Capital Structure Adjustments: Do Macroeconomic and Business Risks Matter?

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December 12, 2013

Abstract

We empirically examine the association between firms' capital structure adjustments and risk. We find that the adjustment process is asymmetric and depends on the type of risk, its magnitude, the firm's current leverage and its financial status. We also show that firms with financial surpluses and above-target leverage adjust their leverage more rapidly when firm-specific risk is low and when macroeconomic risk is high. Firms with financial deficits and below-target leverage adjust their capital structure more quickly when both types of risk are low. Our findings help to explain why managers seek to time equity and debt markets.

Keywords: macroeconomic risk; business risk; capital structure rebalancing; speed of adjustment; deviations from target leverage; financial deficits/surpluses
JEL classification: C23, D81, E44, G32

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1 Introduction

Following the seminal paper by Modigliani and Miller (1958), researchers have proposed several theoretical models to explain the capital structure of firms. Subsequent empirical studies based on these models have helped us to develop a basic understanding of the factors that affect a firm's capital structure decisions. However, these suggested theoretical models, including the trade-off, pecking order, inertia, and market timing theories, do not fully explain the observed time series and the cross-sectional dynamics of corporate capital structures documented in the literature.

More recently, rather than estimating factors that affect firms' capital structure, researchers have begun to estimate the speed of adjustment with which firms reverse deviations from their target debt ratios. Given an estimate of this coefficient, one can then determine whether the manager has a target leverage ratio, as the trade-off theory maintains, or whether the manager does not strive to achieve a certain leverage target, as the pecking order, market timing, and inertia theories of capital structure would suggest. Using survey evidence, Graham and Harvey (2001) found that about 44% of the sample firms have a strict target, about 34% of the firms have a flexible target debt ratio, and only 19% of the firms do not have a target capital structure. This implies that the estimated speed of adjustment should be consistently high in support of the trade-off theory.

We observe substantial variations in the speed of adjustment estimates which range from almost half a year to six years.[1] Several researchers report either slow or negative speed of adjustment estimates.[2] For instance, 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 striving 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 actively adjust their capital structure. Several other researchers document evidence of

[1] Table A, Appendix A lists the speed of adjustment estimates recently reported in the literature.

[2] See, for instance, Fama and French (2002), Xu (2007), Kayhan and Titman (2007), Huang and Ritter (2009), Brav (2009), and Iliev and Welch (2010).

a relatively rapid adjustment toward the target.[3] Overall, it seems that "[c]orporate leverage is mean reverting at the firm level. The speed at which this happens is not a settled issue" (p. 185) as Frank and Goyal (2008) claim.

Another stream of literature investigates asymmetries in speeds of adjustment across firms. Several recent studies have found that as costs and benefits of capital structure adjustments differ across firms, so does the speed at which firms adjust capital structure toward the target (e.g., Byoun (2008), Elsas and Florysiak (2010), Faulkender et al. (2012), and Dang et al. (2012)). These studies indicate that firm-specific factors such as financing gaps, equity market valuations, firm size, profitability and leverage deviations from the target cause asymmetries in adjustment speed across firms. Other studies, such as Cook and Tang (2010), Drobetz and Wanzenried (2006), and Haas and Peeters (2006), have related the asymmetric speed of adjustment to macroeconomic conditions measured by real GDP.

Is there a resolution to these conflicting results? Recent research suggests that the seemingly passive attitude of firms toward leverage targets could be due to mismeasurement of the speed of adjustment. Some researchers argue that the standard partial-adjustment models of leverage lack power to separate the benefits of achieving targets from other motivations of financing (e.g., see Shyam-Sunder and Myers (1999) and Chang and Dasgupta (2009)). Others indicate that estimated leverage adjustment speeds in previous studies are biased (e.g., see Flannery and Rangan (2006), and Huang and Ritter (2009)).

Yet another reason why the speed of adjustment estimates differ could be due to variations in the costs and benefits of capital structure adjustments across firms. Several recent studies depart from estimating a homogenous speed of adjustment for all firms in the sample by examining a modified form of the partial- and full-adjustment models to take heterogeneity in adjustment speeds across firms into account.[4] This line of research successfully relates this heterogeneity to firm-specific factors and adjustment costs such as cash flow imbalances,

[3]See, including, Ozkan (2001), Flannery and Rangan (2006), Lemmon et al. (2008), Antoniou et al. (2008), Chang and Dasgupta (2009), Cook and Tang (2010), Elsas and Florysiak (2011), and Faulkender et al. (2012).

[4]See Drobetz and Wanzenried (2006), Byoun (2008), Cook and Tang (2010), Elsas and Florysiak (2011), Faulkender et al. (2012), and Warr et al. (2012).

equity market valuations, deviations from target leverage, and firm size.[5]

The models that researchers have examined may have omitted some factors which iplay an important role in the adjustment of leverage. For instance, although risk affects firms' leverage decisions, the extent to which risk affects the speed with which managers adjust firms' capital structure has not been carefully scrutinized.[6] In our investigation we make two major contributions to the literature. First, we examine the effect of risk on the speed of capital structure adjustments by employing the full-adjustment model implemented in Byoun (2008).[7] This approach allows us to examine a variety of factors including the firms' leverage deviations and financial positions in conjunction with time-varying firm-specific and macroeconomic risks affecting the speed of adjustment. Our second contribution is methodological. In contrast to most of the studies in the literature which implement fixed effects models, we estimate our models applying the System GMM dynamic panel data estimator. This methodology allows us to overcome the biases arising from potential endogeneity, measurement error, and the presence of the lagged dependent variable in the model.

The empirical investigation is carried out for a publicly quoted UK manufacturing firm-level panel dataset over 1981–2009. We estimate a dynamic target leverage model which includes both macroeconomic and idiosyncratic risks along with other firm-specific variables. This model provides evidence that both types of risk exert a negative and statistically significant impact on firms' target leverage. We next examine the asymmetric effects of risk on the speed of adjustment when the firm's actual leverage is above or below the target leverage. We find that firms having leverage above the target adjust their capital structure more rapidly when firm-specific risk is high and when macroeconomic risk is low. In

[5] Cook and Tang (2010) and Drobetz and Wanzenried (2006) are exceptions in examining the effect of macroeconomic conditions on US and Swiss firms' rebalancing behavior, respectively. Haas and Peeters (2006) relate the speed of adjustment to GDP growth and inflation for Central and Eastern European firms.

[6] Dang et al. (2012) is an exception, as they use the partial-adjustment model of capital structure to examine the impact of idiosyncratic risk on the speed of adjustment. However, their risk measure is not time-varying as their model focuses on the impact of firms' earnings volatility in low vs. high regimes. Likewise, they allow for differing speeds of adjustment for above-threshold and below-threshold financing imbalances, but do not allow the speed of adjustment to vary with the magnitude of risk.

[7] Byoun (2008) investigates the importance of financial imbalances on capital adjustment when the firm is above or below its target debt. However, his research is silent about the role of risk.

contrast, firms with below-target leverage are more likely to adjust their capital structure quickly toward their targets in times of low firm-specific risk and high macroeconomic risk. This model provides our initial set of observations regarding the role of risk on asymmetric adjustment of leverage toward a target ratio.

We then estimate a more general model which examines the role of risk in conjunction with financial imbalances as the firm's leverage lies above or below their target ratio. 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. In contrast, we observe that firms with financial surpluses and below-target leverage do not strive to achieve their target capital structure, but rather maintain their current state. Firms that experience financial deficits with above-target leverage are more likely to issue equity to achieve their target leverage, particularly in times of low macroeconomic risk. For such firms, given the level of macroeconomic risk, an increase in firm-specific risk accelerates the capital adjustment process, whereas firms that have financial deficits with below-target leverage are more likely to adjust their capital structure when both firm-specific and macroeconomic risks are relatively low. An increase in either type of risk retards their process of adjustment.

Our investigation provides clear evidence that the type of risk (macroeconomic *versus* firm-specific) and the extent of risk which firms face matter for their capital adjustment process. Risk exerts asymmetric effects on the firm's capital adjustment process, over and above its financial state or the deviation of leverage from its leverage target. These findings are important in understanding managers' actions given the increased business risks associated with the recent financial crisis.

The rest of the paper proceeds as follows. Section 2 discusses the hypotheses and our expectations. Section 3 presents information on the dataset and describes the procedures we implement to generate firm-specific and macroeconomic risk measures. Section 4 describes the estimation methods. Section 5 presents the empirical findings and robustness checks, and Section 6 concludes the paper.

2 Hypotheses on Risk and Leverage Adjustments

The trade-off theory suggests that the firm's manager adjusts deviations from an optimal debt ratio considering the costs and benefits of adjusting leverage. The firm should rebalance its debt ratio quickly when the cost of adjustment is low. If transaction costs are high, the speed of adjustment toward a leverage target should be slower.

We hypothesize that as costs and benefits of rebalancing the capital structure vary with the source of and variations in risk, so does the speed with which firms adjust leverage toward their targets.[8] However, whether risk accelerates or decelerates the adjustment speed toward the leverage target, and whether the change in adjustment speed due to risk depends on firms' financial status (financial surpluses or financial deficits) and the state of firms' actual leverage (above or below target leverage) is an open question. Hence, our empirical examination considers two models. The first model examines the role of risk on the adjustment speed when we only take into account leverage deviations from the target, while the second model allows us to investigate the effects of risk on the adjustment speed taking into account both the financial state of the firm and leverage deviations from the target.

We initially examine the impact of both macroeconomic and idiosyncratic risks on the speed of adjustment of a firm whose actual leverage falls below or above its target as the risk structure varies. The best time to adjust the firm's capital structure is likely to be when both business and macroeconomic risks are at their lowest. In this case, we expect that firms that are above their target leverage ratio can effectively reduce their debt when firm-specific risk is low, while the speed is expected to increase with an increase in macroeconomic risk as low-risk firms would want to reduce their leverage and thus financial stress. For those firms whose leverage is below their target, we expect to see that adjustment will be faster during periods of high firm-specific risk, as these firms would prefer to reach their target leverage as quickly as possible. We expect such firms to react more quickly when macroeconomic risks

[8]The impact of risk on capital structure has been explored by several researchers. See, for instance, Caglayan and Rashid (2013), Baum et al. (2009), Hatzinikolaou et al. (2002), Wald (1999), Titman and Wessels (1988), Bradley et al. (1984), and Castanias (1983).

are low, as it is easier to raise external funds in that environment.

We next examine the importance of risk, considering the effect of financial imbalances on capital adjustment when the firm is above or below its leverage target. This leads to four alternative scenarios as the firm experiences a financial surplus or deficit while their leverage is below or above the target.

Case 1 is that of a firm which experiences a financial surplus with above-target leverage. In principle, firms that have financial surpluses with above-target leverage can adjust their capital structure by retiring debt. As high levels of debt increase the likelihood of financial distress and firms' risk exposure, firms with above-target debt are more likely to quickly reverse excess deviations from their target leverage ratio. In fact, this reversal should happen more rapidly when the firm is exposed to idiosyncratic or macroeconomic risks, as the costs of distress will then be higher. Consequently, we expect that the speed of adjustment will be highest when both risks are high.

Case 2 is that of a firm which experiences financial deficits with above-target leverage. These firms are expected to issue equity to offset deviations from their leverage targets to reduce their financial deficits as well as their actual leverage. The optimal solution to this problem is to issue equity, which can be done most effectively when the macroeconomic and idiosyncratic risks are low. Higher levels of risk will increase the costs associated with issuing equity due to increased asymmetric information problems. Hence, the adjustment speed will decline as uncertainty increases. Thus an an increase in macroeconomic risk will hinder the adjustment process, as in such circumstances investors reduce their demand for equity due to severe adverse selection problems. However, an increase in firm-specific (idiosyncratic) risk may not have such adverse effects, as the firm will issue new equity through an investment bank that can evaluate its prospects and advise on the issuance of equity.

Case 3 is that of a firm which experiences a financial surplus with a below-target leverage ratio. Such a firm faces no pressure to raise funds to finance operations by either issuing new debt or repurchasing existing equity. However, these firms may find it preferable to reduce their debt obligations rather than resort to equity finance in periods when their projections indicate relative stability of earnings and when macroeconomic prospects are good. An increase of either type of risk will induce these firms to adjust their capital structure more slowly, as the associated costs would be higher in periods of high volatility. We therefore expect to observe that these firms' speed of adjustment would reduce when both types of risks increase.

Case 4 is that of a firm which experiences a financial deficit with below-target leverage. In this case, new financing is needed by firms to adjust their capital structure toward the target leverage. We expect that their 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, when a firm experiences financial deficits with below-target leverage, the firm would adjust its leverage toward the target by issuing debt to satisfy its financing needs. The cost of adjustment of issuing debt for this firm is expected to be low when the firm is more certain about its expected earnings and when macroeconomic conditions are good.

3 Data

Our investigation uses a firm-level unbalanced annual panel dataset for the United Kingdom. The data are obtained from the WorldScope Global database via DataStream and cover the period 1981–2009. The analysis is carried out for manufacturing firms, each of which contributes at least five years of observations.[9,10] As routinely implemented in the literature (see, for instance, Baker and Wurgler (2002) and Kayhan and Titman (2007)), we drop firm-year observations if the ratio of book leverage is greater than one. All remaining firm-specific variables are scaled by total assets and are winsorised at the first and ninety-ninth percentile to eliminate the adverse effects of outliers and misreported data.[11]

Following earlier empirical studies, including Baker and Wurgler (2002), Alti (2006), and

[9] We mitigate sample selection and survivorship biases by allowing for both entry and exit in the sample.

[10] We restrict our attention to those firms which contribute at least five 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.

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

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 equal to total assets minus book equity. Book leverage is then defined as the ratio of book debt to total assets. We investigate book leverage rather than market leverage because market leverage is very sensitive to the market value of equity, which can change substantially due to movements in equity markets even if firms do not alter their actual borrowing. In addition, firms' 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, Moody's, and A.M. Best, also consider the book value of debt in determining a firm's credit rating.[12]

Firm size is defined as the logarithm of net sales. 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. The two-year stock return is defined as the percentage change between share prices at time $t-2$ and share prices at time t. The market-to-book value ratio is equal to book debt plus market equity divided by the book value of total assets. 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, derived from firms' sales to total assets ratio, and macroeconomic risk, which is computed using real gross domestic product (GDP).[13] Details on all variables are given in Appendix B.

3.1 Measuring Firm-Specific Risk

We estimate an autoregressive model of order one ($AR(1)$) for firms' annual sales normalized by the book value of total assets to generate firm-specific risk based on the residuals of the

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

[13]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).

model as suggested in Caglayan and Rashid (2013) and Bo (2002). We estimate the following model for each firm:

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

where $Sales_{i,t}$ is the ratio of sales to book value of total assets for firm i at time t, μ_i captures the fixed effects, φ is the autoregressive parameter, and $\zeta_{i,t}$ is the error term with zero mean and finite variance. We obtain the residuals from the above $AR(1)$ process for each firm and compute the cumulative variance of the obtained residuals. The 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 that each firm contributes at least five years of observations, the measure above uses a minimum of four observations to generate the risk measure.

3.2 Measuring Macroeconomic Risk

To generate a proxy for macroeconomic risk, we estimate an $ARCH$ model on quarterly real GDP over 1975–2009. We include an $AR(1)$ term in the mean equation of our $ARCH(1)$ specification and estimate the following model:

$$\Delta GDP_t = \omega + \eta \Delta GDP_{t-1} + \epsilon_t \tag{2}$$

$$\sigma_t^2 = \alpha + \beta \epsilon_{t-1}^2 \tag{3}$$

where ω is a constant term and η is the autoregressive parameter. 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 averaging over four quarters 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. The $ARCH$ coefficient ($\beta = 0.781$) is less than one and is statistically significant at the 1% level.

3.3 Summary Statistics

Table 1 provides the summary statistics of the firm-specific variables for the full sample as well as three subperiods. Book leverage, with a mean of 0.574 for the full sample, has increased over time suggesting that firms, on average, were less levered and were not as 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 book value of total assets ratio is 0.059 for the entire sample period. In contrast to 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. Reduction in average profitability during the last nine years of the sample could be one of the reasons why firms' fixed capital investment, on average, has declined.

The average two-year stock return is 0.098 for the full sample period, yet it is negative with a value of -0.134 and a high standard deviation during the last nine years of the sample period. Firms' share prices rose in the 1990s, as average stock returns are positive and higher than in the other two subperiods. 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 an increasing trend over the years.

Overall, the summary statistics across the three subperiods show that firms are relatively more leveraged, earn lower returns on their assets, have lower fixed investment expenditures and have a declining trend in their equity value in the later years of the sample, particularly over the 2001–09 period.

Table 2 provides the summary statistics of our risk measures for the full sample and subsamples. 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 operations in the latter years of the sample. Similar to the case of firm-specific risk, macroeconomic risk also appears to be on the rise throughout the period of investigation. Further, the estimated standard deviations provide evidence that the macroeconomic environment is more volatile over the 2001–2009 period as compared to earlier years.

In summary, both macroeconomic risk and firm-specific risk have increased markedly and became more volatile over the recent years: quite understandably, as the financial crisis towards the end of the sample period took its toll on businesses and the economy.[14]

4 Empirical Implementation

In this section, we introduce a standard leverage model which incorporates the impact of both firm-specific and macroeconomic risk measures to compute the change in firms' target leverage. Extending the methodology of Byoun (2008), we then present two sets of modified full-adjustment models of capital structure. The first model permits us to examine the role of risk on the speed of adjustment of the capital structure when firms' actual leverage is below or above the target. The second model allows us to investigate the effects of risk on firms' speed of adjustment as we consider the state of their financial balances and their actual leverage with respect to the target simultaneously.

4.1 The Impact of Risk on Target Leverage

We first estimate a standard leverage model augmented by firm-specific and macroeconomic risk measures to compute the firm-specific target debt ratio, $L^T_{i,t}$. We then use this information to quantify the effects of risk on the adjustment process. We estimate the following

[14] The empirical correlation of the risk measures of 0.002 implies that each measure covers a different aspect of risk associated with the business and macroeconomic environment that firms face in their operations.

model to compute firms' target leverage:

$$L_{i,t} = \beta_1 X_{i,t-1} + \beta_2 R^{firm}_{i,t-1} + \beta_3 R^{macro}_{t-1} + \upsilon_i + \epsilon_{i,t} \tag{4}$$

where $X_{i,t}$ is a vector of firm-specific variables that includes the lagged value of leverage, the market-to-book value ratio, firm profitability, asset tangibility, capital investment expenditures-to-total assets ratio, two-year stock returns, non-debt tax shields and the log of firm sales as a proxy for firm size. $R^{firm}_{i,t}$ and R^{macro}_{t} represent time-varying firm-specific and macroeconomic risks, respectively. The term υ_i captures time-invariant unobservable firm-specific effects. The term $\epsilon_{i,t}$ is the idiosyncratic error term. The subscripts i and t denote firm and time, respectively.

4.2 The Target Adjustment Model

Given the firm-specific target leverage L^T as the predicted value from equation (4), we can examine the adjustment process of leverage toward the target.[15] The model below captures the effects of transactions costs which deter firms from carrying out frequent adjustments in their leverage through the adjustment coefficient, ϕ:

$$L_{i,t} - L_{i,t-1} = \phi(L^T_{i,t} - L_{i,t-1}) + \epsilon_{i,t} \tag{5}$$

where $L_{i,t}$ is the observed (actual) leverage of firm i in year t. The adjustment coefficient ϕ measures how quickly firms adjust their capital structure to attain their target leverage. This coefficient should strictly lie between zero and one if there are positive costs of adjustment. However, when the adjustment costs are very high, the adjustment coefficient would not be statistically different from zero. In particular, if the cost of deviating from the target is higher (lower) than the cost of adjustment, the adjustment coefficient would be smaller (larger), and hence the speed of adjustment will be faster (slower).

[15] Although our approach is a 'two-stage' procedure rather than the 'one-stage' procedure advocated by Dang et al. (2012), it is not subject to the critiques raised in that study. We avoid difficulties with generated regressors by instrumenting the generated target leverage variable in the System GMM estimation procedure. Pagan and Ullah (1988) suggest testing the validity of the underlying assumptions of the model that is used to generate the uncertainty proxy and then use the lags of this proxy as an instrument.

4.2.1 Controlling for Deviations from the Leverage Target

The model in equation (5) does not allow for asymmetry in adjustment speeds across firms with above-target or below-target leverage. However, firms with above-target leverage might adjust at a different speed than those with below-target leverage, as firms in each category have different adjustment costs and benefits.

If a firm's actual leverage is above its target, the firm should either reduce its use of debt or issue new equity. Conversely, 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. We expect that firms adjust their leverage asymmetrically as the risk structure of the environment within which firms operate will cause the firm to give different weights to positive and negative deviations of actual leverage from the target. Hence, we modify equation (5) by interacting our risk measures with indicators that capture the state of current leverage with respect to target leverage as follows:

$$\begin{aligned} L_{i,t} - L_{i,t-1} = {} & (\beta_1 D_{i,t}^{abov} + \beta_2 D_{i,t}^{belo}) DVT_{i,t} + (\beta_3 D_{i,t}^{abov} + \beta_4 D_{i,t}^{belo}) DVT_{i,t} \times R_{i,t-1}^{firm} \\ & + (\beta_5 D_{i,t}^{abov} + \beta_6 D_{i,t}^{belo}) DVT_{it} \times R_{t-1}^{macro} + \upsilon_i + \varepsilon_{i,t} \end{aligned} \tag{6}$$

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 the predicted value from equation (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 the leverage ratio is below the target and zero otherwise. Using equation (6), we examine the extent to which changes in risk affect the adjustment process of capital structure as the firm's leverage exceeds or falls short of its leverage target.

4.2.2 Controlling for Deviations from the Leverage Target and Financial Imbalances

According to 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 prefer debt over equity. Hovakimian et al. (2001) and Hovakimian et al. (2004) provide empirical evidence that firms prefer to use internal funds over external funds even when they have a leverage target. 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 the firm's financial deficit in changes in its debt ratio and the speed of capital structure adjustment, respectively. Specifically, Kayhan and Titman (2007) report that financial deficits have a strong influence on capital structure which is partly reversed over long horizons. 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 more rapidly when their leverage is above the target if 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 which lead to financial deficits or surpluses.

To test for the effects of risk on the capital adjustment process as a firm's financial state changes, we follow Kayhan and Titman (2007) and Byoun (2008) and calculate the imbalances in cash flows (financial deficits/surpluses) utilizing the cash flow identity:

$$CF_{i,t} - CAPE_{i,t} - \Delta WC_{i,t} \equiv DIV_{i,t} - \Delta d_{i,t} - \Delta e_{i,t} \tag{7}$$

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.[16] Rearranging equation (7), we define a firm's financial deficit ($FD_{i,t}$) as:

$$FD_{i,t} = CAPE_{i,t} + \Delta WC_{i,t} + DIV_{i,t} - CF_{i,t} \equiv \Delta d_{i,t} + \Delta e_{i,t} \tag{8}$$

A positive $FD_{i,t}$ implies a financial deficit: i.e., the firm invests more than the internally generated cash. A negative value of $FD_{i,t}$ implies a financial surplus: i.e., the firm invests less than the internally generated cash.

To examine how risk affects the impact of financial conditions on the speed of adjustment for firms with above-target or below-target leverage, we augment equation (6) by incorporating an interaction term between our measures of risk, above-target and below-target indicators, and the financial status of the firm:

$$\begin{aligned} L_{i,t} - L_{i,t-1} = {} & (\beta_1 D_{i,t}^{sur} D_{i,t}^{abov} + \beta_2 D_{i,t}^{def} D_{i,t}^{abov} + \beta_3 D_{i,t}^{sur} D_{i,t}^{belo} + \beta_4 D_{i,t}^{def} D_{i,t}^{belo}) DVT_{i,t} \\ & + (\beta_5 D_{i,t}^{sur} D_{i,t}^{abov} + \beta_6 D_{i,t}^{def} D_{i,t}^{abov} + \beta_7 D_{i,t}^{sur} D_{i,t}^{belo} + \beta_8 D_{i,t}^{def} D_{i,t}^{belo}) DVT_{i,t} \times R_{i,t}^{firm} \\ & + (\beta_9 D_{i,t}^{sur} D_{i,t}^{abov} + \beta_{10} D_{i,t}^{def} D_{i,t}^{abov} + \beta_{11} D_{i,t}^{sur} D_{i,t}^{belo} + \beta_{12} D_{i,t}^{def} D_{i,t}^{belo}) DVT_{i,t} \times R_{i,t}^{macro} \\ & + (\beta_{13} D_{i,t}^{sur} + \beta_{14} D_{i,t}^{def}) + \upsilon_i + \varepsilon_{i,t} \end{aligned} \tag{9}$$

As defined earlier, $DVT_{i,t} = L_{i,t}^T - L_{i,t-1}$, where $L_{i,t}^T$ is the estimated target leverage ratio for firm i at time t. $D_{i,t}^{abov}$ 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. $D_{i,t}^{belo}$ 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 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 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 idiosyncratic errors.

[16]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.

5 Empirical Analysis

Several researchers have used OLS fixed-effects methodology to estimate firms' speed of adjustment toward their target capital structure. The use of the fixed-effects estimator would not be appropriate in a panel data model which incorporates the lagged dependent variable as a regressor. The fixed-effects estimator suffers from a downward 'Nickell bias' on the estimate of the lagged dependent variable's coefficient, leading to overestimation of the speed of adjustment: a particularly serious problem in short panels.[17] Likewise, the use of first differencing introduces a correlation between the lagged dependent variable and the error, necessitating the use of instrumental variables techniques.

In this paper, we apply the System GMM dynamic panel data estimator to estimate our models. While carrying out the estimation procedure, we remove the time-invariant unobservable firm-specific effects by taking the first difference of each underlying variable as we control for the correlation between the regressors and the errors. In addition, using the System GMM method, we can mitigate the presence 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. Last but not the least, the GMM approach allows us to avoid problems that may arise due to the use of generated regressors.

However, in the context of GMM estimation, the use of longer 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 (2009)). Here, we confirm the validity of our instruments by implementing the J test of Hansen (1982). We also apply the Arellano-Bond AR(2) test 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. For all cases, the J statistics show that the instruments used for the System GMM estimator are valid and satisfy the orthogonality

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

conditions. Also, the serial correlation tests do not detect second-order serial correlation in the residuals. Thus, the instruments we use in the estimation are valid for each underlying model. For brevity, we do not comment further on these diagnostics.

5.1 Risk Effects on Target Leverage

We start our empirical analysis by estimating equation (4) to compute firms' target leverage. We find that firm-specific risk has a negative and significant effect on firms' leverage.[18] This finding implies that given positive bankruptcy costs and the expectation 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. We also find that macroeconomic risk exerts a negative impact on leverage, confirming the idea that firms reduce their leverage to attenuate their exposure in periods of high macroeconomic risks. During such periods, firms' cash flows deteriorate and their likelihood of bankruptcy and financial distress increases, inducing firms to use sources of finance other than debt to mitigate the cost of financial distress. This negative sensitivity of firms' target leverage to macroeconomic and idiosyncratic risks is consistent with the earlier literature. Furthermore, results relating to the effects of firm-specific variables, in terms of both sign and statistical significance, are consistent with earlier research.

5.2 Controlling for Deviations from the Leverage Target

We address two issues: (i) do firms weigh deviations of actual leverage from their leverage targets differently in times of greater risk? and (ii) does risk have differential effects for firms with above-target leverage and firms with below-target leverage? To answer these questions, we estimate equation (6), where deviations from the target as well as risk measures are interacted with the above-target ($D_{i,t}^{abov}$) and the below-target ($D_{i,t}^{belo}$) dummies.[19]

[18]Given that similar models have been investigated in the literature, estimates are available upon request. For instance, see Caglayan and Rashid (2013) and the references therein.

[19]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.

If a firm's actual leverage exceeds its target, then the firm can adjust its capital structure to reach its target debt ratio by retiring debt or by issuing new equity. In contrast, if a firm's leverage is below its target, we would expect that the firm can restructure by issuing new debt or repurchasing equity. It would seem 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 that firms experience different levels of macroeconomic and business risks at each point in time, managers are expected to weigh deviations from target differently as either type of risk varies along with other factors that affect the adjustment process.

5.2.1 Marginal Effects of Risk

Table 3 presents the results for equation (6) where we first set both risk measures to zero to obtain a benchmark. Results for this set are given under Model 1. The benchmark results show that firms with above-target leverage ($DVT_{i,t} \times D_{it}^{abov}$) adjust their capital structure faster than firms with below-target leverage ($DVT_{i,t} \times D_{it}^{belo}$). These findings for UK firms are in line with those of Byoun (2008), who considers US 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 firm's actual leverage exceeds or falls short of the target leverage. The impact of firm-specific risk interacted with the below-target indicator ($DVT_{i,t} \times D_{i,t}^{belo} \times R_{i,t-1}^{firm}$) is negative and statistically significant. This implies that an increase in 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 ($DVT_{i,t} \times D_{i,t}^{abov} \times R_{i,t-1}^{firm}$) is positive, but not statistically significant. Thus firm-specific risk decelerates the capital structure adjustment process only when the firms' actual leverage lies below the target.

Macroeconomic risk has a significant role regardless of whether the firm's 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 ($DVT_{i,t} \times D_{i,t}^{abov} \times R_{t-1}^{macro}$), whereas it has a positive effect on the adjustment process of firms with below-target leverage ($DVT_{i,t} \times$

$D_{i,t}^{belo} \times R_{t-1}^{macro}$). Firms with actual leverage above (below) the target are likely to adjust their leverage more slowly (more quickly) toward the target in periods when macroeconomic risk is high.

5.2.2 The Speed of Capital Structure Adjustment

Table 3 shows that the capital structure adjustment process is asymmetric, related to both risk and the level of leverage in comparison to target leverage. Using the estimates in Table 3, we compute the speed of adjustment when risk takes on high, medium, and low levels for firms with above- and below-target leverage and report these values in Table 4. 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 4, we see that the speed of adjustment for the benchmark model with above target leverage, at 32.2%, 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 takes on different levels. The speed of adjustment is highest (i.e., lowest half-life) when macroeconomic risk is low. There is a monotonic increase as firm-specific risk increases from low to medium and high levels within each level of macroeconomic risk: when the 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. This observation accords with intuition. As macroeconomic risk increases, a firm will find it harder to adjust its capital structure, for retiring debt will be costlier in such circumstances due to increased asymmetric information problems.

Figure 1 illustrates that firms with above-target leverage adjust their capital structure more quickly in times of low macroeconomic risk and high firm-specific risk.[20] These results imply that the cost of reducing leverage for firms with above-target leverage would be lower in periods of low macroeconomic risk than in periods of high macroeconomic risk.

[20]Part of the explanation for higher adjustment speeds at low levels of macroeconomic risk is that a stable macroeconomic environment leads to an increase in share prices, rendering equity issuance an attractive source of finance. Thus, firms' managers are likely to use equity issuance to reduce firms' leverage.

The estimated speed of adjustment for firms with below-target leverage is around 24.7% per year for the benchmark model. Adjustment is faster when firm-specific risk is low than when it is high. For a given level of firm-specific risk, an increase of macroeconomic risk accelerates the adjustment process, as illustrated in Figure 1.

On the whole, the estimates given in Table 4 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 their target levels. 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.

5.3 Controlling for Deviations from the Leverage Target and Financial Imbalances

In this section, we incorporate the role of financial imbalances along with deviation of leverage from the target on the adjustment of capital structure and examine the asymmetry in the adjustment process as shown in equation (9), taking the effects of risk into account.

5.3.1 Marginal Effects of Risk

Table 5 provides results for two models based on equation (9): the benchmark Model 1, excluding risk and Model 2, which includes both types of risk.

Model 1: The Benchmark

The benchmark model provides evidence that UK manufacturing firms increase their leverage regardless of whether they face 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 1 which show that firm leverage in the UK has been increasing over the period of investigation. According to the benchmark model, firms with a financial surplus tend to increase their leverage more than those that experience a financial deficit. This observation is in contrast to that of Byoun (2008), who shows that US manufacturing 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 indicators. The coefficient estimates for $D^{sur}_{i,t} \times DVT_{i,t} \times D^{abov}_{i,t}$ and that of $D^{def}_{i,t} \times DVT_{i,t} \times D^{abov}_{i,t}$ are both positive and statistically significant, while 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 a financial deficit. The estimate of the coefficient on the interaction between firms' financial deficits and below-target leverage ($D^{def}_{i,t} \times DVT_{i,t} \times D^{belo}_{i,t}$) is positive and statistically significant but smaller in magnitude than that of above-target leverage, regardless of the financial status of the firm. Firms experiencing financial deficits with below-target leverage adjust their leverage, but at a lower speed than those with above-target leverage. Interestingly, we also find that firms with a financial surplus do not strive to revert to the target level when their leverage is below target. Rather, these firms further deviate from the target, as the coefficient estimate on the financial surplus with below-target interaction ($D^{sur}_{i,t} \times DVT_{i,t} \times D^{belo}_{i,t}$) is negative and statistically significant.

The results from our benchmark model provide evidence that capital structure adjustments are asymmetric and related to firms' cash flow imbalances as well as the stance of firms' actual leverage *versus* their target leverage. In Model 2 below, we explore whether the introduction of the firm-specific and macroeconomic risk interaction terms into the benchmark model would reveal further asymmetries in the leverage adjustment process.

Model 2: The Asymmetric Impact of Firm-Specific Risk

The effect of firm-specific risk on firms with a financial surplus and above-target leverage ($D^{sur}_{i,t} \times DVT_{i,t} \times D^{above}_{i,t} \times R^{firm}_{t-1}$) is negative and statistically significant. Firms enjoying a financial surplus with above-target leverage slow their capital adjustment when firm-specific risk is high. Hence, we expect that firms with above-target leverage and financial surpluses use their surplus to reduce their outstanding debt when these firms are more certain about their expected future cash flows. In contrast, the effect of firm-specific risk on firms that have financial deficits with above-target leverage ($D^{def}_{i,t} \times DVT_{i,t} \times D^{above}_{i,t} \times R^{firm}_{t-1}$) is positive. Firms with above-target leverage experiencing a financial deficit are more likely to issue equity to finance their financial deficits when they experience periods of high firm-specific risk. As debt becomes relatively more expensive for risky firms when banks and other financial institutions charge higher risk premiums, these firms tend to prefer equity over debt financing.

For firms with financial surpluses and above-target leverage, we find that the variable $(D_{i,t}^{sur} \times DVT_{i,t} \times D_{i,t}^{belo} \times R_{t-1}^{firm})$ has a positive coefficient, implying that an increase in firm-level risk leads to an increase in the speed of adjustment toward the level of target leverage. This suggests that below-target firms with financial surpluses tend to repurchase their equity in periods when they experience high firm-specific risk. These firms move their leverage toward the target by reducing their outstanding external financing. The effect of firm-specific risk on firms with financial deficits and below-target leverage $(D_{i,t}^{def} \times DVT_{i,t} \times D_{i,t}^{belo} \times R_{t-1}^{firm})$ is negative, so that these firms slow their capital adjustment process when firm-specific risk is high. They are more likely to attain their target leverage by issuing debt when firm-specific risk is low. Firms do so because they face fewer debt-related problems, such as an increased likelihood of bankruptcy, in periods of low firm-specific risk.

Model 2: The Asymmetric Impact of Macroeconomic Risk

The estimated impacts of macroeconomic risk on the change in leverage when firms experience financial deficits with above-target leverage $(D_{i,t}^{def} \times DVT_{i,t} \times D_{i,t}^{above} \times R_{t-1}^{macro})$ and that for firms with financial deficits and below-target $(D_{i,t}^{def} \times DVT_{i,t} \times D_{i,t}^{belo} \times R_{t-1}^{macro})$ 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. 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. 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, encouraging adjustments in their capital structure.

In cases where firms have a financial surplus along with above-target leverage, the effect of macroeconomic risk on the change in leverage ($D_{i,t}^{sur} \times DVT_{i,t} \times D_{i,t}^{above} \times R_{t-1}^{macro}$) is positive and statistically significant. These firms adjust their leverage more rapidly 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 macroeconomic shocks 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 ($D_{i,t}^{sur} \times DVT_{i,t} \times D_{i,t}^{belo} \times R_{t-1}^{macro}$) is positive, suggesting that such firms use their financial surpluses to repurchase existing equity in order to reduce overall external financing when macroeconomic risks are high.

The results given in Table 5 provide evidence that asymmetric speeds of adjustment are related to risk, above and beyond the state of the firm's leverage and their financial imbalances. Firm-specific risk and macroeconomic risk have differential effects on their speed of adjustment.

5.3.2 The Speed of Adjustment with Financial Imbalances and Deviations from Target Leverage

We now consider the speed of adjustment toward the leverage target, setting risk to vary across low, medium, and high levels. We compute the adjustment speed and the corresponding half-life in four-way interactions with respect to financial imbalances of the firm (financial deficits/surpluses) and the positive or negative deviation of actual leverage from the target. For each sub-panel, we also compute the adjustment speed and the corresponding half-life when both types of risks are set to zero. The results given in Table 6 show that firms' speed of adjustment toward the target leverage differs significantly as the level of risk is varied.

At zero levels of risk, firms that have a financial surplus with above-target leverage exhibit the lowest speed of adjustment coefficient. Sorting by the speeds of adjustment, we see that firms with a financial surplus and above-target leverage adjust their capital structure more quickly when macroeconomic risk is high; the speed of adjustment falls with a decline in macroeconomic risk. Although firm-specific risk exerts a negative effect on the adjustment process, its impact is minor compared to that of macroeconomic risk. For instance, when macroeconomic risk is high and firm-specific risk is low (high), the estimated speed of adjustment is 82.5% (80.6%). The speed of adjustment drops to 67.4% if macroeconomic risk is low and firm-specific risk is high. Firms that enjoy a financial surplus with above-target leverage reduce their outstanding debt more quickly as macroeconomic risk raises the cost of maintaining higher leverage. Given the level of macroeconomic risk, firms also prefer to lower their debt in periods when firm-specific risk is low, as they are then more certain of their cash flows.

When we compute the speed of adjustment for firms that have financial surpluses with below-target leverage, we observe an interesting phenomenon: (i) these firms deviate from their target leverage when there is zero risk, and (ii) these firms do not significantly adjust their capital structure when they experience risk. In general, the estimated adjustment speeds for these firms are negative but not statistically different from zero. However, in some cases of this category, the negative speed of adjustment becomes statistically significant at the 10% level, indicating that these firms deviate further from their targets.

We next examine the capital structure adjustment of those firms that have financial deficits with above-target leverage. We see that these firms have the highest speed of adjustment coefficient (the lowest half-life estimate) when we set both types of risk to zero. Once we incorporate the effects of risk, the adjustment coefficient size changes dramatically. These firms adjust most quickly when macroeconomic risk is low and when firm-specific risk is high, with the slowest adjustment occurring when macroeconomic risk is high and firm-specific risk is low. A potential explanation behind this observation is that as their adjustment process requires issuing equity in the presence of a financial deficit, reducing outstanding debt is difficult. These firms may find it easier to issue equity to meet their financial obligations and to adjust their leverage toward their target when macroeconomic risks are lower.[21]

The last case includes firms that have financial deficits with below-target leverage, which

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

adjust their capital structure most quickly when there is zero risk. When we allow for risk, we observe that such firms adjust most rapidly when both firm-specific and macroeconomic risks are low, with an estimated speed of adjustment of about 30% per year. We also find that the slowest adjustment takes places when both types of risk are high, with the speed of adjustment falling to around 24% per year. As their capital structure adjustment requires debt issuance, these firms are more likely to issue debt when they are relatively more certain about their potential cash flow stream and when macroeconomic prospects are favorable. 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, they tend to increase their use of debt.

Overall, the results in Tables 5 and 6 provide evidence that firms' adjustment speeds are affected asymmetrically with respect to either type of risk while we control for their financial imbalances and deviations from their target leverage. Risk accelerates the speed of adjustment for firms with a financial surplus and above-target leverage and retards the speed of adjustment 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 flows nor by deviations from a leverage target: they are also significantly affected by the levels of firm-specific and macroeconomic risk. In that sense, our findings are useful in interpreting earlier research which questions 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 et al. (2004)) and why they are sensitive to debt and equity market conditions when financing external capital (Baker and Wurgler (2002) and Antoniou et al. (2009)).

5.4 Robustness Checks

To guard against the possibility that our results are driven by specific risk measures, we replace our sales-based firm-specific risk measure with a measure based on firm's cash flow. We also replace our GDP-based macroeconomic risk measure with a risk measure based on the quarterly consumer price index. We then reestimate equation (11) using these alternative measures of risk. The results from this exercise, which are available from the authors, are qualitatively similar to our earlier findings and confirm that the estimated effects of risk on capital structure adjustments are not driven by our choice of risk measures.

6 Summary and Concluding Remarks

Despite the evidence that both idiosyncratic and macroeconomic risks impact firms' capital structure, researchers have not fully investigated the effects of risk on the speed with which firms reverse deviations from their target debt ratios. In this paper, we hypothesize that if the optimal level of leverage varies by firm, the risk structure of the environment within which the firm operates should affect its cost of adjusting its capital structure and in turn the speed of adjustment to its target leverage ratio. Given the state of the current economic and business environment, examining the role of risk on the adjustment process can reveal whether changes in risk impede or accelerate the capital structure adjustment process. We focus on a panel of UK manufacturing firms over the 1981–2009 period, employing the System GMM dynamic panel data estimator.

We first estimate a standard leverage model augmented by both firm-specific and macroeconomic risk measures to compute each firm's target leverage. The model provides evidence that firms' target leverage is negatively related to both types of risk. Next, we estimate a full-adjustment model of capital structure to quantify the effects of risk on each firm's speed of adjustment toward the target level when their actual leverage is above and below the target. The results suggest that firms having leverage above the target adjust their capital structure more rapidly when firm-specific risk is high and when macroeconomic risk is low. In contrast, firms with below-target leverage are more likely to adjust their capital structure quickly toward their targets in times of low firm-specific risk and high macroeconomic risk.

We then examine the asymmetric effects of risk on the speed of adjustment while we control for firms' deviations from the leverage target and their financial imbalances simultaneously. We find that firms with a financial surplus and above-target leverage adjust their leverage toward their targets much more quickly when firm-specific risk is low and macroeconomic risk is high. As higher levels of debt make firms more exposed to aggregate risk, firms with leverage exceeding their target choose to reduce leverage when macroeconomic risk is high. Results for those firms with a financial deficit and above-target leverage show that these firms make adjustments in capital structure more quickly 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 more stable.

In contrast, firms with a financial deficit 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 indicates that firms with financial deficits and below-target leverage require stability to raise funds. Finally, we show that firms that have a financial surplus with below-target leverage do not appear to systematically adjust their leverage toward a target level in the presence of risk.

Our investigation provides compelling evidence that different levels and types of risk exert asymmetric effects on the firm's capital adjustment process, even after controlling for their financial state and the deviations of their leverage from the target. These results are robust to different measures of macroeconomic and firm-specific risk. Our results help us understand why firms may not aggressively act to offset the effects of changes in their market value of equity or earnings, as it is clear that managers must carefully consider both the overall state of the economy, their own business activities and the associated risks. We believe that further research along these lines across broader samples of firms would improve our understanding on the impact of risk on the dynamic adjustment process of firms' capital structure.

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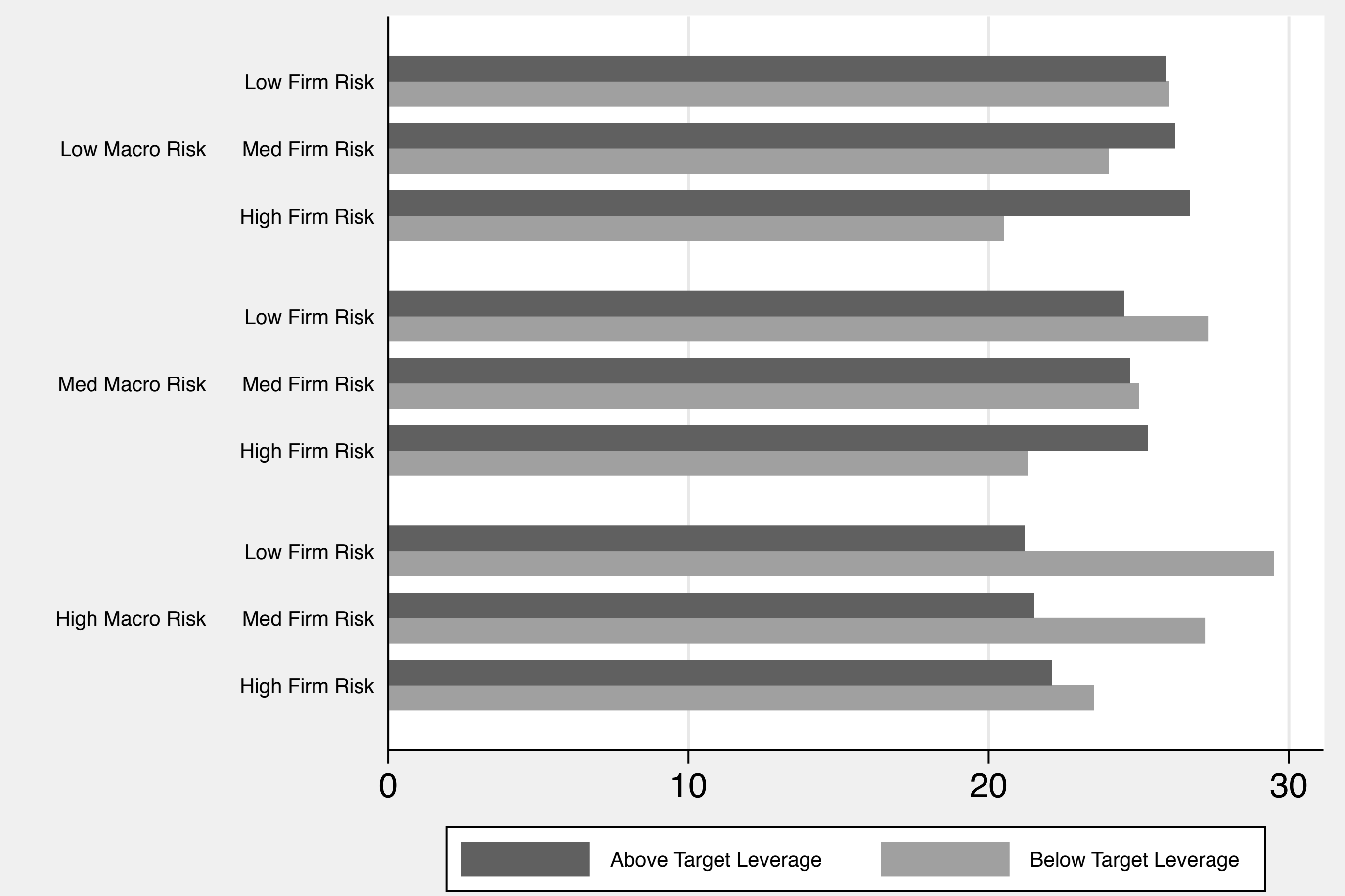
Figure 1: **Speed of Adjustment across Different Levels of Risk**



Low, medium and high levels of risk are the 25th, 50th and 75th percentiles of the risk measure.

Table 1: **Summary Statistics of Firm-Specific Factors**

The second, third and fourth columns report the firm-year observations (N), mean and standard deviation (S.D.) of the firm-specific variables, respectively. The last three columns 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 two-year stock return is the percentage change 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 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 Global 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
1991–2000	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
1991–2000	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
1991–2000	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
1991–2000	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
Two-year Stock Return						
1981–90	1421	0.283	1.187	-0.442	0.288	0.873
1991–2000	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
1991–2000	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
1991–2000	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
1991-2000	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 2: **Summary Statistics of Risk Measures**

The second and third columns report the mean and standard deviation (S.D.) of firm-specific and macroeconomic risk, respectively. The last three columns 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:

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

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, and $\zeta_{i,t}$ is the error term with zero mean and finite variance. Residuals 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(1) model:

$$\begin{aligned} \Delta GDP_t &= \omega + \eta \Delta GDP_{t-1} + \epsilon_t \\ \sigma_t^2 &= \alpha + \beta \epsilon_{t-1}^2 \end{aligned}$$

where ω is a constant term and η is the autoregressive parameter. The estimated conditional variance, $\widehat{\sigma}_t^2$, is the one-period-ahead forecast variance based on prior information. 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 Global 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
1991–2000	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
1991–2000	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

Table 3: **Effects of Risk on the Speed of Adjustment while Controlling for Deviations from the Leverage Target**

Below are the robust two-step System GMM 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:

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

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. 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 Global 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	
Firms	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	

Table 4: **The Speed of Adjustment (SOA) for Firms Above and Below the Leverage Target at Different Risk Levels**

Below are 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 method (results are given in Table 5) and then we calculate the total derivatives at low (25^{th} percentile), medium (50^{th} percentile), and high (75^{th} percentile) levels of risk.

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

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. 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 Global 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**
High	High	22.1	(0.901)***	2.78	23.5	(0.034)***	2.59
High	Medium	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
Medium	High	21.5	(0.091)**	2.86	27.2	(0.301)***	2.18
Medium	Medium	24.7	(0.099)***	2.44	25.0	(0.029)**	2.41
Medium	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	Medium	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

Table 5: **Effects of Risk on the Speed of Adjustment while Controlling for Deviations from the Leverage Target and Financial Imbalances**

Below are the robust two-step System GMM 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:

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

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. 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 Global 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		9,571	
Firms	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	

Table 6: **The Speed of Adjustment for Firms having Above/Below-Target Leverage with a Financial Surplus/Deficit at Different Risk Levels**

Below are the estimates of the speed of adjustment (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 method (results are given in Table 6) and we then calculate the total derivatives at low (25^{th} percentile), medium (50^{th} percentile), and high (75^{th} percentile) risk levels.

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

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. 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 ($R^{firm}_{i,t}$) and macroeconomic risk (R^{macro}_t). 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 Global 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**
Financial Surplus	High	High	80.6	(0.269)***	0.42	-21.2	(0.172)	-3.61
	High	Medium	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
	Medium	High	81.8	(0.270)***	0.40	-24.2	(0.192)	-3.20
	Medium	Medium	72.6	(0.283)**	0.54	-29.4	(0.189)	-2.69
	Medium	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	Medium	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	Medium	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
	Medium	High	18.7	(0.145)	3.35	25.8	(0.056)***	2.32
	Medium	Medium	33.3	(0.132)**	1.71	28.0	(0.061)***	2.11
	Medium	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	Medium	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

Appendix A

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

The second and third columns of the table report the estimated annual capital structure speeds of adjustment (SOA) 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 the leverage target. All reported estimates of the speed of adjustments are based on book leverage except Flannery and Rangan (2006), who 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 et al. (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 et al. (2008)	1963–2003	USA	25.0%	2.4 years
Antoniou et al. (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. (2012)	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

Variables	Definition
Book leverage	The ratio of book debt to the book value of total assets.
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.
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.
Two-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 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.