2.

Table 4: Correlation of Risk and Leverage

Variables	Leverage	
	Non-public	Public
σ_{it}^{level}	-0.008**	-0.035**
$\sigma_{it}^{cumulative}$	-0.025**	-0.021**
σ_t^{T-bill}	-0.012**	-0.002**
σ_t^{GDP}	-0.009**	-0.037**

Table 5: Robust Two-step System-GMM Estimates for Effects of Risk on Leverage

Panel A: Estimation results

Regressors	Model 1	Model 2	Model 3	Model 4
	Coeff. Std.Err.	Coeff. Std.Err.	Coeff. Std.Err.	Coeff. Std.Err.
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_{t-1}^{GDP}	-0.010 (0.002)***	-0.010 (0.002)***		
σ_{t-1}^{T-bill}			-0.453 (0.159)***	-0.844 (0.233)***
σ_{it-1}^{level}	-0.022 (0.008)***		-0.023 (0.009)***	
$\sigma_{it-1}^{cumulative}$		-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

	Model 1	Model 2	Model 3	Model 4
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

Notes: The $J-statistic$, which is a test of the over identifying restrictions, is distributed as chi-squared under the null of instrument validity and AR(2) is the Arellano-Bond test of second-order autocorrelation in the first-differenced residuals. Significance at the 1%, 5%, and 10% level is indicated by ***, **, and *, respectively.

Table 6: Robust Two-step System-GMM Estimates for Differential Effects of Risk on the Leverage of Public and Non-public Firms

Regressors	Model 1	Model 2	Model 3	Model 4
	Coeff. Std.Err.	Coeff. Std.Err.	Coeff. Std.Err.	Coeff. Std.Err.
Panel A: Estimation results				
$D_i^{nonpublic}.Lev_{it-1}$	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

Notes: See notes to Table 5.

Table 7: Indirect Effects of Risk on the Leverage of Public and Non-public Firms

Regressors	Model 1 Coeff. Std.Err.	Model 2 Coeff. Std.Err.	Model 3 Coeff. Std.Err.
Panel A: Estimation results			
$D_i^{nonpublic}.Lev_{it-1}$	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

Notes: See notes to Table 5.

Table 8: Sensitivity of Public Firms' Leverage to Risk and Cash Holdings

	P10	P25	P50	P75	P80	P90
Panel A: Idiosyncratic 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
$\frac{\partial Lev}{\partial \sigma_{firm}}$	-0.002	-0.004	-0.010	-0.025	-0.031	-0.051
Std. Err.	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. Err.	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

Table 9: Sensitivity of Non-Public Firms' Leverage to Risk and Cash Holdings

	P10	P25	P50	P75	P80	P90
Panel A: Idiosyncratic 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
$\frac{\partial Lev}{\partial \sigma_{firm}}$	-0.034	-0.035	-0.038	-0.044	-0.047	-0.054
Std. Err.	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. Err.	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

Table 10: Robustness: Direct and Indirect Effects of Risk on Leverage while Controlling for Additional Firm-Specific Variables

	Model 1		Model 2	
	Coefficient	**Std. Error**	**Coefficient**	**Std. Error**
Panel A: Estimation Results; Dependent Variable: Leverage				
$D_i^{nonpublic}.Lev_{it-1}$	0.779	(0.039)***	0.836	(0.015)***
$D_i^{public}.Lev_{it-1}$	0.528	(0.050)***	0.625	(0.031)***
$D_i^{nonpublic}.Cash_{it}$	-0.046	(0.010)***	-0.059	(0.018)***
$D_i^{public}.Cash_{it}$	-0.247	(0.053)***	-0.224	(0.034)***
$D_i^{nonpublic}.Investment_{it}$	0.010	(0.020)	0.018	(0.025)
$D_i^{public}.Investment_{it}$	0.089	(0.037)**	0.127	(0.026)***
$D_i^{nonpublic}.Sales_{it}$	-0.017	(0.002)***	-0.016	(0.001)***
$D_i^{public}.Sales_{it}$	-0.029	(0.007)***	-0.029	(0.003)***
$D_i^{nonpublic}.Profitability_{it}$	-0.316	(0.039)**	-0.138	(0.033)***
$D_i^{public}.Profitability_{it}$	-0.219	(0.048)***	-0.120	(0.022)***
$D_i^{nonpublic}.Tangibility_{it}$	0.034	(0.011)***	0.037	(0.004)***
$D_i^{public}.Tangibility_{it}$	0.036	(0.013)***	0.042	(0.005)***
$D_i^{nonpublic}.Size_{it}$	0.028	(0.005)***	0.023	(0.000)***
$D_i^{public}.Size_{it}$	0.034	(0.004)***	0.026	(0.000)***
$D_i^{nonpublic}.Growth_{it}$	-0.032	(0.009)***	-0.034	(0.018)***
$D_i^{public}.Growth_{it}$	-0.066	(0.006)***	-0.048	(0.010)***
$D_i^{nonpublic}.\sigma_{t-1}^{GDP}$	-0.013	(0.000)**	-0.014	(0.000)***
$D_i^{public}.\sigma_{t-1}^{GDP}$	-0.024	(0.000)**	-0.030	(0.001)***
$D_i^{nonpublic}.\sigma_{it-1}^{level}$	-0.036	(0.000)***	-0.039	(0.002)***
$D_i^{public}.\sigma_{it-1}^{level}$	-0.007	(0.000)***	-0.008	(0.002)**
$D_i^{nonpublic}.Cash_{it}.\sigma_{it-1}^{level}$			-0.046	(0.044)
$D_i^{public}.Cash_{it}.\sigma_{it-1}^{level}$			-0.154	(0.006)***
$D_i^{nonpublic}.Cash_{it}.\sigma_{t-1}^{GDP}$			0.028	(0.000)***
$D_i^{public}.Cash_{it}.\sigma_{t-1}^{GDP}$			0.115	(0.001)***
Constant	-0.399	(0.047)***	-0.076	(0.028)***
Panel B: Diagnostic tests				
Firm-years	22,375		22,375	
Firm	5,254		5,254	
AR(2)	1.690		1.620	
p-value	0.182		0.196	
J-statistic	84.080		145.620	
p-value	0.599		0.623	

Notes: See notes to Table 5.

Table 11: Robustness: Indirect Effects of Risk on Leverage using Firm Size as a Proxy for Firms' Financial Strength and Controlling for Industry-Specific Effects

Panel A: Estimation Results; Dependent Variable: Leverage

	Coefficient	**Std. Error**
$D_i^{nonpublic}.Lev_{it-1}$	0.843	(0.015)***
$D_i^{public}.Lev_{it-1}$	0.612	(0.026)***
$D_i^{nonpublic}.Cash_{it}$	-0.064	(0.018)***
$D_i^{public}.Cash_{it}$	-0.219	(0.042)***
$D_i^{nonpublic}.Investment_{it}$	0.022	(0.026)
$D_i^{public}.Investment_{it}$	0.135	(0.032)***
$D_i^{nonpublic}.Sales_{it}$	-0.017	(0.001)***
$D_i^{public}.Sales_{it}$	-0.031	(0.003)***
$D_i^{nonpublic}.Profitability_{it}$	-0.138	(0.042)***
$D_i^{public}.Profitability_{it}$	-0.120	(0.020)***
$D_i^{nonpublic}.Tangibility_{it}$	0.036	(0.004)***
$D_i^{public}.Tangibility_{it}$	0.043	(0.021)***
$D_i^{nonpublic}.Size_{it}$	0.017	(0.000)***
$D_i^{public}.Size_{it}$	0.020	(0.000)***
$D_i^{nonpublic}.Growth_{it}$	-0.037	(0.018)***
$D_i^{public}.Growth_{it}$	-0.049	(0.011)***
$D_i^{nonpublic}.\sigma_{t-1}^{GDP}$	-0.011	(0.000)***
$D_i^{public}.\sigma_{t-1}^{GDP}$	-0.023	(0.001)***
$D_i^{nonpublic}.\sigma_{it-1}^{level}$	-0.048	(0.002)***
$D_i^{public}.\sigma_{it-1}^{level}$	-0.009	(0.006)
$D_i^{nonpublic}.Size_{it}.\sigma_{it-1}^{level}$	-0.016	(0.001)***
$D_i^{public}.Size_{it}.\sigma_{it-1}^{level}$	-0.027	(0.005)***
$D_i^{nonpublic}.Size_{it}.\sigma_{t-1}^{GDP}$	0.015	(0.009)*
$D_i^{public}.Size_{it}.\sigma_{t-1}^{GDP}$	0.088	(0.000)***
Constant	-0.135	(0.018)***
Panel B: Diagnostic tests		
Firm-years	22,375	
Firm	5,254	
AR(2)	1.650	
p-value	0.182	
J-statistic	135.490	
p-value	0.398	

Notes: See notes to Table 5.

Figure 1

Marginal Effects of Idiosyncratic Uncertainty on Public Firms' Leverage

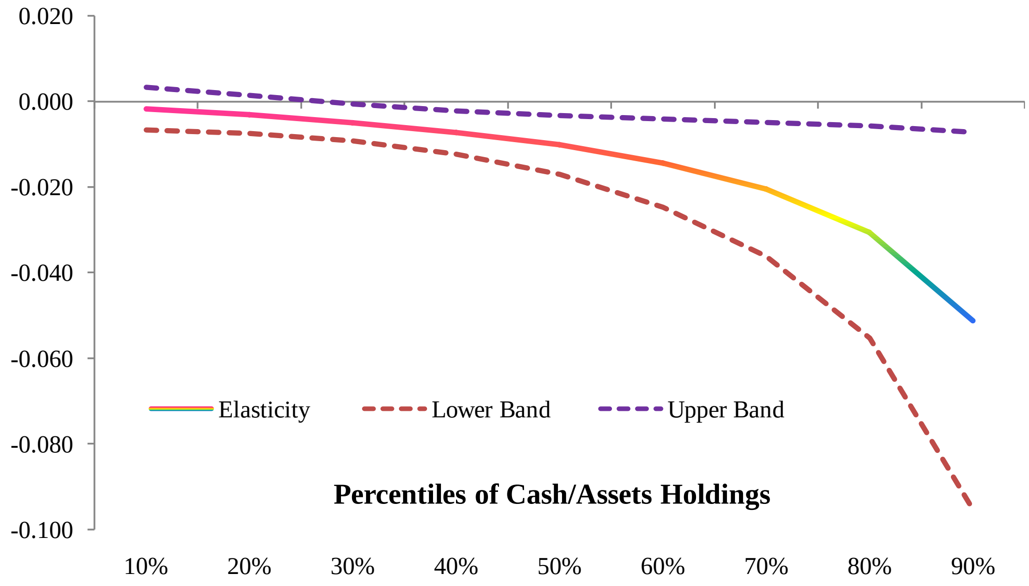


Figure 2

Marginal Effects of Macroeconomic Uncertainty on Public Firms' Leverage

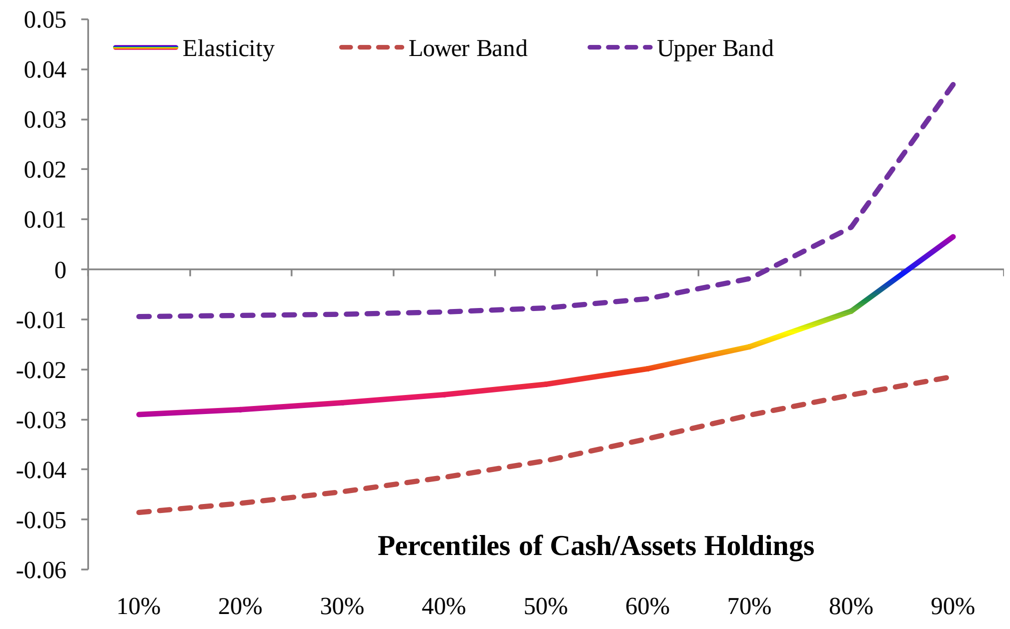


Figure 3

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

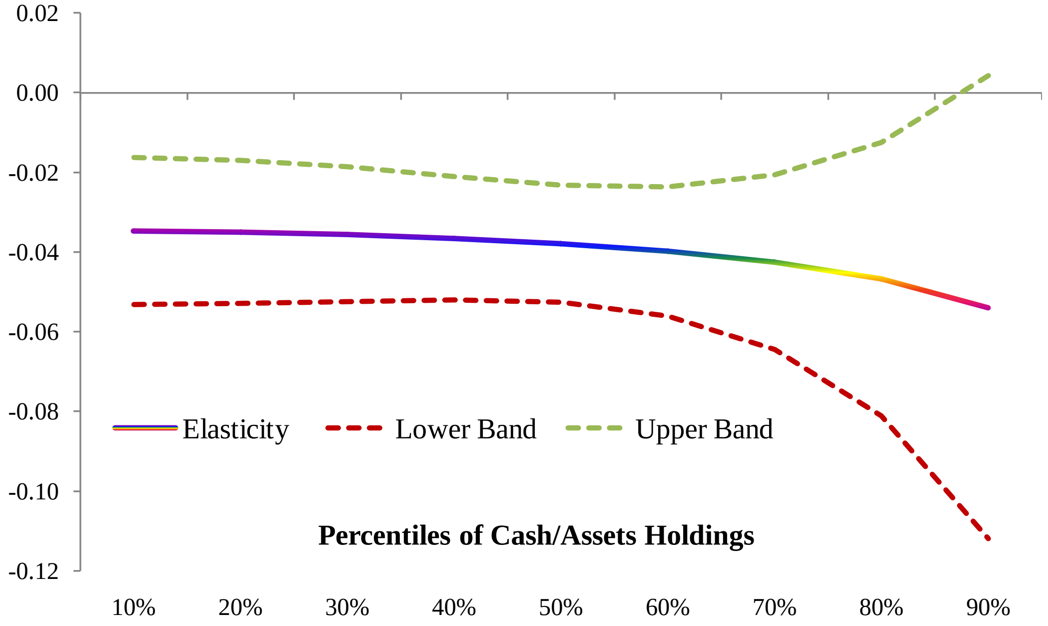
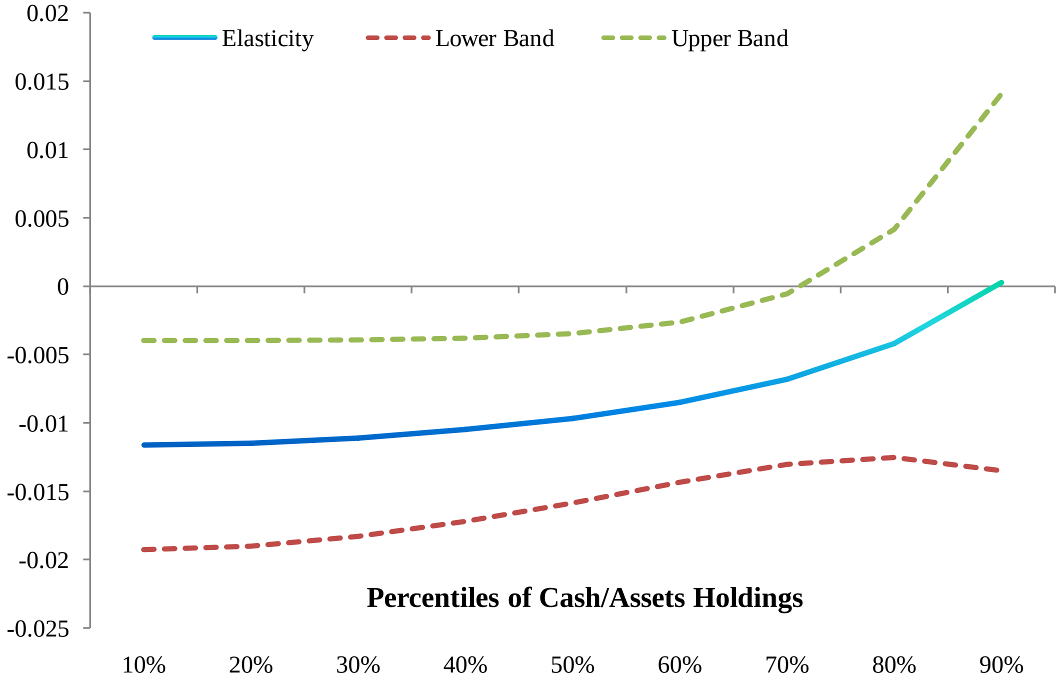


Figure 4

Marginal Effects of Macroeconomic Uncertainty on Non-Public Firms' Leverage



Appendix
Table A.1: Symbol and Definitions of Variables

Symbol	Variable	Definition
Lev_{it}	Sort-term debt/total assets	Short-term debt at the end of this year divided by total assets
$Sales_{it}$	Sales/total assets	Total turnover during a year divided by total assets
$Invt_{it}$	Investment/total assets	Fixed investment expenditures divided by total assets
$Cash_{it}$	Cash/ total assets	Cash and equivalent divided by total assets
$Size_{it}$	Firm size	The natural log of total assets normalized by consumer price index.
$Tangibility_{it}$	Tangibility	Tangibility is the ratio of tangible assets to total assets.
$Profitability_{it}$	Firm profitability	The ratio of earnings before interest and taxes to total assets.
$Growth_{it}$	Firm growth	Growth is defined as the difference of the log of net sales normalized by consumer price index.
$D_i^{nonpublic}$	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 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 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_t^{GDP}	Conditional variance for real gross domestic product (GDP)	ARCH/GARCH specifications are used for real UK GDP to obtain the conditional variance as proxy for macroeconomic uncertainty.
σ_t^{TBR}	Conditional variance for Treasury bill rates (T-bill rates)	ARCH/GARCH models are estimated for T-bill rates to proxy for macroeconomic uncertainty.

Table A.2: ARCH/GARCH Estimates for Macroeconomic Risk

Regressors	ΔTBR		ΔGDP	
	Coeff.	Std.Err.	Coeff.	Std.Err.
ΔX_{t-1}	-0.120	(0.271)	0.232	(0.112)**
ΔX_{t-2}	0.353	(0.187)*	-0.001	(0.147)
Constant	0.013	(0.006)**	2.789	(0.917)***
MA(1)	0.577	(0.274)**		
ARCH(1)	0.724	(0.164)***	0.859	(0.368)**
GARCH(1)	0.271	(0.128)**		
Constant	0.005	(0.001)***	1.281	(0.420)***
Diagnostic tests for remaining GARCH effects				
Log-likelihood	92.569		-103.101	
Observations	148.000		51.000	
LM-test(4)	0.140		2.510	
P-value	0.997		0.643	
Q(8)	3.274		11.225	
P-value	0.916		0.189	
Q(15)	3.865		16.009	
P-value	0.998		0.381	

Statistical significance at the 1%, 5%, and 10% level is indicated by ***, **, and *, respectively.