School of Economics and Finance

Capital Structure and Financial Flexibility: Expectations of Future Shocks

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Working Paper No. 731 October 2014 ISSN 1473-0278

Queen Mary
University of London

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This draft: 3 October 2014

Abstract

We test one of the main predictions of the financial flexibility paradigm that expectations about future firm-specific shocks affect the firm's leverage. We extract the expectations of small and large future shocks from the market prices of equity options. We find that expectations for future shocks decrease leverage and are statistically significant even when we control for traditional determinants. Moreover, they have a first-order effect to capital structure decisions affecting more the small and financially constrained firms. Our findings confirm the De Angelo et al. (2011) model predictions and evidence drawn from surveys that managers seek for financial flexibility.

JEL classifications: G13, G30, G32

Keywords: Capital structure, Financial flexibility, Options, Risk-neutral volatility, Risk-neutral kurtosis

[*] We thank Harry DeAngelo for helpful comments. Any remaining errors are our own responsibility.

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1. Introduction

Within the corporate finance literature, the financial flexibility paradigm has a key role in determining the firm's capital structure. Financial flexibility is defined as the ability of a firm to avoid costly underinvestment, i.e., to avoid cutting back on existing operations in the event of a negative shock to its cash flows and to take advantage of a positive shock in its investment opportunity set, i.e., to fund investment when profitable opportunities arise. Graham and Harvey (2001), Bancel and Mitoo (2004) and Brounen et al. (2006) survey studies document that U.S. and European Chief Financial Officers are primarily concerned about maintaining the firm's financial flexibility when setting the firm's financing policy. Furthermore, DeAngelo et al. (2011) derive one of the main predictions of the financial flexibility paradigm. Their structural model predicts that the firm's leverage is inversely related to the expectations about future shocks to the firm's cash flows. This is because expectations for either a negative or a positive shock in the cash flow of the next period imply that the firm will need additional funding in the next period to avoid costly underinvestment. Therefore, in the case where a shock is expected, the firm acts *proactively* and it decreases its leverage to preserve a greater debt capacity today to meet its *future* expected borrowing.[1]

Being motivated by the strong empirical evidence that firms aim for financial flexibility and DeAngelo et al. (2011) model's prediction, we explore whether expectations for future shocks affect firm's leverage. We measure the expectations for future "small" (diffusive) and "large" (jumps) shocks by extracting the stock returns risk-neutral volatility and risk-neutral kurtosis, respectively, from a cross-section of liquid equity options. Gorbenko and Strebulaev (2010) develop a dynamic trade-off capital structure model where both types of shocks affect the firm's capital structure. We use the model-free method of Bakshi, Kapadia and Madan (2003) to calculate risk-neutral volatility and risk-

[1] DeAngelo et al. (2011) show that debt is the least costly source of capital for a firm when a realized shock dictates financing. Debt has a tax advantage and it is also subject to lower adverse selection costs relative to equity. Furthermore, stockpiling cash is also costly because it creates agency costs that lower the firm value.

neutral kurtosis for all firms that belong to any of the S&P LargeCap 500, S&P MidCap 400 and S&P SmallCap 600 indices and which they have available accounting data as well as reliable equity option data. Next, following standard practice in the empirical capital structure literature (e.g., Korajczyk and Levy, 2003, Frank and Goyal, 2009), we use panel data regressions to estimate the effect of the two risk-neutral moments (RNMs) on the firms leverage ratios.

Two points are in order regarding the validity of the two implicit assumptions which underlie our approach to proxy firm's managers expectations with stock investor's expectations for future shocks to stock prices. First, in line with Andres et al. (2014), we assume that the firm managers who decide about leverage, also participate as investors in the stock market where these moments are extracted from. This is a plausible assumption because managers own considerable parts of their companies' shares (Fahlenbrach and Stulz, 2009, Holderness, 2009) as they often receive stocks and stock options as part of their compensation scheme (Frydman and Saks, 2010). In addition, there is also empirical evidence that managers tend to trade in their own firms' stock (Lakonishok and Lee, 2001, Jeng et al., 2003). Second, we ensure the mapping from stock returns to cash flows shocks by converting our measures of expectations for future shocks from the stock return metric to the asset value metric which is inherently linked to cash flows.

Our findings can be summarized as follows. First, we find that expectations for diffusive shocks and jumps affect the firm's leverage. Specifically, an increase in risk-neutral volatility and kurtosis decreases leverage. These findings are consistent with the DeAngelo et al. (2011) model's predictions. In the case where managers expect a shock, they lower the firm's leverage. They do so to increase the reserves of untapped borrowing power of the firm so that the firm can access the debt markets and address its funding needs if the shock is realized. Second, we find that expectations for both small and big shocks affect the firm's leverage over and above the traditional determinants of the firm's leverage. Third, the expectations for the future shocks capture the greatest part of the leverage variation (22.2% to 45.3%) explained by our empirical specifications when we control for all other traditional determinants. These results are consistent with the findings of Graham and Harvey (2001), Bancel and Mitoo (2004) and Brounen et al. (2006) survey studies which document that U.S. and European Chief Financial Officers consider financial flexibility as the most important factor when they decide on financing policy. Fourth, we find that the leverage of the more financially constrained firms is more sensitive to expectations for shocks. This is consistent with the notion of financial flexibility and the implications of DeAngelo et al. (2011) model. The greater the risk that a firm will not be able to respond to a future shock by accessing capital markets, the more the debt capacity it needs to preserve today and thus the lower the leverage. Finally, we find that the RNMs prevail their significance and sign even when we control for the firm's probability of default. This verifies that the documented effect of RNMs on the capital structure cannot be explained by a probability of default story (i.e. an increase in RNMs reflects an increase in probability of default and thus managers decrease leverage) and it renders further support to the financial flexibility explanation.

Our paper contributes to three strands of literature. First, our findings contribute to the growing literature which explores the implications of financial flexibility for corporate financing policy. The financial flexibility paradigm has two testable implications (DeAngelo et al., 2011). The first one is that managers decrease leverage when future small or large shocks are expected. The second one is that new investments are mostly financed with debt. In this paper, we test the former implication whereas the previous research has investigated the latter.[2] Denis and McKeon (2012) find that the large corporate debt issues are used mostly to fund long-term investments. DeAngelo and Roll (2014)

[2] There is a concurrent study by Borochin and Yang (2014) who also examine whether expectations about future shocks affect leverage. They also measure these expectations by using option based variables. However, there are two main differences between the two studies. First, their study is set within an asset pricing setting where they test whether these expectations measure the *current* ability of the firm to receive funding and whether they are priced in the cross section of equities. They interpret an increase in their option based measures as the firm becoming riskier and hence it cannot access markets at time t, i.e. it becomes financially constrained and as a result it decreases its leverage over $[t,t+1]$. Instead we place our study within a corporate finance setting where in the presence of expected shocks, managers react *proactively* and they decrease leverage over $[t,t+1]$ to maintain their *future* financial flexibility at $t+1$; here, financial flexibility is defined as the firm's ability to avoid costly underinvestment in the future. Second, Borochin and Yang construct option based measures as spread variables. However, these variables are only proxies for the actual risk-neutral moments that we use (Rehman and Vilkov, 2012).

find that substantial increases in a firm's leverage are strongly associated with increases in its investments. Hess and Immenkötter (2014) find that firms fund new investments mostly with debt. Moreover, they find that firms which preserve high unused debt capacity are able to undertake a larger fraction of the investment opportunities they encounter relative to the rest of the firms. Marchiva and Mura (2010) and Ferrando et al. (2014) find that a conservative debt policy aimed at maintaining low leverage ratios increases future corporate investment. Furthermore, Ferrando et al. (2014) find that firms which followed a conservative debt policy during the period preceding the global financial crisis of 2007-2010, reduced their investment less than the rest of the firms during the crisis.

Second, our findings also contribute to the literature that explores the determinants of future firm leverage (e.g., Rajan and Zingales, 1995; Korajczyk and Levy, 2003; Frank and Goyal, 2009). Understanding the drivers of future leverage is of importance to academics in order to understand how the optimal leverage is determined. This topic is in the centre of the capital structure literature (for a review, see Frank and Goyal, 2008). It is also of importance to investors because the forecasts from a predictive model for future leverage affect the pricing of corporate bonds (Flannery, Nikolova and Öztekin, 2012, Elkamhi et al., 2014), corporate credit default swaps (Elkamhi et al., 2014) and the liquidity of the firm's stock (Andres et al., 2014). Third, our approach to measure managers' expectations about shocks to future cash flows from market option prices contributes to the extensive literature which views option prices as a market-based estimate of investors' expectations (e.g., Bates, 1991, Jackwerth and Rubinstein, 1996, Kostakis, Panigirtzoglou, Skiadopoulos, 2011, and for an excellent review, Christoffersen, Jacobs and Chang, 2012). Breeden and Litzenberger (1978) show that the risk-neutral distribution of the returns of the underlying asset can be extracted from the market option prices. These risk-neutral moments (RNMs) represent the expectations of a risk-neutral investor. Nevertheless, the RNMs are related to the moments of the physical distribution; the risk-neutral distribution is the product of the pricing kernel times the physical distribution. Therefore, RNMs convey information about the expectations of market participants.[3]

The remainder of the paper is structured as follows. Section 2 describes the sample construction. Section 3 presents the method for calculating the risk-neutral moments. In Section 4 we describe our empirical specification and present and discuss our results. In Section 5 we explore the effect of expectations on leverage across different categories of firms. Section 6 concludes.

2. Data

We collect firm-level accounting data and equity options data from Compustat North America and OptionMetrics Ivy DB database, respectively. Data are measured quarterly spanning the period from 1996:Q1 to 2012:Q2. Our dataset starts in 1996 because data on equity options are available from 1996 onwards. We match firm-level data from the two databases using eight-digit CUSIP numbers. Our sample consists of all firms that belong to any of the S&P LargeCap 500, S&P MidCap 400 and S&P SmallCap 600 indices and have available accounting and equity option data.[4] We choose to confine the sample to firms belonging to these benchmark indices because the equity options written on the stocks of these firms are the most liquid among the universe of U.S. traded equity options. Thus, they are suitable for the purposes of our analysis.

Following common practice in empirical capital structure studies, we filter accounting data as follows. We exclude financial firms (SIC codes 6000-6999) and utilities (SIC codes 4900-4949),

[3] Notice that we do not claim that these moments forecast realized shocks accurately. However, this is not an issue for the purposes of our study. Our focus is on proxying the market participants' expectations for future shocks by a forward-looking measure extracted from market prices. By definition, RNMs serve to this end.

[4] At any point in time, participation in these indices is mutually exclusive. That is, a firm cannot belong to more than one index at the same time.

because their capital structure is significantly affected by regulatory factors. Furthermore, we only use firm-quarters in which firms have non-missing data for any of the variables of interest. Moreover, we exclude firm-quarters with firms having non-positive book assets, book equity or market equity and negative debt or total liabilities. To avoid the effect of misreported data and outliers, we winsorize all final accounting variables at the 1st and the 99th percentiles.

Regarding the equity options data, we use the implied volatilities provided by Ivy DB for each traded contract. These are calculated based on the midpoint of bid and ask option prices using the Cox, Ross, and Rubinstein (1979) model because individual equity options are American style. We filter the options data to remove any noise. We only consider out-of-the-money (OTM) and at-the-money options with time-to-maturity of at least 5 days. We also discard options with zero open interest, zero bid price, and premiums below 3/8 $. In addition, we retain only option contracts that do not violate Merton's (1973) no-arbitrage conditions for American options and have implied volatilities less than 100%. As a proxy for the risk-free rate, we use the zero curves provided by IvyDB. IvyDB provides continuously compounded zero rates which have been constructed based on the 1 week and 1-12 months US LIBOR rates as well as settlement prices of CME Eurodollar futures. To obtain the rate for any maturity not contained in the database, we use linear interpolation across the two closest available maturities. This way, we ensure consistency between the interest rates used in this paper and the interest rates used to compute implied volatilities. We also obtain the history of expected dividend payments over the life of each option contract and their timing provided by IvyDB. These expected dividend payments have been calculated based on the assumption of constant dividend yields over the life of the option.

Finally, we obtain data on equity market return from CRSP and we obtain data on the aggregate nonfinancial corporate profit growth and GDP growth from the Federal Reserve Board and Federal Reserve Bank of St. Louis websites, respectively (http://www.federalreserve.gov/releases and http://research.stlouisfed.org).

3. Calculation of risk-neutral moments

We extract RNMs from market option prices using the model-free methodology suggested by Bakshi, Kapadia, and Madan (2003, BKM hereafter).

3.1. The BKM method: Description

Let $S(t)$ be the price of the underlying asset at time t, r the risk-free rate and $R(t,\tau) \equiv \ln\left[S\left(t+\tau\right)\right] - \ln\left[S\left(t\right)\right]$ the τ-period continuously compounded return. The computed at time t model-free risk-neutral volatility (*IV*), skewness (*SKEW*) and kurtosis (*KURT*) of the log-returns $R(t,\tau)$ distribution with horizon τ are given by:

$$IV(t,\tau) = \sqrt{E_t^Q\left\{R(t,\tau)^2\right\} - \mu(t,\tau)^2} = \sqrt{V(t,\tau)e^{r\tau} - \mu(t,\tau)^2} \tag{1}$$

$$\begin{aligned} SKEW(t,\tau) &= \frac{E_t^Q\left\{(R(t,\tau) - E_t^Q\left[R(t,\tau)\right])^3\right\}}{\left\{E_t^Q(R(t,\tau) - E_t^Q\left[R(t,\tau)\right])^2\right\}^{\frac{3}{2}}} \\ &= \frac{e^{r\tau}W(t,\tau) - 3\mu(t,\tau)e^{r\tau}V(t,\tau) + 2\mu(t,\tau)^3}{\left[e^{r\tau}V(t,\tau) - \mu(t,\tau)^2\right]^{\frac{3}{2}}} \end{aligned} \tag{2}$$

$$\begin{aligned} KURT(t,\tau) &= \frac{E_t^Q\left\{(R(t,\tau) - E_t^Q\left[R(t,\tau)\right])^4\right\}}{\left\{E_t^Q(R(t,\tau) - E_t^Q\left[R(t,\tau)\right])^2\right\}^2} \\ &= \frac{e^{r\tau}X(t,\tau) - 4\mu(t,\tau)e^{r\tau}W(t,\tau) + 6e^{r\tau}\mu(t,\tau)^2V(t,\tau) - 3\mu(t,\tau)^4}{\left[e^{r\tau}V(t,\tau) - \mu(t,\tau)^2\right]^2} \end{aligned} \tag{3}$$

where $V(t, \tau)$, $W(t,\tau)$ and $X(t,\tau)$ are the fair values of three artificial contracts (volatility, cubic and quartic contract) defined as:

$$V(t,\tau) \equiv E_t^Q\left\{e^{-r\tau}R(t,\tau)^2\right\},\ W(t,\tau) \equiv E_t^Q\left\{e^{-r\tau}R(t,\tau)^3\right\},\ X(t,\tau) \equiv E_t^Q\left\{e^{-r\tau}R(t,\tau)^4\right\} \tag{4}$$

and $\mu(t, \tau)$ is the mean of the log return for period τ defined as:

$$\mu(t,\tau) \equiv E_t^Q\left\{ln\left[\frac{S(t+\tau)}{S(t)}\right]\right\} \approx e^{r\tau} - 1 - \frac{e^{r\tau}}{2}V(t,\tau) - \frac{e^{r\tau}}{6}W(t,\tau) - \frac{e^{r\tau}}{24}X(t,\tau) \quad (5)$$

The prices of the three contracts can be computed as a linear combination of out-of-the-money call and put options:

$$V(t,\tau) = \int_{S(t)}^{\infty} \frac{2\left(1 - ln\left[\frac{K}{S(t)}\right]\right)}{K^2} C(t,\tau;K)\,dK + \int_{0}^{S(t)} \frac{2\left(1 + ln\left[\frac{S(t)}{K}\right]\right)}{K^2} P(t,\tau;K)\,dK \quad (6)$$

$$W(t,\tau) = \int_{S(t)}^{\infty} \frac{6\,ln\left[\frac{K}{S(t)}\right] - 3\left(ln\left[\frac{K}{S(t)}\right]\right)^2}{K^2} C(t,\tau;K)\,dK - \int_{0}^{S(t)} \frac{6\,ln\left[\frac{S(t)}{K}\right] + 3\left(ln\left[\frac{S(t)}{K}\right]\right)^2}{K^2} P(t,\tau;K)\,dK \quad (7)$$

$$X(t,\tau) = \int_{S(t)}^{\infty} \frac{12\left(ln\left[\frac{K}{S(t)}\right]\right)^2 - 4\left(ln\left[\frac{K}{S(t)}\right]\right)^3}{K^2} C(t,\tau;K)\,dK + \int_{0}^{S(t)} \frac{12\left(ln\left[\frac{S(t)}{K}\right]\right)^2 + 4\left(ln\left[\frac{S(t)}{K}\right]\right)^3}{K^2} P(t,\tau;K)\,dK \quad (8)$$

where $C(t,\tau;K)$ and $P(t,\tau;K)$ are the call and put prices with strike price K and time to maturity τ.

3.2. The BKM method: Implementation

The implementation of equations (6), (7) and (8) requires a continuum of OTM call and put options across strikes. However, market option quotes are available only for a bounded finite range of discrete strike prices. This will incur a bias in the calculation of RNMs (Dennis and Mayhew, 2002, and Jiang and Tian, 2005). In addition, we need to extract constant maturity moments to eliminate the effect of the shrinking time to maturity on the RNMs as time goes by. To address both issues, once we apply the data filters described in Section 2 to any given day, we extract the expirations for which at least two OTM puts and two OTM calls are traded. We discard maturities that do not satisfy this requirement. We also discard any maturity for which there is no data on at least one call option with delta smaller than 0.25 and one put option with delta larger than 0.25. We do this to ensure that the computed RNMs reflect a wide range of option strike prices. Then, we fit a cubic spline through the implied volatilities for each available maturity as a function of moneyness (defined as the ratio of the underlying price to the strike price). We evaluate this spline at an equally spaced moneyness grid of 1000 points with minimum moneyness 0.01 and maximum moneyness 3. This yields for each maturity 1000 pairs of moneyness and implied volatilities (for a similar approach, see Rehman and Vilkov, 2012, Chang, Christoffersen and Jacobs, 2013, Neumann and Skiadopoulos, 2013). For each one of these 1,000 moneyness levels, we fit a cubic spline in the maturity dimension and evaluate it at the target maturity; we calculate the RNMs on a daily level for fixed maturities 3, 6 and 12 months. For moneyness levels below (above) the smallest (largest) available moneyness level in the market, we extrapolate the implied volatility of the lowest (highest) available strike price horizontally. If the target expiration is below the smallest available traded expiration, a constant maturity implied volatility curve is not constructed to avoid any noise from extrapolation in the time to maturity dimension.

Finally, we convert the moneyness grid and the corresponding constant maturity implied volatilities to the associated strike and option prices via the Black and Scholes (1973) model.[5] To account for any dividends expected to be paid over the life of the constant maturity option, we adjust the underlying price by the present value of the expected dividends (for a similar approach, see e.g., Dumas, Fleming and Whaley, 1998). Then, we compute the constant maturity moments [equations

[5] The use of the Black-Scholes (1973) model to convert implied volatilities to option prices does not introduce a bias even though we use American options. This is because we use only short maturity (less than six months), out-of-the money options which have a very small early exercise premium (see Barone-Adesi and Whaley, 1987, for an extensive analysis of these points).

(1), (2), and (3)] by evaluating the integrals in formulae (6), (7), and (8) using trapezoidal approximation.

In line with Bakshi, Kapadia and Madan (2003) and Conrad, Dittmar and Ghysels (2013), we average the daily RNM over the period of interest (quarter) to diminish the effect of any outliers in risk-neutral moments that may still be present on a daily level. The application of the filtering constraints to the options data, delivers a different sample size for the RNMs across the different horizons. As a result, the sample size of the firms' panel which is matched with the RNMs differs across the different horizons. The use of 3-month, 6-month and 12-month option prices yields 17,229 19,558 and 12,465 firm-quarter observations, respectively.

4. Leverage and expectations

4.1. Empirical specification

To explore the effects of expectations about future shocks on leverage, we run the following fixed-effects panel regression:

$$L_{i,t} = a_i + \beta RNM_{i,t-1,\tau} + \gamma FL_{i,t-1} + \delta ML_{t-1} + \varepsilon_{i,t} \tag{9}$$

Equation (9) describes the leverage ratio $(L_{i,t})$ of the i^{th} firm in quarter t as a function of the vector of risk-neutral moments $(RNM_{i,t-1,\tau})$ implied by τ-month individual equity options; the vector includes the risk-neutral volatility and kurtosis for each firm. To isolate the effects of RNMs on leverage, we also include firm fixed effects (a_i), and two vectors of standard firm-level $(FL_{i,t-1})$ and market-level (ML_{t-1}) determinants of leverage in equation (9), respectively, proposed by the previous literature. In line with previous studies (e.g., Rajan and Zingales, 1995, Korajczyk and Levy, 2003, Frank and

Goyal, 2009), all explanatory variables are lagged one quarter to signify that at t-1 the manager decides on the firm's leverage to prevail over the interval [t-1, t]. Firm fixed effects (a_i) incorporate any effects from omitting variables that are relevant for the leverage determination such as managerial preferences, corporate governance characteristics, competitive threats and corporate culture that are difficult to be measured accurately (Parsons and Titman, 2008).

Two remarks are in order regarding the measurement of expectations of future shocks and the measurement of leverage. To capture expectations for shocks to cash flows, we convert the stock returns risk-neutral volatility to the asset risk-neutral volatility. The asset value is linked to cash flows because the former is the present value of discounted cash flows. In line with Welch (2004), Faulkender and Petersen (2006) and Frank and Goyal (2009), we perform the conversion from the stock return to the asset value metric by multiplying the equity volatility with the equity-to-asset ratio of the firm. In the case of the risk-neutral kurtosis, there is no need to perform a conversion because kurtosis is invariant to linear transformations.[6] Hence, the risk-neutral kurtosis of stock returns equals the risk-neutral kurtosis of asset returns. Regarding the measurement of leverage, in line with the previous literature (e.g., Huang and Ritter, 2009), we measure leverage in both book (i.e., accounting) and market terms because there is no consensus on which one of the two measures leverage better. We estimate equation (9) for the case where we measure leverage by book and market values separately. The former is measured as book debt divided by total assets and the latter as book debt divided by the sum of the market value of equity and book debt.

The set of firm-level variables $\left(FL_{i,t-1}\right)$ controls for the effect of agency costs, asymmetric information, default risk and tax shield variability on leverage. Following Flannery and Rangan

[6] In line with Welch (2004), Faulkender and Petersen (2006) and Frank and Goyal (2009), we convert from the stock returns metric to the cash flow metric by assuming that the variance of debt equals zero.

(2006), Hovakimian and Li (2011) and Faulkender at el. (2012), we use the following our set of firm-level variables:

- **INDUSTRY**: Industry median leverage. Within any quarter, it is defined as the median leverage ratio among all firms of the industry (defined by two-digit SIC codes) that the firm belongs to. The industry median leverage proxies industry factors that affect leverage, such as business risk and regulation.
- **MB**: Market-to-book ratio of assets. It is calculated as the sum of book liabilities and market value of equity divided by book assets. It proxies a firm's growth opportunities. Firms with high growth potential are more concerned about the debt overhang problem and thus they are expected to have lower leverage.[7]
- **ASSETS**: Natural log of book assets expressed in 2009 U.S. dollars as a measure of firm size. Large firms are considered to have lower default risk and investors possess more information about them. Therefore, they are considered to have higher debt capacity.
- **PROF**: Profitability calculated as earnings before interest, taxes, depreciation and amortization divided by the book value of assets. More profitable firms are expected to be less levered because the availability of internally generated funds reduces the need to resort to costly debt financing. Furthermore, retained earnings may mechanically reduce the firm's book leverage ratio.
- **TANG**: Tangibility, calculated as net property, plant and equipment divided by book assets. Tangibility proxies collateral. Firms operating mostly with fixed assets have a greater debt capacity, given that fixed assets have a high liquidation value in case of default.

[7] According to the debt overhang problem, the greater the leverage of a firm, the greater the probability that it will forgo positive net present value projects. This happens because the share of the firm's future proceeds received by current creditors increases with leverage, leaving little or no incentive to equityholders or new creditors to finance a new profitable investment.

- **DEP**: Depreciation expenses, calculated as depreciation and amortization divided by book assets. Depreciation expenses proxy for non-debt tax shields. The greater the depreciation expenses of a firm, the less the need for interest expenses to reduce taxable income.
- **SELL**: Selling expenses, calculated as selling, general and administrative expenses divided by sales. Selling expenses proxy the degree of uniqueness of the firm, i.e., how easily replaceable are the assets of the firm by the assets of another firm. Specialized assets have a lower expected liquidation value. Thus, firms with highly specialized assets are expected to have a lower debt capacity. Flannery and Rangan (2006), Hovakimian and Li (2011) and Faulkender at el. (2012) use research and development (R&D) expenses to proxy uniqueness. In line with Korajczyk and Levy (2003), we use selling expenses instead, because R&D expenses are not frequently reported by firms on a quarterly basis.

In equation (1), we also include three market-level variables $(ML_{t\text{-}1})$ to control for the effect of macroeconomic fluctuations on leverage. Korajczyk and Levy (2003) and Leary (2009) find that leverage is countercyclical for financially unconstrained firms and procyclical for financially constrained firms in U.S. Halling et al. (2012) find that leverage is pro-cyclical in common law countries including U.S. Following Leary (2009), we use the one-year real aggregate domestic nonfinancial corporate profit growth (AGG_PROF), the one-year real stock market return (MARKET_RET) and the one-year real GDP growth (GDP).

4.2. Results and discussion

We use RNMs extracted for three different time horizons 3, 6 and 12 months. We use three different time horizons to examine whether expectations for longer horizon shocks may also matter for leverage determination. Firms may set the next quarter's leverage by taking into account expectations for longer horizons shocks, too. DeAngelo et al. (2011) show that when managers believe that shocks are serially correlated, they take into account expectations for longer horizon shocks when making financing decisions. For each time horizon, we estimate four alternative specifications of equation (9), depending on whether we use market or book leverage as a dependent variable and depending on whether we include market-level control variables on top of the firm's specific ones or not. Furthermore, we estimate each one of the four alternative specifications twice, once including the RNMs and once without including them in order to measure the incremental effect of the RNMs to the fit of our empirical model. Overall, we estimate 8 specifications for each time horizon. In line with Petersen (2009), we conduct statistical inference by using the Cameron, Gelbach and Miller (2011) and Thompson (2011) standard errors clustered by both firm and year.

Tables 1, 2 and 3 report the results for the cases where expectations for shocks over the next 3-month, 6-month and 12-month period, respectively, are taken into account by managers. In each table, columns (1) to (4) report the results from the specifications of equation (9) in the case where the RNMs are excluded. Columns (1) and (2) report results when leverage is measured by market and book leverage, respectively, and only firm-level determinants are used. Columns (3) and (4) report results when both firm and market-level determinants are used for the case where leverage is measured by market and book values, respectively. In analogy with columns (1) - (4), columns (5) to (8) report results for the corresponding specifications of equation (9) that include the RNMs.

In line with previous capital structure papers (Huang and Ritter, 2009, Hovakimian and Li, 2012), tables report the *within-firm* adjusted R^2 defined to be the explained variation of leverage that is attributable to all explanatory variables but the firm fixed effects (i.e. the firm specific constant). To obtain the within-firm R^2, we time-demean the data and estimate the following equation:

$$L_{i,t} - \overline{L}_i = \beta(RNM_{i,t-1,\tau} - \overline{RNM}_{i,\tau}) + \gamma(FL_{i,t-1} - \overline{FL}_i) + \delta(ML_{t-1} - \overline{ML}) + (\varepsilon_{i,t} - \overline{\varepsilon}_i) \qquad (10)$$

where, $\overline{L}_i$ is the time series average leverage of the i^{th} firm. The estimation of equation (10), known as within estimation, yields the same slope coefficients (β,γ,δ) as the estimation of equation (9). The adjusted R^2 obtained from the estimation of equation (10) is the reported within-firm R^2.

Three remarks are in order regarding our findings. First, we can see that expectations for future shocks are significant even when we control for other well-known determinants of leverage. The coefficients for the risk-neutral volatility and risk-neutral kurtosis are negative and statistically significant in almost all specifications and time horizons but the 12-month risk-neutral kurtosis in the book leverage specification with firm specific and market-level variables. This is consistent with the predictions of the DeAngelo et al. (2011) model and it suggests that an increase in the expectations for either diffusive or large future shocks decreases the firm's leverage.[8] From an economic point of view, a 1% increase in the standard deviation of risk-neutral volatility (risk-neutral kurtosis) decreases leverage by 2.1% to 3.2% (0.3% to 0.9%) depending on the specification and the way that leverage is measured. This effect is similar regardless of the horizon under scrutiny. Second, the fact that changes in the 6 and 12 months risk-neutral volatility and kurtosis also affect leverage indicates that expectations about shocks occur beyond the next quarter where the leverage will be set also matter.

Third, we can see that all control variables but depreciation expenses have the expected sign, albeit some of them are not significant across all specifications and time-horizons. The empirical evidence on the effect of depreciation expenses on leverage is mixed. Hovakimian and Li (2011) find a positive whereas Faulkender and Rangan (2006) find a negative relation. Interestingly, the tangibility variable is insignificant in all cases. This is due to the nature of our employed sample which contains

[8] Welch (2004) finds that part of the variation in market leverage ratios is mechanical in the sense that it is due to changes in the market value of the firm's equity. He argues that once the change in the market value of the firm's equity is accounted for, some of the previously identified leverage determinants become statistically insignificant. In unreported tests, we re-run all market leverage regressions augmented with the firm's stock quarterly return. We find that the results for the RNMs do not change.

firms that belong to widely followed stock indices. As a result, these firms follow strict corporate governance rules and they are transparent to investors and thus the importance for tangibility as collateral and safety net for creditors is mitigated. Consistently with our conjecture, De Jong et al. (2008) find that the importance of tangibility as a leverage determinant decreases in the case where shareholders rights are protected.

4.3. Expectations of future shocks versus traditional determinants

We assess the importance of expectations about future shocks relative to that of the determinants suggested by the previous literature. To this end, we examine the contribution of the two RNMs to the goodness of fit of the model described by equation (9) relative to the goodness of fit obtained from employing a nested version of equation (9) which uses only the traditional leverage determinants. Table 1 shows that the adjusted R^2 in the 3-month specification increases by 19.7% (40.4%) in the case of the market (book) leverage when we include the two RNMs in the firm-level specifications (columns 1 and 2 versus columns 5 and 6). Likewise, in the specification that include both firm-level and market-level variables, the adjusted R^2 rises by 30.6% (54.1%) in the case of the market (book) leverage when we include the RNMs (columns 3 and 4 versus columns 7 and 8, correspondingly). The results for the 6-month and 12-month cases are similar.

Next, we conduct a variance decomposition of leverage to determine the fraction of explained variation of the dependent variable that is attributable to the RNMs. Following Lemmon et al. (2008), we employ the framework of analysis of covariance (ANCOVA). For each model specification, we calculate the *partial Type III explained sum of squares* of each explanatory variable. This is calculated as follows. For each explanatory variable, we estimate equation (10) after excluding the particular variable. Next, we obtain the explained sum of squares (ESS) defined as the sum of the squares of the deviations of the fitted leverage values from the mean leverage value of this regression. The difference between the ESS of this model and the ESS of the model that includes the particular variable is the partial Type III ESS for the particular variable. It expresses the explained variation of the dependent variable that is attributable to the particular explanatory variable once all other explanatory variables have been taken into account. The sum of the partial Type III ESS of all explanatory variables in the model equals the ESS of the model that includes all variables.

Table 4 reports the variance decomposition results for the specifications which include the 3-month RNMs. Each column corresponds to an alternative model specification for leverage. In each column, the entry for a particular variable is calculated as the ratio of the partial Type III ESS of that variable over the sum of the partial Type III ESS of all explanatory variables in the model. Thus, every column adds to 100%. Hence, each figure expresses the percentage of the within-firm adjusted R^2 that is attributable to a particular explanatory variable. Entries in columns (4) to (8) show that the risk-neutral volatility accounts for most of the within-firm adjusted R^2 compared to all other determinants in three out of the four specifications; it captures 17.5% to 38.2% of leverage variation, depending on the specification. The remaining explained variation is captured mostly by industry median leverage and profitability (18.8% to 40.4% and 18.1% to 22.5%, respectively). This is consistent with the findings of Lemmon et al. (2008), who document that the industry median leverage is the most influential identified leverage determinant. The results are similar in the 6-month and 12-month specifications (Tables 5 and 6) where risk-neutral volatility captures 21.2% to 42.5% and 17.8% to 44% of the leverage explained variation, respectively. Risk-neutral kurtosis accounts for a relatively smaller fraction of leverage variation, ranging from 0.7% to 6.30%, depending on the specification and the time horizon of the moments.

4.4. Expectations of future shocks and the probability of default

As we discussed, our findings on the effect of market expectations on the firms' capital structure is in accordance with the DeAngelo (2011) model's predictions regarding financial flexibility as a determinant of corporate financial policy. Alternatively, one could argue that the documented effect of RNMs on the capital structure reflects a probability of default explanation; an increase in RNMs reflects that the firm's probability of default increases and thus managers decrease leverage. We explore this alternative explanation by including a measure of probability of default on the right-hand side of equation (10). We use two alternative measures to proxy for the probability of default proposed by the previous literature. In line with Graham (2000) and Byoun (2008), we use the Altman's (1968) *Z*-score as modified by Mac-Kie Mason (1990):

$$Z_{i,t} = \frac{3.3 \times EBIT_{i,t} \ + \ Sales_{i,t} \ + \ 1.4 \times RE_{i,t} \ + \ 1.2 \times WC_{i,t}}{TA_{i,t}} \tag{11}$$

Equation (11) describes the modified Altman's Z-score for the i^{th} firm in quarter t , where *EBIT*: Earnings before Interest and Taxes, *Sales*: Total sales, *RE*: Retained Earnings, and *TA*: Total Assets. The lower the *Z*-score, the higher is the probability that the firm will default. The second probability of default measure we employ is the standard deviation of the first difference in the firm's historical operating profits $(EBITDA_{i,t} - EBITDA_{i,t-1})$ divided by the mean of total assets. Following Mac-Kie Mason (1990), for each quarter *t* we use the last ten observations, i.e., the period spanning from quarter *t-9* to quarter *t*, to calculate both the standard deviation of the operating profits and the mean of the assets. If data are missing, we require at least 6 quarters of non-missing data. The higher the value of this measure, the higher is considered to be the firms' probability of bankruptcy. We find that the RNMs prevail their significance and sign even when we control for each one of these measures (results are available upon request). Therefore, our finding that an increase in RNMs decreases leverage cannot be explained under a probability of default perspective. This renders further support to the financial flexibility explanation of our findings.

5. Expectations of shocks and financial constraints

In this section, we examine further the effect of expectations for future shocks to the firm's leverage when we classify firms according to their ability to obtain external finance to fund their activities. An implication of the DeAngelo et al. (2011) model is that the greater the risk that a firm will not be able to respond to a future shock by accessing capital markets, the more the debt capacity it needs to preserve today and thus the lower the leverage today. Hence, the effect of the expectations for shocks on leverage is expected to be stronger for the financially constrained firms. To test this implication, we distinguish the financially constrained from the financially unconstrained firms in our sample. We use three alternative classification criteria employed by the previous literature to ensure that our results are not sensitive to the choice of the classification criterion. In particular, we classify firms according to firm size, the existence of a credit rating and the financial constraints index developed by Kaplan and Zingales (1997).

5.1. Expectation of shocks and firm size

In line with Hahn and Lee (2009), Campello and Chen (2010) and Hovakimian (2011), our first criterion to classify firms into constrained and unconstrained groups is the firm size. Small firms are considered to have a more difficult access to capital markets due to lower collateral availability and higher asymmetric information problems (Gertler and Gilchrist, 1994). For any given time horizon, we trace the median firm size across all firm-quarters in our panel; we measure size as the real (i.e. deflated) market value of assets calculated as the book value of liabilities plus the market value of equity. We classify a firm as small (big) if the market value of its real assets is lower (higher) than the sample median. We augment the panel regression in equation (9) by interacting all variables with a dummy $D_{i,t}^{small}$ that takes the value of one if the firm-quarter belongs to the small-firm group and zero if it belongs to the large-firm group, i.e.

$$L_{i,t} = a_i + \varphi_i D_{i,t}^{small} + \beta RNM_{i,t-1,\tau} + \zeta D_{i,t}^{small} RNM_{i,t-1,\tau} + \gamma FL_{i,t-1} + \eta D_{i,t}^{small} FL_{i,t-1} + \delta ML_{t-1} + \theta D_{i,t}^{small} ML_{t-1} + \varepsilon_{i,t} \quad (12)$$

In this specification, the coefficient vectors α_i, β, γ and δ represent the effect of firm fixed effects, risk-neutral moments $(RNM_{i,t-1})$, firm-level $(FL_{i,t-1})$ and market-level (ML_{t-1}) factors, respectively, on leverage for the large-firm group. Vectors φ_i, ζ, η and θ represent the differences between the coefficients for the large-firm and the small-firm group.

Table 7 reports the results from estimating equation (11). Columns (1) - (4), (5) - (8) and (9) - (12) report the results obtained from estimating the specifications which include the 3-month, 6-month and 12-month constant maturity RNMs, respectively. For brevity, we report results only for risk-neutral volatility and kurtosis (coefficient vector β) and their interaction terms (coefficient vector ζ). We can see that there is a negative effect of risk-neutral volatility and skewness on the leverage of large firms. In addition, the results for the interaction coefficient on volatility are always negative and statistically significant in ten out of twelve specifications. The estimated coefficient for the kurtosis interaction variable is negative and statistically significant across almost all specification, i.e. in eleven out of twelve specifications. Given that the estimated coefficients for volatility and kurtosis in the large-firm group are negative, the negative sign of the interaction coefficients indicates that the impact of shocks on leverage is stronger in absolute terms for the small firms as predicted by the theory.

5.2. Expectations of shocks and credit ratings

Next, in line with Hahn and Lee (2009) and Hovakimian (2011), the second criterion we adopt to classify firms is whether a firm has a commercial paper rating or not. Rated firms are considered to be less opaque to investors because they are evaluated by rating agencies and thus they can access capital markets easier (Calomiris, Himmelberg, and Wachtel, 1994). Within any given quarter, we classify a firm as unconstrained if it has a commercial paper rating. In addition, we classify a firm as unconstrained if it does not have a commercial paper rating but it has zero debt.[9] The remaining firms are classified as financially constrained. We obtain Standard & Poor's rating data downloaded from Compustat; Compustat does not provide information about whether a firm is rated for 103 firm quarters of our sample. Under this classification, firms are characterized as unconstrained in 44.2% of total firm-quarter observations and they are characterized as constrained in the remaining 55.8% of total observations. Interestingly, the vast majority of the ratings in the sample are investment-grade. In particular, 98.7% of the ratings are investment-grade, ranging from grade A1 to grade A3, and 1.8% are speculative-grade, ranging from grade B1 to grade B3. This ensures that the firm rating in our sample is a meaningful criterion to distinguish between constrained and unconstrained firms; if rated firms had received a poor rating, then it would be have been debatable whether they are constrained or unconstrained.

We augment the regression in equation (9) by including the product of each one of the explanatory variable with a dummy variable $D_{i,t}^{constr}$ that takes the value of one for the financially constrained firms and zero otherwise, i.e.

$$\begin{aligned} L_{i,t} = a_i + \varphi_i D_{i,t}^{constr} + \beta RNM_{i,t-1,\tau} + \zeta D_{i,t}^{constr} RNM_{i,t-1,\tau} \\ + \gamma FL_{i,t-1} + \eta D_{i,t}^{constr} FL_{i,t-1} + \delta ML_{t-1} + \theta D_{i,t}^{constr} ML_{t-1} + \varepsilon_{i,t} \end{aligned} \quad (13)$$

[9] There is no consensus on whether firms that have zero debt in their balance sheet and yet they do not have a credit rating should be classified as constrained or unconstrained. For instance, Hovakimian (2011) classifies them as unconstrained, Campello and Chen (2010) classify them as constrained and Hahn and Lee (2009) excludes them from the sample. One may argue that the absence of debt in their balance sheet combined with the lack of a credit rating indicates that these firms are completely rationed by private and public debt markets and therefore they should be categorised as financially constrained. Alternatively, one may argue that these firms have chosen to finance themselves solely with equity and thus they are not interested in issuing debt, either private or public. In this case, the absence of credit rating is a matter of choice rather than credit rationing. So, classifying them as constrained would not be accurate. We report results for the case where we classify firms with zero debt and no credit rating as financially unconstrained. Yet our results are robust to interpreting them as financially constrained or excluding them from our sample.

Coefficient vectors α_i, β, γ and δ represent the effect of firm fixed effects, risk-neutral moments $(RNM_{i,t-1})$, firm-level $(FL_{i,t-1})$ and market-level (ML_{t-1}) factors, respectively, on leverage for the unconstrained group. Vectors φ_i, ζ, η and θ represent the differences between the coefficients for the unconstrained and the constrained group.

Table 8 reports the results for risk-neutral volatility and kurtosis (coefficient vector β) and their interaction terms (coefficient vector ζ). The coefficients for the RNMs are negative in the unconstrained group. The coefficients for the interaction dummy variables for risk-neutral volatility and kurtosis are negative and significant across all moment horizons and across all regression specifications. Given that the coefficients for kurtosis and volatility in the unconstrained group are negative, the negative sign of the interaction coefficients suggests that the impact of shocks on leverage is stronger for financially constrained relative to unconstrained firms. Again, this is in line with DeAngelo et al. (2011) predictions.

5.3. Expectations of shocks and the Kaplan and Zingales index

In line with Campello and Chen (2010) and Hovakimian (2011), the third criterion we adopt to classify firms is the Kaplan and Zingales (1997) index as this was first applied by Lamont et al. (2001), i.e.

$$\begin{aligned} KZ_{i,t} = &-1.002\times\left(CF_{i,t} / FA_{i,t-1}\right) + 0.283\times MB_{i,t} + 3.139\times\left(D_{i,t} / TC_{i,t}\right) \\ &-39.368*\left(DIV_{i,t} / FA_{i,t-1}\right) - 1.315\times\left(CASH_{i,t} / FA_{i,t-1}\right) \end{aligned} \tag{14}$$

where $KZ_{i,t}$ denotes the value of the Kaplan and Zingales index, $CF_{i,t}$ denotes net cash flows, $FA_{i,t}$ denotes fixed assets, $MB_{i,t}$ denotes the market-to-book ratio, $TC_{i,t}$ denotes the sum of debt and equity book values, $DIV_{i,t}$ denotes dividends and $CASH_{i,t}$ denotes cash holdings for the i^{th} firm in quarter *t*.

Kaplan and Zingales (1997) obtain the right hand side of equation (14) using hand-collected qualitative information from the annual reports that firms file with the Securities and Exchange Commission (SEC) to classify firms in discrete categories according to the severity of the financial constraints they face. Then, they construct an ordinal variable (1 for unconstrained, 2 for likely unconstrained, 3 for unclassified, 4 for likely constrained and 5 for undoubtedly constrained) based on this classification. Next, they regress this ordinal variable on certain accounting variables to test whether the degree of financial constraints that a firm faces is related to these variables. Lamont et al. (2001) use the estimated coefficients from this regression to construct the $KZ_{i,t}$ index which measures the severity of financial constraints as a function of the accounting variables that Kaplan and Zingales used. The greater the value of the index, the more constrained a firm is considered to be because higher values of the ordinal variable used by Kaplan and Zingales indicate more severe constraints.

For any given RNM time horizon, we trace the median *KZ* index value across all firms-quarters in our panel. Within any given quarter, we classify a firm as constrained (unconstrained) if the *KZ* index value is greater (less) than the median index value. We re-estimate equation (9), augmented with an interaction dummy variable $D_{i,t}^{KZ}$ which takes the value of one for constrained firm-quarters and zero otherwise:

$$\begin{aligned} L_{i,t} = a_i + \varphi_i D_{i,t}^{KZ} + \beta RNM_{i,t-1,\tau} + \zeta D_{i,t}^{KZ} RNM_{i,t-1,\tau} \\ + \gamma FL_{i,t-1} + \eta D_{i,t}^{KZ} FL_{i,t-1} + \delta ML_{t-1} + \theta D_{i,t}^{KZ} ML_{t-1} + \varepsilon_{i,t} \end{aligned} \quad (15)$$

Coefficient vectors α_i, β, γ and δ represent the effect of firm fixed effects, risk-neutral moments $(RNM_{i,t-3})$, firm-level $(FL_{i,t-3})$ and market-level (ML_{t-3}) factors, respectively, on leverage for the unconstrained group. Vectors φ_i, ζ, η and θ represent the differences between the coefficients for the unconstrained and the constrained group. In 63 firm-quarters, Compustat does not have available information for the accounting variables required to calculate the *KZ* index.

Table 9 reports results for the effect of risk-neutral volatility and kurtosis (coefficient vector β) and their interaction terms (coefficient vector ζ). The coefficients for the RNMs are negative for the financially unconstrained group. Moreover, the coefficient of the interaction dummy variable for volatility is always negative and significant for all horizons, whereas the coefficient for the interaction dummy variable for kurtosis is always negative and statistically significant in nine out of the twelve specifications (firm level and market level, book leverage and market leverage, three horizons). Given that the coefficients for volatility and kurtosis in the unconstrained group are negative, the negative sign of the interaction coefficients indicates that the shocks expectations affect the leverage of constrained firms more than that of unconstrained firms. These results corroborate the findings obtained in the case where the firm size or the existence of a credit rating was used as a criterion to classify firms as constrained and unconstrained.

6. Conclusions

DeAngelo et al. (2011) model and the evidence from the Graham and Harvey (2001), Bancel and Mitoo (2004) and Brounen et al. (2006) survey studies predict that the expectations of a firm's manager about future shocks on the firm's cash flows should matter for the determination of leverage. We test this prediction by quantifying the expectations for future cash flow shocks.

We proxy the expectations for future specific shocks to small and large firm by the risk-neutral volatility and risk-neutral kurtosis, respectively. We extract the two risk-neutral moments from a cross-section of liquid equity options over different time horizons. We find that expectations for both diffusive shocks and jumps decrease the firm's leverage. This effect is stronger for the small and the financially constrained firms as predicted by the theory. Furthermore, expectations for future shocks account for the determination of the firm's leverage even when we control for the traditional determinants of the firm's leverage. In addition, we find that these expectations account for most of the leverage variability. These results hold also for expectations spanning time horizons which extend beyond the one over which managers set the firm leverage.

Our results have four implications. First, managers set the leverage to prevail over the next period at a lower level when they expect a future shock. This is consistent with the empirical evidence drawn from the previously mentioned empirical studies that managers look for financial flexibility, i.e. they maintain low leverage today to preserve the ability to borrow when a future shock dictates a financing need. It is also in accordance with the DeAngelo et al. (2011) model's predictions. Second, managers set leverage by taking into account expectations for both small and large future shocks. Third, expectations about future shocks constitute a first order effect to capital structure decisions compared to the effect of the standard leverage determinants proposed by the previous literature. Fourth, managers are concerned not only about shocks to be realized over the period that leverage is set for but they are also concerned for shocks to be realized at times beyond the one that the leverage is set for.

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Table 1. Leverage determinants and risk-neutral moments: 3-months horizon

	Traditional determinants only				Traditional determinants & firm-level moments			
	(1) ML	(2) BL	(3) ML	(4) BL	(5) ML	(6) BL	(7) ML	(8) BL
INDUSTRY	0.327***	0.346***	0.292***	0.312***	0.378***	0.393***	0.319***	0.338***
	(9.11)	(7.14)	(7.16)	(6.45)	(9.55)	(7.96)	(7.48)	(6.85)
MB	-0.005***	-0.004**	-0.004***	-0.004**	-0.003***	-0.003*	-0.002**	-0.003
	(-3.96)	(-2.26)	(-3.59)	(-2.50)	(-2.94)	(-1.71)	(-1.98)	(-1.59)
ASSETS	0.027***	0.012**	0.025***	0.014**	0.025***	0.007	0.017***	0.004
	(6.14)	(2.22)	(5.09)	(2.52)	(5.43)	(1.28)	(3.37)	(0.73)
PROF	-0.660***	-0.454***	-0.637***	-0.453***	-0.692***	-0.505***	-0.669***	-0.492***
	(-8.44)	(-5.21)	(-7.65)	(-5.11)	(-8.75)	(-5.86)	(-7.58)	(-5.40)
TANG	0.039	0.039	0.041	0.037	0.025	0.035	0.030	0.034
	(1.02)	(0.96)	(1.07)	(0.88)	(0.69)	(0.87)	(0.83)	(0.82)
SELL	-0.016*	-0.022***	-0.016*	-0.022***	-0.015*	-0.021***	-0.014*	-0.020***
	(-1.78)	(-3.09)	(-1.72)	(-3.00)	(-1.81)	(-3.19)	(-1.68)	(-3.04)
DEP	0.709	0.957*	0.588	0.810	1.135***	1.425***	1.083***	1.290**
	(1.63)	(1.68)	(1.35)	(1.39)	(2.84)	(2.60)	(2.81)	(2.39)
MARKET_RET			-0.014	-0.009			-0.053***	-0.044***
			(-0.88)	(-0.99)			(-2.62)	(-3.48)
AGG_PROF			-0.007	-0.020***			-0.014	-0.027***
			(-1.16)	(-4.00)			(-1.53)	(-3.74)
GDP			-0.132	0.254**			-0.128	0.250*
			(-0.87)	(2.25)			(-0.73)	(1.77)
VOL3					-0.264***	-0.251***	-0.382***	-0.341***
					(-7.83)	(-6.42)	(-8.51)	(-6.90)
KURT3					-0.020***	-0.008***	-0.019***	-0.006*
					(-6.32)	(-2.60)	(-4.46)	(-1.67)
N	17229	17229	17229	17229	17229	17229	17229	17229
Adj. R^2	0.152	0.057	0.157	0.061	0.182	0.080	0.205	0.094
Firms	775	775	775	775	775	775	775	775

Entries report the results from estimating alternative specifications of equation (9). All equations are estimated via OLS with firm fixed effects. All explanatory variables are lagged one quarter. Sample period is 1996:Q1 to 2012:Q2. BL is book leverage, i.e. book debt divided by book assets. ML is market leverage, i.e. book debt divided by the sum of market equity and book debt. INDUSTRY is the median leverage of the industry (defined by two-digit SIC codes) that the firm belongs to. MB is the sum of book liabilities plus market value of equity divided by book assets. ASSETS is the natural log of book assets expressed in 2009 US dollars. DEP is depreciation and amortization divided by book assets. PROF is earnings before interest, taxes, depreciation and amortization divided by book assets. TANG is net property, plant and equipment divided by book assets. SELL is selling, general and administrative expenses divided by sales. MARKET_RET is the one-year real stock market return (CRSP value-weighted index of stocks traded on NYSE, NASDAQ and AMEX). AGG_PROF is the one-year real aggregate domestic nonfinancial corporate profit growth. GDP is the year-on-year growth of real GDP. AGG_PROF and GDP are matched with the firm quarter with the most overlap for firms whose fiscal year does not coincide with the calendar year. VOL3 is the daily average over a quarter of firm-specific stock return volatility extracted from 90-days option prices. KURT3 is the daily average over a quarter of firm-specific stock return kurtosis extracted from 90-days option prices. *N* is the number of firm-quarters. Adj. R^2 is the within adj. R^2. The reported *t*-statistics reflect standard errors (White standard errors clustered by firm and quarter) robust to heteroskedasticity and to residual dependence within firms and within quarters. Numbers in parentheses are *t*-statistics. ***, ** and * indicate 1%, 5% and 10% statistical significance levels, respectively.

Table 2. Leverage determinants and risk-neutral moments: 6-months horizon

	Traditional determinants only				Traditional determinants & firm-level moments			
	(1) ML	(2) BL	(3) ML	(4) BL	(5) ML	(6) BL	(7) ML	(8) BL
INDUSTRY	0.339***	0.340***	0.295***	0.309***	0.402***	0.396***	0.333***	0.344***
	(9.80)	(7.26)	(7.34)	(6.62)	(10.43)	(8.36)	(7.84)	(7.29)
MB	-0.005***	-0.004**	-0.005***	-0.005**	-0.004***	-0.003	-0.002*	-0.002
	(-4.04)	(-2.30)	(-3.55)	(-2.55)	(-2.96)	(-1.64)	(-1.87)	(-1.49)
ASSETS	0.028***	0.011**	0.025***	0.012**	0.027***	0.007	0.018***	0.004
	(5.99)	(1.97)	(4.83)	(2.10)	(5.60)	(1.31)	(3.44)	(0.62)
PROF	-0.762***	-0.516***	-0.736***	-0.511***	-0.787***	-0.559***	-0.758***	-0.541***
	(-9.17)	(-5.55)	(-8.46)	(-5.39)	(-9.61)	(-6.15)	(-8.28)	(-5.56)
TANG	0.056	0.013	0.060	0.010	0.037	0.005	0.045	0.004
	(1.42)	(0.31)	(1.49)	(0.23)	(0.95)	(0.12)	(1.16)	(0.10)
SELL	-0.022**	-0.024***	-0.023*	-0.024**	-0.019*	-0.022***	-0.019*	-0.021**
	(-2.00)	(-2.64)	(-1.93)	(-2.52)	(-1.95)	(-2.62)	(-1.82)	(-2.43)
DEP	0.582	0.878	0.472	0.749	1.114**	1.412**	1.115**	1.316**
	(1.12)	(1.25)	(0.88)	(1.03)	(2.39)	(2.13)	(2.50)	(2.00)
MARKET_RET			-0.013	-0.000			-0.049**	-0.032***
			(-0.75)	(-0.02)			(-2.28)	(-2.63)
AGG_PROF			-0.006	-0.020***			-0.012	-0.026***
			(-0.89)	(-3.95)			(-1.26)	(-3.47)
GDP			-0.224	0.165			-0.294	0.097
			(-1.38)	(1.49)			(-1.57)	(0.69)
VOL6					-0.234***	-0.204***	-0.324***	-0.264***
					(-9.30)	(-7.12)	(-9.27)	(-7.14)
KURT6					-0.021***	-0.010***	-0.019***	-0.007*
					(-6.54)	(-3.08)	(-3.40)	(-1.71)
N	19558	19558	19558	19558	19558	19558	19558	19558
Adj. R^2	0.153	0.054	0.160	0.058	0.190	0.081	0.217	0.094
Firms	776	776	776	776	776	776	776	776

Entries report the results from estimating alternative specifications of equation (9). All equations are estimated via OLS with firm fixed effects. All explanatory variables are lagged one quarter. Sample period is 1996:Q1 to 2012:Q2. BL is book leverage, i.e. book debt divided by book assets. ML is market leverage, i.e. book debt divided by the sum of market equity and book debt. INDUSTRY is the median leverage of the industry (defined by two-digit SIC codes) that the firm belongs to. MB is the sum of book liabilities plus market value of equity divided by book assets. ASSETS is the natural log of book assets expressed in 2009 US dollars. DEP is depreciation and amortization divided by book assets. PROF is earnings before interest, taxes, depreciation and amortization divided by book assets. TANG is net property, plant and equipment divided by book assets. SELL is selling, general and administrative expenses divided by sales. MARKET_RET is the one-year real stock market return (CRSP value-weighted index of stocks traded on NYSE, NASDAQ and AMEX). AGG_PROF is the one-year real aggregate domestic nonfinancial corporate profit growth. GDP is the year-on-year growth of real GDP. AGG_PROF and GDP are matched with the firm quarter with the most overlap for firms whose fiscal year does not coincide with the calendar year. VOL6 is the daily average over a quarter of firm-specific stock return volatility extracted from 180-days option prices. KURT6 is the daily average over a quarter of firm-specific stock return kurtosis extracted from 180-days option prices. *N* is the number of firm-quarters. Adj. R^2 is the within adj. R^2. The reported t-statistics reflect standard errors (White standard errors clustered by firm and quarter) robust to heteroskedasticity and to residual dependence within firms and within quarters. Numbers in parentheses are *t*-statistics. ***, ** and * indicate 1%, 5% and 10% statistical significance levels, respectively.

Table 3. Leverage determinants and risk-neutral moments: 12-months horizon

	Traditional determinants only				Traditional determinants & firm-level moments			
	(1) ML	(2) BL	(3) ML	(4) BL	(5) ML	(6) BL	(7) ML	(8) BL
INDUSTRY	0.351***	0.303***	0.281***	0.283***	0.398***	0.346***	0.320***	0.316***
	(7.45)	(4.95)	(5.36)	(4.54)	(7.50)	(5.46)	(5.94)	(5.02)
MB	-0.006***	-0.004***	-0.005**	-0.004**	-0.005**	-0.003**	-0.002	-0.002
	(-3.17)	(-2.60)	(-2.59)	(-2.60)	(-2.52)	(-2.05)	(-1.33)	(-1.48)
ASSETS	0.026***	0.004	0.020**	0.002	0.028***	0.004	0.018**	-0.001
	(3.55)	(0.45)	(2.55)	(0.23)	(3.85)	(0.52)	(2.37)	(-0.08)
PROF	-0.755***	-0.447***	-0.725***	-0.433***	-0.766***	-0.476***	-0.741***	-0.455***
	(-7.85)	(-5.26)	(-6.59)	(-4.84)	(-8.17)	(-5.74)	(-6.49)	(-4.95)
TANG	0.070	-0.024	0.078	-0.028	0.056	-0.028	0.072	-0.027
	(1.28)	(-0.53)	(1.49)	(-0.61)	(1.05)	(-0.63)	(1.45)	(-0.61)
SELL	-0.025***	-0.018	-0.028***	-0.019*	-0.020***	-0.014	-0.021***	-0.015
	(-3.00)	(-1.59)	(-3.13)	(-1.68)	(-2.72)	(-1.23)	(-2.68)	(-1.24)
DEP	0.499	0.961	0.456	0.900	0.976	1.421*	1.186*	1.484*
	(0.68)	(1.09)	(0.62)	(0.96)	(1.49)	(1.71)	(1.91)	(1.75)
MARKET_RET			-0.011	0.006			-0.042	-0.021
			(-0.48)	(0.61)			(-1.59)	(-1.61)
AGG_PROF			0.005	-0.012**			0.004	-0.013*
			(0.58)	(-2.08)			(0.37)	(-1.73)
GDP			-0.536***	-0.100			-0.659***	-0.213
			(-2.64)	(-0.73)			(-2.98)	(-1.36)
VOL12					-0.150***	-0.124***	-0.221***	-0.166***
					(-7.08)	(-5.45)	(-7.08)	(-6.00)
KURT12					-0.018***	-0.009***	-0.013**	-0.005
					(-5.42)	(-3.07)	(-2.37)	(-1.31)
N	12465	12465	12465	12465	12465	12465	12465	12465
Adj. R^2	0.150	0.046	0.166	0.049	0.179	0.067	0.214	0.079
Firms	506	506	506	506	506	506	506	506

Entries report the results from estimating alternative specifications of equation (9). All equations are estimated via OLS with firm fixed effects. All explanatory variables are lagged one quarter. Sample period is 1996:Q1 to 2012:Q2. BL is book leverage, i.e. book debt divided by book assets. ML is market leverage, i.e. book debt divided by the sum of market equity and book debt. INDUSTRY is the median leverage of the industry (defined by two-digit SIC codes) that the firm belongs to. MB is the sum of book liabilities plus market value of equity divided by book assets. ASSETS is the natural log of book assets expressed in 2009 US dollars. DEP is depreciation and amortization divided by book assets. PROF is earnings before interest, taxes, depreciation and amortization divided by book assets. TANG is net property, plant and equipment divided by book assets. SELL is selling, general and administrative expenses divided by sales. MARKET_RET is the one-year real stock market return (CRSP value-weighted index of stocks traded on NYSE, NASDAQ and AMEX). AGG_PROF is the one-year real aggregate domestic nonfinancial corporate profit growth. GDP is the year-on-year growth of real GDP. AGG_PROF and GDP are matched with the firm quarter with the most overlap for firms whose fiscal year does not coincide with the calendar year. VOL12 is the daily average over a quarter of firm-specific stock return volatility extracted from 360-days option prices. KURT12 is the daily average over a quarter of firm-specific stock return kurtosis extracted from 360-days option prices. *N* is the number of firm-quarters. Adj. R^2 is the within adj. R^2. The reported *t*-statistics reflect standard errors (White standard errors clustered by firm and quarter) robust to heteroskedasticity and to residual dependence within firms and within quarters. Numbers in parentheses are *t*-statistics. ***, ** and * indicate 1%, 5% and 10% statistical significance levels, respectively.

Table 4. Variance decomposition of leverage determinants: 3-months risk-neutral moments

	Traditional determinants only				Traditional determinants & firm-level moments			
	(1) ML	(2) BL	(3) ML	(4) BL	(5) ML	(6) BL	(7) ML	(8) BL
INDUSTRY	43.2%	39.1%	37.8%	28.4%	40.4%	31.1%	28.1%	18.8%
MB	8.9%	14.8%	9.5%	16.6%	3.1%	4.6%	1.4%	3.1%
ASSETS	18.0%	7.4%	16.9%	8.9%	9.8%	1.4%	4.3%	0.4%
PROF	27.4%	29.3%	31.1%	27.3%	22.1%	22.5%	21.5%	18.1%
TANG	0.4%	1.0%	0.6%	0.9%	0.1%	0.5%	0.2%	0.4%
SELL	1.3%	5.5%	1.6%	5.1%	0.8%	3.2%	0.8%	2.4%
DEP	0.7%	2.9%	0.6%	1.9%	1.3%	3.9%	1.2%	2.7%
MARKET_RET			0.7%	0.5%			5.7%	6.2%
AGG_PROF			0.5%	6.4%			1.1%	6.7%
GDP			0.6%	4.1%			0.4%	2.2%
VOL3					17.5%	31.3%	31.0%	38.2%
KURT3					4.7%	1.5%	4.3%	0.7%
N	17229	17229	17229	17229	17229	17229	17229	17229
Adj. R^2	0.152	0.057	0.157	0.061	0.182	0.080	0.205	0.094
Firms	775	775	775	775	775	775	775	775

Entries express the percentage of the within-firm adjusted R^2 that is attributable to each explanatory variable in the regressions (reported in Table 1) that estimate alternative specifications of equation (9). Each column corresponds to an alternative specification of equation (9). In each column, the entry for a particular variable is calculated as the ratio of the partial Type III explained sum of squares (henceforth ESS) of that variable over the sum of the partial Type III ESS of all explanatory variables in the model. Thus, every column adds to 100%. The partial Type III ESS are calculated as follows. For each explanatory variable, we estimate equation (10) after excluding the particular variable and calculate the explained sum of squares (henceforth ESS). The difference between the ESS of this model and the ESS of the model that includes the particular variable is the partial Type III ESS for the particular variable. BL is book leverage, i.e. book debt divided by book assets. ML is market leverage, i.e. book debt divided by the sum of market equity and book debt. INDUSTRY is the median leverage of the industry (defined by two-digit SIC codes) that the firm belongs to. MB is the sum of book liabilities plus market value of equity divided by book assets. ASSETS is the natural log of book assets expressed in 2009 US dollars. DEP is depreciation and amortization divided by book assets. PROF is earnings before interest, taxes, depreciation and amortization divided by book assets. TANG is net property, plant and equipment divided by book assets. SELL is selling, general and administrative expenses divided by sales. MARKET_RET is the one-year real stock market return (CRSP value-weighted index of stocks traded on NYSE, NASDAQ and AMEX). AGG_PROF is the one-year real aggregate domestic nonfinancial corporate profit growth. GDP is the year-on-year growth of real GDP. AGG_PROF and GDP are matched with the firm quarter with the most overlap for firms whose fiscal year does not coincide with the calendar year. VOL3 is the daily average over a quarter of firm-specific stock return volatility extracted from 90-days option prices. KURT3 is the daily average over a quarter of firm-specific stock return kurtosis extracted from 90-days option prices. *N* is the number of firm-quarters.

Table 5. Variance decomposition of leverage determinants: 6-months risk-neutral moments

	Traditional determinants only				Traditional determinants & firm-level moments			
	(1) ML	(2) BL	(3) ML	(4) BL	(5) ML	(6) BL	(7) ML	(8) BL
INDUSTRY	41.7%	38.4%	34.4%	29.1%	37.7%	29.1%	25.1%	19.2%
MB	9.8%	14.4%	10.3%	16.6%	3.1%	3.6%	1.2%	2.4%
ASSETS	15.2%	5.5%	14.1%	6.1%	8.6%	1.3%	3.6%	0.3%
PROF	30.5%	35.0%	35.3%	33.2%	22.5%	23.5%	21.7%	19.9%
TANG	0.8%	0.1%	1.2%	0.1%	0.2%	0.0%	0.4%	0.0%
SELL	1.5%	4.2%	1.8%	4.0%	0.7%	2.0%	0.7%	1.7%
DEP	0.4%	2.3%	0.3%	1.6%	1.0%	3.3%	1.0%	2.6%
MARKET_RET			0.6%	0.0%			4.4%	3.5%
AGG_PROF			0.3%	7.5%			0.7%	6.5%
GDP			1.8%	1.8%			1.8%	0.3%
VOL6					21.2%	34.8%	35.4%	42.5%
KURT6					5.0%	2.4%	4.0%	1.1%
N	19558	19558	19558	19558	19558	19558	19558	19558
Adj. R^2	0.153	0.054	0.160	0.058	0.190	0.081	0.217	0.094
Firms	776	776	776	776	776	776	776	776

Entries express the percentage of the within-firm adjusted R^2 that is attributable to each explanatory variable in the regressions (reported in Table 2) that estimate alternative specifications of equation (9). Each column corresponds to an alternative specification of equation (9). In each column, the entry for a particular variable is calculated as the ratio of the partial Type III explained sum of squares (henceforth ESS) of that variable over the sum of the partial Type III ESS of all explanatory variables in the model. Thus, every column adds to 100%. The partial Type III ESS are calculated as follows. For each explanatory variable, we estimate equation (10) after excluding the particular variable and calculate the explained sum of squares (henceforth ESS). The difference between the ESS of this model and the ESS of the model that includes the particular variable is the partial Type III ESS for the particular variable. BL is book leverage, i.e. book debt divided by book assets. ML is market leverage, i.e. book debt divided by the sum of market equity and book debt. INDUSTRY is the median leverage of the industry (defined by two-digit SIC codes) that the firm belongs to. MB is the sum of book liabilities plus market value of equity divided by book assets. ASSETS is the natural log of book assets expressed in 2009 US dollars. DEP is depreciation and amortization divided by book assets. PROF is earnings before interest, taxes, depreciation and amortization divided by book assets. TANG is net property, plant and equipment divided by book assets. SELL is selling, general and administrative expenses divided by sales. MARKET_RET is the one-year real stock market return (CRSP value-weighted index of stocks traded on NYSE, NASDAQ and AMEX). AGG_PROF is the one-year real aggregate domestic nonfinancial corporate profit growth. GDP is the year-on-year growth of real GDP. AGG_PROF and GDP are matched with the firm quarter with the most overlap for firms whose fiscal year does not coincide with the calendar year. VOL6 is the daily average over a quarter of firm-specific stock return volatility extracted from 180-days option prices. KURT6 is the daily average over a quarter of firm-specific stock return kurtosis extracted from180-days option prices. *N* is the number of firm-quarters.

Table 6. Variance decomposition of leverage determinants: 12-months risk-neutral moments

	Traditional determinants only				Traditional determinants & firm-level moments			
	(1) ML	(2) BL	(3) ML	(4) BL	(5) ML	(6) BL	(7) ML	(8) BL
INDUSTRY	46.8%	41.2%	33.0%	35.9%	39.1%	29.8%	23.7%	22.1%
MB	12.1%	18.6%	10.1%	18.9%	5.1%	5.6%	1.2%	2.3%
ASSETS	9.5%	0.6%	7.1%	0.2%	8.0%	0.4%	3.3%	0.0%
PROF	28.6%	33.1%	34.0%	32.7%	21.6%	21.6%	20.3%	18.1%
TANG	1.3%	0.5%	2.1%	0.7%	0.6%	0.4%	1.0%	0.3%
SELL	1.4%	2.4%	2.1%	2.7%	0.6%	0.9%	0.7%	0.8%
DEP	0.3%	3.6%	0.3%	3.4%	0.8%	4.5%	1.2%	4.5%
MARKET_RET			0.4%	0.4%			3.3%	1.9%
AGG_PROF			0.3%	4.0%			0.1%	2.3%
GDP			10.6%	1.0%			9.0%	2.2%
VOL12					17.8%	32.8%	32.7%	44.0%
KURT12					6.3%	4.0%	3.3%	1.3%
N	12465	12465	12465	12465	12465	12465	12465	12465
Adj. R^2	0.150	0.046	0.166	0.049	0.179	0.067	0.214	0.079
Firms	506	506	506	506	506	506	506	506

Entries express the percentage of the within-firm adjusted R^2 that is attributable to each explanatory variable in the regressions (reported in Table 3) that estimate alternative specifications of equation (9). Each column corresponds to an alternative specification of equation (9). In each column, the entry for a particular variable is calculated as the ratio of the partial Type III explained sum of squares (henceforth ESS) of that variable over the sum of the partial Type III ESS of all explanatory variables in the model. Thus, every column adds to 100%. The partial Type III ESS are calculated as follows. For each explanatory variable, we estimate equation (10) after excluding the particular variable and calculate the explained sum of squares (henceforth ESS). The difference between the ESS of this model and the ESS of the model that includes the particular variable is the partial Type III ESS for the particular variable. BL is book leverage, i.e. book debt divided by book assets. ML is market leverage, i.e. book debt divided by the sum of market equity and book debt. INDUSTRY is the median leverage of the industry (defined by two-digit SIC codes) that the firm belongs to. MB is the sum of book liabilities plus market value of equity divided by book assets. ASSETS is the natural log of book assets expressed in 2009 US dollars. DEP is depreciation and amortization divided by book assets. PROF is earnings before interest, taxes, depreciation and amortization divided by book assets. TANG is net property, plant and equipment divided by book assets. SELL is selling, general and administrative expenses divided by sales. MARKET_RET is the one-year real stock market return (CRSP value-weighted index of stocks traded on NYSE, NASDAQ and AMEX). AGG_PROF is the one-year real aggregate domestic nonfinancial corporate profit growth. GDP is the year-on-year growth of real GDP. AGG_PROF and GDP are matched with the firm quarter with the most overlap for firms whose fiscal year does not coincide with the calendar year. VOL12 is the daily average over a quarter of firm-specific stock return volatility extracted from 360-days option prices. KURT12 is the daily average over a quarter of firm-specific stock return kurtosis extracted from 360-days option prices. *N* is the number of firm-quarters.

Table 7. The effect of risk-neutral moments on leverage across small and large firms

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	ML without market-level variables	BL without market-level variables	ML with market-level variables	BL with market-level variables	ML without market-level variables	BL without market-level variables	ML with market-level variables	BL with market-level variables	ML without market-level variables	BL without market-level variables	ML with market-level variables	BL with market-level variables
VOL3	-0.157*** (-4.20)	-0.141*** (-3.44)	-0.292*** (-5.46)	-0.247*** (-4.21)								
VOL3*D_SMALL	-0.131** (-2.33)	-0.136** (-2.15)	-0.090 (-1.33)	-0.095 (-1.33)								
KURT3	-0.009*** (-2.68)	-0.002 (-0.53)	-0.010** (-2.25)	-0.000 (-0.12)								
KURT3* D_SMALL	-0.025*** (-3.96)	-0.013* (-1.95)	-0.023*** (-3.43)	-0.012* (-1.88)								
VOL6					-0.141*** (-4.69)	-0.092*** (-2.99)	-0.245*** (-5.85)	-0.155*** (-3.79)				
VOL6* D_SMALL					-0.129*** (-2.91)	-0.149*** (-3.05)	-0.094* (-1.74)	-0.129** (-2.27)				
KURT6					-0.007** (-2.22)	-0.000 (-0.11)	-0.007 (-1.44)	0.002 (0.46)				
KURT6* D_SMALL					-0.044*** (-6.62)	-0.029*** (-4.18)	-0.041*** (-5.36)	-0.028*** (-4.05)				
VOL12									-0.059** (-2.36)	-0.034 (-1.36)	-0.129*** (-3.99)	-0.066** (-2.06)
VOL12* D_SMALL									-0.154*** (-4.09)	-0.142*** (-3.51)	-0.144*** (-3.11)	-0.156*** (-3.24)
KURT12									-0.005* (-1.75)	-0.004 (-1.20)	-0.003 (-0.63)	-0.002 (-0.46)
KURT12* D_SMALL									-0.034*** (-5.50)	-0.014** (-2.14)	-0.028*** (-4.10)	-0.009 (-1.28)
N	17229	17229	17229	17229	19558	19558	19558	19558	12465	12465	12465	12465
Firms	775	775	775	775	776	776	776	776	506	506	506	506

Entries report the regression results from estimating eq. (11): $L_{i,t} = a_i + \varphi_i D_{i,t}^{small} + \beta RNM_{i,t-3} + \zeta D_{i,t}^{small} RNM_{i,t-3} + \gamma FL_{i,t-3} + \eta D_{i,t}^{small} FL_{i,t-3} + \delta ML_{t-3} + \theta D_{i,t}^{small} ML_{t-3} + \varepsilon_{i,t}$.

In each of our three subsamples, i.e. the subsamples corresponding to 3- 6- and 12-month RNMs, $D_{i,t}^{small}$ is a dummy variable that, within any given quarter, takes the value of one if the value of the firm's real market value of assets (calculated as the book value of liabilities plus the market value of equity) is lower than the subsample median and zero otherwise. Coefficient vectors *α, β ,γ* and *δ* represent the effect of firm fixed effects, risk-neutral moments $(RNM_{i,t-3})$, firm-level $(FL_{i,t-3})$ and market-level (ML_{t-3}) factors, respectively, on leverage for the large-firm group. That is, if we estimated equation (9) using only the firm-quarters that belong to the large-firm group, we would have obtained these estimates. Vectors *φ, ζ, η* and *θ* represent the differences between the coefficients for the large-firm and the small-firm group. That is, if we estimated equation (9) using only the firm-quarters that belong to the small-firm group, we would have obtained coefficients *α+φ, β+ζ, γ+η* and *δ+θ* for fixed effects, risk-neutral moments, firm-level and market-level factors, respectively. For brevity, we report results only for risk-neutral volatility and kurtosis (coefficient vector *β*) and their interaction terms (coefficient vector *ζ*). Columns (1)-(4), (5)-(8) and (9)-(12) refer to the specifications which include the 3-month, 6-month and 12-month constant maturity RNMs, respectively. Sample period is 1996:Q1 to 2012:Q2. BL is book leverage, i.e. book debt divided by book assets. ML is market leverage, i.e. book debt divided by the sum of market equity and book debt. VOL3, VOL6 and VOL12 are the daily average over a quarter of firm-specific stock return volatility extracted from 90-, 180- and360-days option prices, respectively. KURT3, KURT6 and KURT12 are the daily average over a quarter of firm-specific stock return kurtosis extracted from 90-, 180- and 360-days option prices, respectively. The reported *t*-statistics reflect standard errors (White standard errors clustered by firm and quarter) robust to heteroskedasticity and to residual dependence within firms and within quarters. Numbers in parentheses are *t*-statistics. ***, ** and * indicate 1%, 5% and 10% statistical significance levels, respectively.

Table 8. The effect of risk-neutral moments on leverage across financially constrained and unconstrained firms (credit rating partition)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	ML without market-level variables	BL without market-level variables	ML with market-level variables	BL with market-level variables	ML without market-level variables	BL without market-level variables	ML with market-level variables	BL with market-level variables	ML without market-level variables	BL without market-level variables	ML with market-level variables	BL with market-level variables
VOL3	-0.037 (-1.36)	-0.050* (-1.77)	-0.157*** (-3.67)	-0.141*** (-3.40)								
VOL3*D_CONSTR	-0.348*** (-6.87)	-0.262*** (-4.89)	-0.330*** (-5.41)	-0.240*** (-3.90)								
KURT3	-0.007** (-2.09)	-0.005 (-1.42)	-0.008** (-1.98)	-0.004 (-1.10)								
KURT3* D_CONSTR	-0.030*** (-5.43)	-0.011* (-1.88)	-0.027*** (-4.84)	-0.010* (-1.80)								
VOL6					-0.032 (-1.53)	-0.036 (-1.54)	-0.123*** (-3.96)	-0.093*** (-2.95)				
VOL6* D_CONSTR					-0.322*** (-8.64)	-0.236*** (-5.65)	-0.311*** (-7.03)	-0.227*** (-4.67)				
KURT6					-0.004 (-1.24)	-0.002 (-0.43)	-0.004 (-0.90)	-0.000 (-0.03)				
KURT6* D_CONSTR					-0.042*** (-6.79)	-0.022*** (-3.65)	-0.039*** (-5.91)	-0.021*** (-3.73)				
VOL12									-0.027 (-1.51)	-0.028 (-1.28)	-0.105*** (-3.74)	-0.070** (-2.45)
VOL12* D_CONSTR									-0.232*** (-7.26)	-0.153*** (-4.13)	-0.210*** (-5.60)	-0.144*** (-3.38)
KURT12									-0.007** (-2.30)	-0.004 (-1.23)	-0.004 (-0.91)	-0.002 (-0.47)
KURT12* D_CONSTR									-0.040*** (-5.49)	-0.017*** (-3.07)	-0.035*** (-4.47)	-0.014** (-2.40)
N	17135	17135	17135	17135	19490	19490	19490	19490	12457	12457	12457	12457
Firms	775	775	775	775	776	776	776	776	506	506	506	506

Entries report the regression results from estimating eq. (12): $L_{i,t} = a_i + \varphi_i D^{constr}_{i,t} + \beta RNM_{i,t-3} + \zeta D^{constr}_{i,t} RNM_{i,t-3} + \gamma FL_{i,t-3} + \eta D^{constr}_{i,t} FL_{i,t-3} + \delta ML_{t-3} + \theta D^{constr}_{i,t} ML_{t-3} + \varepsilon_{i,t}$. $D^{constr}_{i,t}$ is a dummy variable that indicates financially constrained firms. Within any given quarter, $D^{constr}_{i,t}$ takes the value of zero if a firm has a commercial paper rating or has not a commercial paper rating but has zero debt, and one otherwise. Coefficient vectors *α, β ,γ* and *δ* represent the effect of firm fixed effects, risk-neutral moments $(RNM_{i,t-3})$, firm-level $(FL_{i,t-3})$ and market-level (ML_{t-3}) factors, respectively, on leverage for the unconstrained firms. That is, if we estimated equation (9) using only the unconstrained firms, we would have obtained these estimates. Vectors *φ, ζ, η* and *θ* represent the differences between the coefficients for the unconstrained and the constrained firms. That is, if we estimated equation (9) using only the constrained firms, we would have obtained coefficients *α+φ, β+ζ, γ+η* and *δ+θ* for fixed effects, risk-neutral moments, firm-level and market-level factors, respectively. For brevity, we report results only for implied volatility and kurtosis (coefficient vector *β*) and their interaction terms (coefficient vector *ζ*). Columns (1)-(4), (5)-(8) and (9)-(12) refer to the specifications which include the 3-month, 6-month and 12-month constant maturity RNMs, respectively. Sample period is 1996:Q1 to 2012:Q2. BL is book leverage, i.e. book debt divided by book assets. ML is market leverage, i.e. book debt divided by the sum of market equity and book debt. VOL3, VOL6 and VOL12 are the daily average over a quarter of firm-specific stock return volatility extracted from 90-, 180- and360-days option prices, respectively. KURT3, KURT6 and KURT12 are the daily average over a quarter of firm-specific stock return kurtosis extracted from 90-, 180- and 360-days option prices, respectively. The reported *t*-statistics reflect standard errors (White standard errors clustered by firm and quarter) robust to heteroskedasticity and to residual dependence within firms and within quarters. Numbers in parentheses are *t*-statistics. ***, ** and * indicate 1%, 5% and 10% statistical significance levels, respectively.

Table 9. The effect of risk-neutral moments on leverage across financially constrained and unconstrained firms (KZ index partition)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	ML without market-level variables	BL without market-level variables	ML with market-level variables	BL with market-level variables	ML without market-level variables	BL without market-level variables	ML with market-level variables	BL with market-level variables	ML without market-level variables	BL without market-level variables	ML with market-level variables	BL with market-level variables
VOL3	-0.138^{***} (-4.40)	-0.159^{***} (-2.62)	-0.191^{***} (-4.98)	-0.227^{***} (-3.16)								
VOL3*D_KZ	-0.247^{***} (-4.21)	-0.131^{*} (-1.78)	-0.359^{***} (-5.35)	-0.151^{*} (-1.81)								
KURT3	-0.010^{***} (-3.23)	-0.005 (-1.16)	-0.009^{**} (-2.46)	-0.003 (-0.72)								
KURT3*D_KZ	-0.021^{***} (-4.06)	-0.006 (-1.10)	-0.022^{***} (-3.96)	-0.006 (-1.11)								
VOL6					-0.115^{***} (-4.80)	-0.123^{***} (-2.86)	-0.157^{***} (-5.11)	-0.170^{***} (-3.22)				
VOL6*D_KZ					-0.250^{***} (-5.85)	-0.134^{**} (-2.58)	-0.337^{***} (-7.04)	-0.149^{**} (-2.46)				
KURT6					-0.009^{***} (-2.68)	-0.004 (-0.84)	-0.007^{*} (-1.68)	-0.002 (-0.30)				
KURT6*D_KZ					-0.027^{***} (-4.76)	-0.011^{*} (-1.87)	-0.025^{***} (-3.70)	-0.010^{*} (-1.72)				
VOL12									-0.062^{***} (-2.86)	-0.083^{**} (-2.39)	-0.092^{***} (-3.37)	-0.117^{***} (-2.82)
VOL12*D_KZ									-0.188^{***} (-4.98)	-0.075^{*} (-1.82)	-0.268^{***} (-6.16)	-0.095^{**} (-2.00)
KURT12									-0.004 (-1.53)	-0.003 (-0.81)	-0.002 (-0.49)	0.000 (-0.05)
KURT12*D_KZ									-0.030^{***} (-4.86)	-0.009^{*} (-1.74)	-0.023^{***} (-3.58)	-0.006 (-1.17)
N	17178	17178	17178	17178	19503	19503	19503	19503	12438	12438	12438	12438
Firms	773	773	773	773	774	774	774	774	505	505	505	505

Entries report the regression results from estimating equation (14): $L_{i,t} = a_i + \varphi_i D_{i,t}^{KZ} + \beta RNM_{i,t-3} + \zeta D_{i,t}^{KZ} RNM_{i,t-3} + \gamma FL_{i,t-3} + \eta D_{i,t}^{KZ} FL_{i,t-3} + \delta ML_{t-3} + \theta D_{i,t}^{KZ} ML_{t-3} + \varepsilon_{i,t}$. $D_{i,t}^{KZ}$ is a dummy variable that indicates financially constrained firms. In each of our three subsamples, i.e. the subsamples corresponding to 3- 6- and 12-month RNMs, and within any given quarter, $D_{i,t}^{KZ}$ takes the value of zero if the value of the KZ index is greater than the subsample median KZ index, and zero otherwise. The KZ index (Kaplan and Zingales, 1997; Lammont et al. 2001) proxies for the level of financial constraints faced by a firm and is calculated as KZ = -1.002*(cash_flow/fixed_assets) + 0.283*market_to_book + 3.139*(debt/total capital) - 39.368*(dividends/fixed_assets) - 1.315*(cash/fixed_assets). Coefficient vectors *α, β ,γ* and *δ* represent the effect of firm fixed effects, risk-neutral moments $(RNM_{i,t-3})$, firm-level $(FL_{i,t-3})$ and market-level (ML_{t-3}) factors, respectively, on leverage for the unconstrained firms. That is, if we estimated equation (9) using only the unconstrained firms, we would have obtained these estimates. Vectors *φ, ζ, η* and *θ* represent the differences between the coefficients for the unconstrained and the constrained firms. That is, if we estimated equation (9) using only the constrained firms, we would have obtained coefficients *α+φ, β+ζ, γ+η* and *δ+θ* for fixed effects, risk-neutral moments, firm-level and market-level factors, respectively. For brevity, we report results only for implied volatility and kurtosis (coefficient vector *β*) and their interaction terms (coefficient vector *ζ*). Columns (1)-(4), (5)-(8) and (9)-(12) refer to the specifications which include the 3-month, 6-month and 12-month constant maturity RNMs, respectively. Sample period is 1996:Q1 to 2012:Q2. BL is book leverage, i.e. book debt divided by book assets. ML is market leverage, i.e. book debt divided by the sum of market equity and book debt. VOL3, VOL6 and VOL12 are the daily average over a quarter of firm-specific stock return volatility implied by 90-, 180- and360-days option prices, respectively. KURT3, KURT6 and KURT12 are the daily average over a quarter of firm-specific stock return kurtosis implied by 90-, 180- and 360-days option prices, respectively. The reported t-statistics reflect standard errors (White standard errors clustered by firm and quarter) robust to heteroskedasticity and to residual dependence within firms and within quarters. Numbers in parentheses are t-statistics. ***, ** and * indicate 1%, 5% and 10% statistical significance levels, respectively.

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