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The Relative Leverage Premium

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The Relative Leverage Premium*

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Abstract

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JEL Classification: G12, G32
Keywords: leverage, cross section of returns, target leverage, dynamic capital structure, financial frictions

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1 Introduction

The role of financial leverage as a determinant of the cross-section of equity returns has increasingly been investigated since Bhandari (1988). However, as illustrated by Gomes and Schmid (2010), the existing empirical evidence does not yet provide a clear understanding of how leverage and returns are related. While some studies show a positive relationship between financial leverage and expected stock returns, others conclude that average returns are either insensitive, or decrease with leverage after controlling for the effects of size and book-to-market equity.

The trade-off theory of capital structure predicts that firms choose their capital structure by balancing the costs and benefits of operating at different levels of debt financing.[1] A common feature of trade-off models is that they imply the existence of a firm-specific target leverage ratio. Firms that exhibit a targeting behavior choose a target leverage ratio and gradually converge towards it.[2] However, the presence of adjustment costs and other frictions may prevent firms from achieving the optimal capital structure at any one time (Leary and Roberts (2005), Strebulaev (2007)). Firms can then temporarily deviate from their optimal capital structure, and be over- or under-leveraged with respect to target. As discussed by Korteweg (2010), this non-frictionless dynamic environment can generate heterogeneity in the cross-section of observed leverages. The equity of firms with the same observed leverage but with different target bears a different risk exposure, and is then priced differently. Looking only at observed debt ratios does not allow to make this distinction. One should then remove firm-specific heterogeneity before trying to establish a cross-sectional relationship between leverage and expected

[1] The corporate finance literature identifies several types of costs and benefits related to the use of debt. For example, Korteweg (2010) mentions tax shields of debt, agency benefits of debt due to a lower free cash flow, bankruptcy costs, and indirect costs related to debt overhang, asset substitution, and asset fire-sales.

[2] For an excellent review of dynamic and static trade-off theories see Frank and Goyal (2008). More specifically, for recent dynamic models see Fischer, Heinkel, and Zechner (1989), Leland (1994), Goldstein, Ju, and Leland (2001).

stock returns.

Differently from previous approaches, in this paper we explicitly account for firm-specific heterogeneity in target leverage ratios and for deviations from the target. First, we estimate firm-specific target leverage employing the partial-adjustment model originally developed by Flannery and Rangan (2006), and later examined by Lemmon, Roberts, and Zender (2008), Huang and Ritter (2009), and Faulkender, Flannery, Hankins, and Smith (2010). Then, we decompose observed leverage into target leverage and deviation from target. We define the deviation from target as *relative leverage*. When *relative leverage* is positive a firm is over-leveraged with respect to target, while a firm is under-leveraged when *relative leverage* is negative. Next, we examine the cross-sectional relationship between *relative leverage* and equity returns. Our main objective is to test whether positive (negative) deviations from target are associated with higher (lower) expected returns.

The main finding of the paper is that *relative leverage* is positively and strongly related to expected equity returns. The marginal effect of relative leverage is very high in our entire investigation period (1965-2009) and stable across all the sub-periods 1965-1979, 1980-1994, and 1995-2009. Our empirical evidence also suggests that this variable has a much more substantial impact on expected stock returns than both size and book-to-market.

More precisely, we first sort stocks into quintiles by observed market leverage (market debt ratio (MDR)) and *relative leverage*, and illustrate that there is no clear pattern in average returns as one moves from low to high MDR. On the contrary, average returns show a strong positive correlation with *relative leverage* within every quintile of MDR. This indicates that the positive relationship between *relative leverage* and average stock returns is observed for both over-leveraged and under-leveraged firms. Moreover, the premium (discount) associated with *relative leverage* is fairly symmetric. On average, a deviation of 10% between observed and target leverage corresponds to a premium (discount) of about 0.5% per month for over- (under-) leveraged firms. Average returns of firms on target are around 1.5% per month.

We then follow the Fama and MacBeth (1973) (FMB) regression approach and examine the time-series averages of the estimated coefficients of monthly cross-sectional regressions of stock returns on size, book-to-market equity, momentum and *relative leverage*. We find that *relative leverage* plays a dominant role in the cross-section of expected equity returns. *Relative leverage* has an average coefficient of 3.509 in the period 1965-2009, 20.73 standard errors from zero. The explanatory power of (log) book-to-market equity is weak if both (log) size and *relative leverage* are included in the same regression. The positive relation between average returns and *relative leverage* is strong in all regressions specifications and in all sub-periods, also after controlling for momentum.

Next, we compare the explanatory power of *relative leverage* with that of observed market leverage. For robustness, we also compute *relative leverage* and observed leverage at book values. Our findings provide support to Gomes and Schmid (2010) and Obreja (2010), in that neither MDR nor book leverage are important in the cross-section of expected returns after controlling for size and book-to-market. On the contrary, our results show that *relative leverage* at market and book value is strongly significant after controlling for observed leverage (respectively at market and book value). MDR remains significant (with a negative sign) after controlling for *relative leverage*. Further investigations show that the significance of MDR is driven by the period 1980-1994, while it does not appear in other periods. Our findings shed light into the relationship between financial leverage and expected equity returns. Specifically, they suggest that *relative leverage* rather that observed leverage is the most relevant leverage variable in the cross-section of equity returns.

Finally, we examine the implications of our results for factor asset pricing models.

Following the approach of Chan, Karceski, and Lakonishok (1998), itself based on Fama and French (1993), we define a factor mimicking portfolio motivated by the *relative leverage* premium. We define the OMU (over- minus under-leveraged) factor as the difference between the average monthly returns of stocks with *relative leverage* above the 80th percentile and below the 20th percentile. We first run orthogonalizing regressions to show that the explanatory power of OMU is not subsumed by the Fama and French's (FF) factors, RMRF, SMB, and HML. On the contrary, the explanatory power of the size factor SMB is subsumed by RMRF, HML, and OMU. Accordingly, we compare the pricing ability of a multifactor model including RMRF, HML, and OMU with that of the FF three-factor model and of the CAPM. To do so, we choose 27 portfolios independently sorted on size, book-to-market equity, and *relative leverage* as test assets. We also consider other sets of test assets to verify that our results are not specific to the 27 portfolios initially selected. We find that the model including OMU is able to correctly price more assets than the FF model and CAPM, with lower average pricing errors. These results suggest that (i) the *relative leverage premium* is not captured by the FF model, and (ii) a factor based on *relative leverage* is useful for pricing expected returns across assets, and is consistent with a rational *relative leverage premium*.

Our results have implications for both asset pricing and corporate finance. For asset pricing, we propose *relative leverage* as a new variable that matters in the cross-section of equity returns. This variable is strongly significant and has a clear economic meaning. The premium associated with *relative leverage* may be explained as follows: during recessions, firms tend to become more leveraged, because the value of equity tends to decrease more than that of debt. The opposite holds for firms that are over-leveraged. As the value of equity drops, in a recession the leverage of these firms moves further away from the desired level. According to the trade-off theory the costs of an unbalanced capital structure increase as leverage moves away from target. This suggests that the payoffs of under-leveraged stocks increase during a recession and are counter-cyclical, while those of over-leveraged stocks tend to decrease and are cyclical. As a result, risk-averse investors require a lower expected return for under-leveraged stocks than for over-leveraged ones.

For corporate finance, our results provide support to the existence of a target leverage ratio which depends on firm-specific characteristics as well as market conditions. Importantly, however, the interpretation of our findings does not require firms to exhibit a targeting behavior[3]. Therefore, our results are not inconsistent with the findings of Chang and Dasgupta (2009) and Iliev and Welch (2010), according to which firms are sluggish in their convergence towards the targets.

The remainder of the paper is organized as follows. Section 2 reviews the existing literature and provides an introduction to our main results. Section 3 discusses the estimation of target leverage based on the partial-adjustment model of Flannery and Rangan (2006). Section 4 is dedicated to the construction of our sample. Sections 5 and 6 present the empirical results of our asset pricing tests. Section 7 summarizes and discusses our findings.

2 Related literature and stylized evidence

The starting point of our analysis is Proposition 2 of Modigliani and Miller (1958), according to which the expected yield of a share of stock is equal to the appropriate capitalization rate for a pure equity stream, plus a premium related to the debt-to-equity ratio of the firm. The proposition suggests that the relationship between equity

[3]The existing literature is still divided on the right magnitude of the speed of adjustment towards target. Flannery and Hankins (2010) provide evidence that the empirical estimates of the speed of adjustment can vary dramatically depending on the econometric methodology adopted. The speed implied by our estimation is 23.8% per year and is in line with other recent estimations of the partial adjustment model (e.g. Lemmon, Roberts, and Zender (2008), Faulkender, Flannery, Hankins, and Smith (2010)). Reassuringly enough, Flannery and Hankins (2010) also show that the estimates of target leverage are hardly affected by the methodology that one follows in its estimation.

returns and leverage is positive. Bhandari (1988) is the first to examine this relationship and to show that a positive relationship between expected stock returns and market leverage exists, and that leverage remains significant after controlling for both levered equity beta and market capitalization. This finding represents an empirical violation of the Capital Asset Pricing Model (CAPM) of Sharpe (1964), Lintner (1965) and Black (1972). According to CAPM, the relationship between leverage and average returns should be captured by the beta.

In their well known study, Fama and French (1992) find that the natural logarithms of market leverage and of book leverage have significant and approximately opposite coefficients in a Fama-MacBeth (FMB) regression in which returns are the dependent variable. They argue that the difference between these two leverage measures, i.e. the natural logarithm of the book-to-market ratio of equity, should be associated with higher expected stock returns. However, subsequent work does not provide full support to this argument. Penman, Richardson, and Tuna (1992) propose an accounting decomposition of the book-to-market ratio into an operating component and a leverage component. Their evidence indicates that the leverage component is significantly and negatively related to stock returns. They show that the negative relation holds for both market and book leverage. George and Hwang (2010) revise this evidence and show that, after controlling for book-to-market equity, stocks of firms in the highest quintile of book leverage earn lower average returns, while the opposite holds for those in the lowest quintile.

Two recent theoretical papers, Gomes and Schmid (2010) and Obreja (2010), explore the relationship between leverage and expected stock returns using dynamic models in which capital structure and investment decisions interact, thus violating the assumption of Modigliani and Miller on the separation between financing and investment decisions. The model of Obreja (2010) studies the interaction between book-to-market and leverage.

After calibration, the model is able to generate samples that replicate the empirical evidence provided by Bhandari (1988) and Fama and French (1992).

Instead, the model of Gomes and Schmid (2010) shows that expected returns should be positively related to leverage after controlling for firm size. Such a positive relation is more pronounced for market than for book leverage. However, after controlling for book-to-market equity, the relation becomes very weak.

In sum, several empirical studies have directly or indirectly examined the relationship between leverage and expected equity returns. However, an agreement has not yet been reached on two fundamental issues, i.e. whether leverage should be relevant in explaining the cross-section of equity returns, and if the answer to this question is positive, what sign should leverage have.

In this paper, we argue that one key element that has been ignored by the above literature is that firms may have different desired leverage ratios, an idea that is at the heart of the trade-off theory of capital structure. Introducing heterogeneity in the cross-section of observed leverage ratios may complicate the identification of the linear relation between leverage and expected returns. If a target leverage ratio exists, then returns may be related to the deviations from this benchmark, rather than to observed leverage. Intuitively, a 0.7 leverage ratio for a large firm in a consolidated industry, such as steel manufacturing, has a very different meaning than for a small firm in a high growth sector, such as communication technology. We then suggest that the relationship between leverage and returns should be re-phrased as the relationship between *relative leverage* and returns.

A related idea has been examined by Caskey, Hughes, and Liu (2011) in the accounting literature. Following Graham (2000), they empirically estimate firms' excess leverage with respect to the level that maximizes the tax benefits of debt. They find that, using annual data from 1980 to 2006, this excess leverage measure is negatively related to future stock returns, and explains a great part of the negative relationship documented by Penman, Richardson, and Tuna (1992). Their tests appear to contradict the risk-based explanation proposed by George and Hwang (2010), and support an alternative interpretation related to market under-reaction.

Figure 1 provides some preliminary evidence on the relationship between leverage and returns, and between *relative leverage* and returns. The figure displays average returns for firms assigned to 25 portfolios through two-way independent sorts on (market) leverage and *relative leverage*. The sorting procedure is the same that we will employ in Section 5 below. The figure shows that there is not a clear relationship between average returns and observed leverage. Across quintiles of *relative leverage*, returns are neither clearly increasing nor clearly decreasing in leverage. On the contrary, the sort on *relative leverage* generates a considerable spread in average returns. Returns are higher for stocks of over-leveraged firms (positive *relative leverage*) and lower for stocks of under-leveraged firms (negative *relative leverage*). This basic finding suggests that our attempt to remove heterogeneity from the cross-section of observed leverage can be helpful in explaining expected equity returns.

(Insert Figure 1 about here)

Building on this evidence, Figure 2 illustrates how *relative leverage* interacts with firm size, which we compute as in Fama and French (1992). Along the horizontal axis we report deciles of *relative leverage*, while along the vertical axis we have size. In absolute value *relative leverage* is larger for smaller firms. This means that smaller firms tend to be further away from the desired level of leverage than larger firms. This evidence is coherent with the existence of fixed costs of adjustment that prevent small firms to rebalance their capital structure as frequently as large firms, as suggested by Kurshev and Strebulaev (2007). This evidence suggests that size as employed in the specification of Fama and French (1992) may be proxying for *relative leverage*.

(Insert Figure 2 about here)

3 The decomposition of leverage

In this section we implement the leverage decomposition of Flannery and Rangan (2006) (FR) which allows us to identify the firm-specific components of total leverage that we will use in the asset pricing tests of Section 5.[4] Following FR we measure leverage as the market debt ratio, defined as

$$MDR_{i,t} = \frac{D_{i,t}}{D_{i,t} + ME_{i,t}} \tag{1}$$

where $D_{i,t}$ denotes the stock of interest-bearing debt of firm i in period t and $ME_{i,t}$ is the stock market capitalization of firm i in period t. We then consider the partial-adjustment model of FR, according to which firms (partially) adjust their leverage over time towards the desired level $MDR^*_{i,t+1}$ at a speed of adjustment λ:

$$MDR_{i,t+1} - MDR_{i,t} = \lambda(MDR^*_{i,t+1} - MDR_{i,t}) + \epsilon_{i,t+1} \tag{2}$$

with

$$MDR^*_{i,t+1} = \beta X_{i,t} \tag{3}$$

$MDR^*_{i,t+1}$ is modeled as a linear function of a set of firm-specific characteristics $X_{i,t}$, and varies both over time and across firms. Equations (2) and (3) lead to the following

[4] As we discuss below, the measure of target leverage developed by Flannery and Rangan currently encompasses other measures because it explicitly accounts for temporary deviations from the optimum. Other measures of target leverage have been proposed in the literature on capital structure. The relationship between these leverage measures and returns is not examined in this paper, but it represents an possible line of enquiry for future research.

estimable model:

$$MDR_{i,t+1} = (\lambda\beta)X_{i,t} + (1-\lambda)MDR_{i,t} + \epsilon_{i,t+1} \tag{4}$$

FR interpret $MDR^*_{i,t+1}$ as a proxy of a firm's target leverage within the framework of the trade-off theory of capital structure. Accordingly, the variables in $X_{i,t}$ are firm-specific characteristics that the literature on the trade-off theory has identified as relevant for capital structure. The parameter λ can be interpreted as the percentage reduction in the gap between actual and target leverage occurred over one period. FR also show that $MDR^*_{i,t+1}$ is a well-behaved proxy of a firm's target leverage in three respects. First, *regardless of their absolute leverage level*, firms appear to voluntarily change their capital structure towards the estimated target, which is consistent with targeting behavior. Second, when comparing the model of FR to those previously employed in the literature (e.g. Fama and French (2002); Korajczyk and Levy (2003)), the specification of FR is preferable because it relies on more realistic assumptions. A key missing element in the previous specifications is the exclusion of lagged MDR in the estimation of (4). The exclusion of lagged MDR amounts to assuming that a firm's target leverage coincides with its observed leverage, and leads to substantially lower empirical estimates of the adjustment speed λ.[5] The very high and significant loading of $MDR_{i,t}$ in the empirical estimate of (4) in FR is consistent with Leary and Roberts (2005) and Strebulaev (2007), according to which the existence of frictions prevents firms from instantaneously adjusting towards their desired capital structure. In the absence of frictions firms would

[5] If $MDR_{i,t+1}$ was *expected* to equal $MDR^*_{i,t+1}$, then we should find $\lambda = 1$ from the estimation of Equation (4). This is equivalent to saying that firms immediately adjust their capital structure to the desired level. In this case, the partial-adjustment model in (2) simplifies to

$$MDR_{i,t+1} = MDR^*_{i,t+1} + \epsilon_{i,t+1}$$

that is

$$E[MDR_{i,t+1}] = E[MDR^*_{i,t+1}]$$

always be on-target. Instead, in the presence of frictions it might be optimal for them to operate away their optimal target, thus avoiding the adjustment costs required to achieve the target. Third, FR test whether alternative theories of capital structure can replace their partial-adjustment model. They find that neither the pecking-order theory nor the market-timing theory provide a better explanations of their results. They also find little support for the "stock price mechanics" explanation of Welch (2004), according to which managers passively accept the mechanical effect of share price changes on market leverage. The empirical estimation of (4) leads to a decomposition of $MDR_{i,t}$ into a target-related component $(\lambda\beta)X_{i,t-1}$, an autoregressive component $(1-\lambda)MDR_{i,t-1}$, and a residual component $\epsilon_{i,t}$. In Section 3.2 we empirically implement this decomposition and define the variables that we use in our asset pricing tests.

3.1 Data and variables for the estimation of target leverage

For the leverage decomposition of FR, we use the Compustat Industrial Annual database over the period 1965-2009 including all companies listed on AMEX, NYSE, and NASDAQ, and excluding foreign firms that are not incorporated in the United States. We exclude financials (SIC codes 6000-6999) and utilities (SIC codes 4900-4999) because of their special characteristics.

Our measure of leverage is MDR as defined in (1), and is computed as the book value of short-term plus long-term interest bearing debt (Compustat items [DLTT]+[DLC]) divided by the market value of assets ([DLTT]+[DLC] + [PRCC_F]*[CSHO]). As in FR, $X_{i,t}$ contains the following variables:[6]

- Profitability (EBIT_TA): Earnings before interest and taxes [EBIT] over total assets [AT];

[6] Variables that are not expressed as ratios are deflated by the consumer price index in 1983 dollars.

- Market Value over Assets (MB): Book value of liabilities plus market value of equity ([DLTT]+[DLC]+[PRCC_F]*[CSHO]) over total assets [AT];
- Depreciation (DEP_TA): Depreciation [DP] over total assets [AT];
- Size (lnTA): Logarithm of total assets [AT];
- Tangibility (FA_TA): Property, plant, and equipment [PPENT] over total assets [AT];
- R&D expenses (R&D_TA): R&D expenses [XRD] over total assets [AT];
- R&D Dummy (R&D_DUM): Dummy equal to one for firms with missing values for R&D expenses [XRD];
- Industry MDR (Ind_Median): Median industry MDR calculated for each year for the industries of Fama and French (2002);
- A firm fixed effect.

Following standard procedures, all the previous variables (including MDR) are winsorized at the 1st and 99th percentiles to mitigate the influence of extreme observations. All variables are based on fiscal years. When included, year dummies are based on calendar years. Table 1 provides summary statistics for the variables listed above.

(Insert Table 1 about here)

3.2 Estimation of the partial adjustment model

Table 2 reports different specifications for Equation (4). FR and Lemmon, Roberts, and Zender (2008) underline the importance of including unobservable firm fixed-effects in $X_{i,t}$. Columns 2 and 3 include these effects, and accordingly the regressions are estimated as a dynamic panel data model.

(Insert Table 2 about here)

Flannery and Hankins (2010) find that the technique that generates the most accurate parameter estimates in Equation (4) is the system GMM of Blundell and Bond (1998). Therefore, as in Lemmon, Roberts, and Zender (2008), Lockhart (2010), and Faulkender, Flannery, Hankins, and Smith (2010), in our "base" specification of column 3 we estimate the partial-adjustment model (4) using Blundell and Bond system GMM.[7]

The results of our estimations are provided in Table 2 and are in line with previous work. In particular, our estimate of the adjustment speed λ in column (3) is 23.8% which is similar to what obtained by others. As econometric theory predicts, our estimate of the autoregressive term $1-\lambda$ (0.762) lies in the interval between the pooled OLS estimate in column 1 (0.845), which is expected to be biased upwards, and the fixed-effect estimate in column 2 (0.647), which is expected to be biased downwards (Hsiao (2003)). As these three estimates show, the estimated value of the speed of adjustment λ depends significantly on the methodology employed. Recent work (Chang and Dasgupta (2009), Iliev and Welch (2010)) casts doubts on whether firms exhibit a targeting behavior - as our estimate of λ by system GMM suggests. Instead, the estimation of target leverage appears to be less sensitive to different estimation techniques. Simulation results provided by Flannery and Hankins (2010) suggest that the econometric techniques employed in the recent literature all have satisfactory finite-sample performance (in terms of average bias) in estimating firm-specific target debt ratios $MDR^*_{i,t+1}$. In our analysis of cross-section returns, we use the regression specification of column 3. However, if the target is estimated as in Flannery and Rangan (2006) - our column 2 - our results are qualitatively unaffected.

[7] In the estimation of Equation (4) with the Blundell and Bond system GMM, we consider all right-hand-side variables as predetermined with a lag length of one year. Only year dummies are regarded as fully exogenous. The inclusion of further lags has no significant influence on results.

For the purpose of Section 5, it is useful to define the leverage-related variables that we include in our asset pricing tests. These variables are: 1) our measures of *relative leverage* obtained as the difference between observed and target leverage, 2) distance, which is the absolute value of *relative leverage*, 3) over-leverage which is the maximum between *relative leverage* and zero, and 4) under-leverage which is the negative of the minimum between *relative leverage* and zero. Noting that $M\hat{D}R^*_{i,t}$ denotes the estimated firm-specific target for firm i in period t, obtained from the regression equation in column 3 of Table 2, we have:

$$Rel\_Lev_{i,t} \equiv MDR_{i,t} - M\hat{D}R^*_{i,t} \tag{5}$$

$$Distance_{i,t} \equiv \|MDR_{i,t} - M\hat{D}R^*_{i,t}\| \tag{6}$$

$$Overlev_{i,t} \equiv max\{Rel\_Lev_{i,t}, 0\} \tag{7}$$

$$Underlev_{i,t} \equiv -min\{Rel\_Lev_{i,t}, 0\} \tag{8}$$

4 Data and variables for the analysis of the cross-section of stock returns

In our asset pricing tests we use monthly stock prices and returns for firms on NYSE, AMEX, Nasdaq covered by the Center of Research in Security Prices (CRSP) from 1965 to 2009. We exclude financial companies (SIC codes 6000-6999) and utility companies (SIC codes 4900-4999), and foreign firms not incorporated in the United States. Delisting returns are included in monthly returns.

We match these monthly data to annual income statement and balance sheet data from the CRSP/COMPUSTAT merged database, and to the annual series of the variables that we have defined in Section 3. To avoid look-ahead bias, we follow the matching procedure of Fama and French (1992), which ensures a minimum gap of six months between fiscal year-ends and returns. Thus, we match monthly prices and returns from July of calendar year t to June of calendar year $t+1$ with data from each company's latest fiscal year ending in calendar year $t-1$.

In our tests, we consider the natural logarithm of market capitalization, the natural logarithm of book-to-market equity, and momentum as control variables. Market capitalization - defined as the product of a company's stock price times the number of outstanding shares - is measured at June of calendar year t for the returns between July of calendar year t and June of calendar year $t+1$. We measure book-to-market equity as the ratio between a firm book equity and its market capitalization at the end of December of calendar year $t-1$. Following Fama and French (1993), we compute book equity as the sum of shareholders' equity, balance sheet deferred taxes and investments, and tax credits if available, minus the book value BE of preferred stocks. Depending on data availability, we estimate the book value of preferred stocks using, in this order, their redemption, liquidation or par value. Since we consider the natural logarithm of book-to-market equity in our tests, we eliminate firms with negative book equity from our analysis. Finally, we measure momentum as the sum of monthly returns from month $t-1$ to month $t-12$.

In Section 5.3 we also consider book-valued debt ratios (BDR), defined as the book value of short-term plus long-term interest bearing debt ([DLTT] + [DLC]) divided by the book value of assets ([DLTT] + [DLC] + book value of equity BE). For BDR, we estimate a *relative leverage* measure following the same procedure as in Section 3. More precisely, our *relative leverage* measure for BDR is obtained by re-estimating Equation (4) with BDR as dependent variable[8]. These annual series are matched to monthly data from CRSP as described before.

[8]Accordingly, MDRInd is replaced by the industry median of BDR.

In Section 6 we also employ monthly series of Fama and French's factors RMRF, HML, SMB and of the riskfree rate RF. We obtain these data from Kenneth French's website.

5 Relative leverage and expected returns

Table 3 displays a correlation matrix for the main variables of our analysis. In the first column, MDR and *relative leverage* present a high average cross-sectional correlation (0.425) but are far from identical, as can be seen from column two. In particular, over-leverage has a higher correlation with MDR than under-leverage, which indicates that *relative leverage* differs from MDR more for under-leveraged firms than for over-leveraged ones. Furthermore, a correlation of 0.162 between MDR and distance indicates that firms with high levels of observed leverage tend to deviate from their target debt ratios by a greater amount (in absolute value). However, distance is correlated to over-leverage and under-leverage with coefficients of 0.450 and 0.597 respectively: this suggests that under-leveraged firms are on average more distant from target than over-leveraged firms.

In addition, the table shows that all our leverage-related variables are correlated to the variables normally known to affect the cross-section of expected equity returns. Specifically, the natural logarithm of market capitalization is negatively related to the absolute deviation from target leverage with a mean correlation of -0.121, while the natural logarithm of book-to-market equity is positively related to *relative leverage* - with a correlation of 0.138. Both these interactions are stronger for over-leverage, while under-leverage is weakly correlated to log(size) and log(bm). Consistent with previous studies, observed debt ratios are negatively correlated to log(size) and positively correlated to log(bm). Our measure of momentum is correlated to *relative leverage* with a coefficient of 0.142, and it also presents cross-sectional correlations coefficients of similar magnitude with over-leverage (0.118) and under-leverage (-0.106).

(Insert Table 3 about here)

The sorts of Table 4 allow to examine separately the effects of observed leverage and *relative leverage* on expected stock returns. Portfolios are formed each June by independently ranking stocks into five groups by market debt ratios and *relative leverage*. The panels from top-left to bottom-right respectively report averages of monthly time series of 1) returns, 2) MDR, 3) BE/ME, 4) number of firms, 5) log(size), and 6) momentum.

Starting from the "average return" panel, we observe that no clear pattern exists in average returns as firms move from low to high MDR (vertical shift). Low MDR stocks are weakly associated with higher returns than high MDR stocks within the first three quintiles of *relative leverage* (first three columns). However, this trend is inverted in the last two columns. Moreover, these effects do not appear to be monotonic across quintiles of MDR. This evidence suggests that sorting by MDR produces little variation in average returns. On the contrary, average returns show a strong positive relation with *relative leverage* within every quintile of MDR. Average percent monthly returns of stocks in the lowest *relative leverage* quintile range from 0.56 and 0.96, while they are between 2.19 and 2.57 for stocks with the highest values of *relative leverage*. Moreover, average returns appear to increase monotonically across *relative leverage* quintiles. This suggests that *relative leverage* is positively related to stock returns for both over-leveraged and under-leveraged firms. As a consequence, the direction of deviations from target capital structure seems relevant in explaining expected returns.

The "MDR" panel indicates that MDR is roughly constant across *relative leverage* quintiles. Therefore, with reference to the "average return" panel, the positive relationship between returns and *relative leverage* is not due to higher MDR.

In the "log(size)" panel, we observe a U-shaped relationship between *relative lever-*

age and size. This pattern is consistent with Kurshev and Strebulaev (2007), according to which the presence of fixed costs of external financing prevents small firms to rebalance their capital structure frequently. Hence, small firms are expected to deviate from optimal capital structure more than large firms.

The "BE/ME" panel shows the well-known positive relationship between BE/ME and MDR. However, there is no evident relationship between BE/ME and *relative leverage* within any MDR quintile. Thus, the positive correlation between the book-to-market ratio and *relative leverage* in Table 3 is likely the result of the positive correlation between MDR and *relative leverage*.

Finally, the "momentum" panel shows that profits due to momentum are higher both for firms with high MDR and for firms with high *relative leverage*. This stresses the importance to account for the interaction of momentum variable both with MDR and *relative leverage*.

(Insert Table 4 about here)

Figure 3 depicts average monthly returns of stocks of firms sorted according to *relative leverage*. Panel A refers to the full sample, while Panels B, C and D refer to the subperiods 1965-1979, 1980-1994, and 1995-2009 respectively. The figure emphasizes the magnitude of the *relative leverage* premium and shows a certain symmetry around the estimated target MDR ratios (vertical line). In all four panels, firms that are over-leveraged by 7.5% to 12.5% consistently earn average returns of about 2% per month, while firms that are under-leveraged by 7.5% to 12.5% earn average returns of about 1% per month. Average returns of firms on target are around 1.5% per month.

(Insert Figure 3 about here)

5.1 The Relative Leverage Premium

Table 5 reports time-series averages of the estimated coefficients of monthly cross-sectional regressions of stock returns on size, book-to-market equity, momentum and *relative leverage*. As in Fama and French (1992) and George and Hwang (2010), we follow the regression approach in Fama and MacBeth (1973) (FMB). We report FMB tests with a Newey-West correction with lag-length of 2 to assess which regressors have a coefficient that is significantly different from zero in the period 1965-2009 (Panel A), and in the subperiods 1965-1979 (Panel B), 1980-1994 (Panel C), and 1995-2009 (Panel D). In our application, the FMB approach has the advantage to use all the available data on individual securities in order to take into account the interactions among the explanatory variables in order to identify the effect of *relative leverage* that is not related to the other regressors. Following the interpretation provided in Fama (1976), the individual coefficients of the FMB regressions provide the returns of trading strategies that hedge the effects of the other variables contained in the regression. Specifically, the slope of *relative leverage* in a regression with (log) size and (log) book-to-market as control is the average monthly return of a self-financing monthly trading strategy (an "excess return") with a portfolio that has zero (log) size, zero (log) book-to-market, and *relative leverage* equal to one.

A well-known econometric issue that affects FMB regressions is the errors-in-variables problem, which may introduce a bias in the estimation of the coefficients. This issue may be important in our analysis because *relative leverage* is the result of a previous estimation procedure, similarly to what happens for the CAPM beta in Fama and French (1992), and for the distress measures in George and Hwang (2010). More precisely, the errors-in-variables problem may induce a bias towards zero of the estimated coefficients (Greene (2008)). Therefore, if our estimate of *relative leverage* contains errors, the FMB regressions of Table 5 are producing more conservative estimates for our coefficient than we should observe in the absence of errors. We then conclude that the errors-in-variables problem is of no prime concern for our results on the existence of a *relative leverage premium*.[9]

The FMB regressions in Table 5 take the following form:

$$R_{i,t} = \beta_0 + \beta_1 log(size_{i,t-1}) + \beta_2 log(bm_{i,t-1}) + \beta_3 mom_{i,t-1} + \beta_4 Rel\_Lev_{i,t-1} + \epsilon_{i,t} \quad (9)$$

where $R_{i,t}$ denotes realized returns, $size_{i,t-1}$ market capitalization, $bm_{i,t-1}$ book-to-market equity, $mom_{i,t-1}$ momentum, and $Rel\_Lev_{i,t-1}$ *relative leverage*.

The results of Table 5 highlight the dominant role played by *relative leverage* in the cross-section of expected equity returns. In the regression of column 7 of Panel A, *relative leverage* has an average slope of 3.509% in the period 1965-2009, with a sizeable t-statistic of 20.73. In the same regression, the natural logarithm of market capitalization has a slope of -0.221%, while the slope of (log) book-to-market equity does not appear to be statistically different from zero. The explanatory power of (log) book-to-market equity drops significantly when both (log) size and *relative leverage* are included in the same regression. Book-to-market is a significant when it is the only variable in the regression (column 2), and when it interacts separately either with size (column 4) or *relative leverage* (column 6). The positive relation between average returns and *relative leverage* persists across all regressions specifications, also after including momentum (column 8). The estimated slopes for *relative leverage* range from 3.509% to 4.003%, with Newey-West t-statistics between 18.68 and 22.27.

The evidence of Panels B-D shows that the *relative leverage premium* is consistently strong in the three sub-periods 1965-1979, 1980-1994, and 1995-2009. In comparison

[9] On the contrary, the problem of errors-in-variables is more serious in Fama and French (1992) because they argue that the relationship between average returns and CAPM beta is flat. For more discussion of the errors-in-variables issue see Kim (2010) and Carmichael and Coen (2008).

with *relative leverage*, the explanatory power of size and book-to-market appear much less stable in the sub-periods. Size has a strong effect on average returns in the 1995-2009 sub-period, both in terms of estimated slope and significance, while its effect is weak in the sub-period 1965-1979. Book-to-market equity has a strong effect in the years 1980-1994, while its slope is not statistically different from zero in the years 1965-1979 and 1995-2009.

In sum, the FMB regressions provide support for a *relative leverage premium*, which plays a dominant role in explaining the cross-section of expected equity returns, also after controlling for size, book-to-market equity, and momentum.

(Insert Table 5 about here)

5.2 Symmetry of the Relative Leverage Premium

The regressions in Table 6 investigate the relative importance that the following four measures of leverage have in explaining equity returns: *relative leverage*, distance, over-leverage, and under-leverage.

Panel A covers the entire sample from 1965 to 2009. The slope of distance is significant when *relative leverage* is not included (column 3), with a slope of -0.709 and a t-statistic of -2.278. However, confirming our informal tests, the regression in column 6 of panel A shows that when distance and *relative leverage* are included in the same regression, the slope of distance is not statistically different from zero, with a t-statistic of 0.07.

Columns 4 and 5 of panel A confirm that the *relative leverage premium* is not limited to neither under-leveraged nor over-leveraged firms. Over- and under-leverage are statistically insignificant when they are included in the same regression with *relative leverage*. Sub-period evidence in panels B,C and D shows that the marginal effect of *relative* *leverage* dominates both distance, over-leverage and under-leverage in each sub-period.

Another issue that we have discussed above regards the symmetry of the *relative leverage premium* around the target. The regression in column 2 of panel A shows that the over- and under-leverage components of *relative leverage* have slopes of similar magnitude (3.496 and -3.450 respectively), but opposite sign. This suggests that their difference, that is *relative leverage*, is what matters in explaining returns, which is consistent with the results of columns 4 and 5. We perform a Wald test of the linear restriction that the slope of over-leverage is equal, in absolute value, to the slope of under-leverage. The test does not reject the null hypothesis that the restriction holds with an F-stat of 0.02 and a p-value of 0.897. Sub-period evidence confirms that the over- and under-leverage components of *relative leverage* have statistically indistinguishable slopes (in absolute values). In particular, Wald tests cannot reject this restriction with p-values of 0.1664 in the sub-period 1965-1979 (column 2 of panel B), of 0.1914 in the sub-period 1980-1994 (column 2 of panel C), and of 0.8018 in the sub-period 1995-2009 (column 2 of panel D).

In sum, our results indicate that there is a linear relationship between expected stock returns and *relative leverage*. As Figure 1 suggests, the premium associated with over-leverage is comparable to the discount associated with under-leverage.

(Insert Table 6 about here)

5.3 Relative vs. Observed Leverage

As discussed in Section 2, the empirical evidence about leverage in the cross-section of expected equity returns is mixed. It is not clear yet whether (observed) leverage is an important variable in explaining expected equity returns. In this section, we explore this issue and compare the explanatory power of observed leverage with that of *relative* *leverage*. The aim of this section is to show that *relative leverage*, rather than observed leverage, is the relevant variable to account for in the cross-section of average stock returns. To this end we include observed leverage and *relative leverage* in the same regression and test the significance of the two coefficients. Our results are in Table 7, which examines the full sample in Panel A, and the sub-periods in Panels B-D.

A potential source of disagreement among the studies that examine the role of leverage in the cross-section of expected stock returns is whether one considers market or book leverage. As discussed in Flannery and Rangan (2006), the corporate finance literature largely focuses on market debt ratios. However, in the interest of completeness, we run the comparison between relative and observed leverage both in book and market value terms. We then have two pairs of variables: observed leverage at book and market values, and *relative leverage* at book and market values. This requires us to introduce two new variables: book leverage (BDR) which is computed as the book value of debt [DLTT]+[DLC] divided by the sum of the itself plus the book value of equity - measured as in Fama and French (1993). The second variable is Rel_Lev(book) which denotes *relative leverage* with respect to BDR. In the construction of Rel_Lev(book) we follow the same steps employed for the FR decomposition of *relative leverage* at market values, discussed in Section 4.

The comparison between relative and observed leverage is carried out in columns 3 and 6, respectively for market and book values. Notice that observed leverage can be decomposed as the sum of *relative leverage* plus target leverage. Therefore, we can equivalently interpret the regressions in columns 3 and 6 as tests on the significance of target leverage for explaining equity returns, after controlling for *relative leverage*. Columns 1 and 2 of panel A respectively estimate the slope of market leverage in a univariate regression and with size and book-to-market equity as control variables. Consistent with Gomes and Schmid (2010) and Obreja (2010), expected returns are positively and significantly related to MDR in a univariate setting (with a slope of 0.987 and a t-statistic of 3.296), but they are insignificant after controlling for size and book-to-market. The regressions for book leverage in columns 4 and 5 are also in line with the predictions of Gomes and Schmid (2010) and Obreja (2010). In particular, reading from column 4, the explanatory power of book leverage is lower than that of market leverage, with an estimated slope of 0.332, 1.833 standard errors from zero. Also, book leverage is insignificant at the multivariate level, after controlling for market capitalization and book-to-market equity.

Regressions in columns 3 and 6 show that when relative and observed leverage are included in the same regression, *relative leverage* is clearly more important than observed leverage for explaining expected stock returns, both in economic and statistical terms. Regardless of whether market or book leverage is employed, *relative leverage* is highly significant with estimated slopes of 3.992% (with t-statistic 21.32) for market values, and 1.542% (with t-statistic 12.17) for book values.

Observed leverage, both at market and book values, remains significant after accounting for *relative leverage*. More precisely, in column 3 MDR is still significant, with a negative slope of -1.000 and a t-statistic of -3.725. The residual explanatory power is much lower for book-valued variables (column 6): the estimated slope of BDR is -0.386, with a t-statistic of -1.775. As discussed by Flannery and Rangan (2006), Lemmon, Roberts, and Zender (2008), and Flannery and Hankins (2010), target measurement can be noisy. In a dynamic panel noise may become a relevant econometric issue and affect the estimates of target leverage ratios. Hence, it might be difficult to precisely disentangle the target component of observed leverage and to correctly identify *relative leverage*. We look at Panels B, C, and D to examine the evidence for the various sub-periods. We find that the significance of observed leverage is concentrated only in the 1980-1994 sub-period. On the contrary, observed leverage is not statistically significant at the 5% level neither in the years 1965-1979, nor in the years 1995-2009. Furthermore, in the years 1980-1994, the significance level of observed leverage is much lower than that of *relative leverage*. Taking into account the instability of the significance of observed leverage across different estimation periods, we prefer to take the interpretation that noise is driving the results on observed leverage rather than regard the significance of leverage as an unsolved puzzle. Our findings in Appendix A are consistent with this interpretation.

(Insert Table 7 about here)

6 Implications for factor pricing models

In this section we investigate the implications of the above results for the pricing of assets. We want to ascertain if the introduction of a new factor based on *relative leverage* can improve the pricing performance of existing factor models. We take the Fama and French (FF) three factor model as a benchmark. We compare its pricing performance to that of a multi-factor model that contains a factor-mimicking portfolio based on the *relative leverage premium*. If we find that the mimicking portfolio helps in pricing assets, we interpret the result as consistent with a rational *relative leverage premium* coherent with no-arbitrage in the stock market, in the spirit of the Arbitrage Pricing Theory (APT) of Ross (1976).

As the evidence in Fama and French (1996) and Fama and French (2008) suggests, many anomalies do not require the introduction of new factors, but can be explained by the three factor model. In addition, even if the three factor model does not succeed in explaining the *relative leverage premium*, it is not straightforward whether a new multifactor model manages to explain the spread in average returns associated with *relative leverage*. If not, the *relative leverage premium* represents a pricing anomaly that may be exploited by investors.

As our tests are not based on a theoretical model, a caveat is needed. Our definition of a factor-mimicking portfolio based on *relative leverage* is somehow arbitrary, because it has no theoretical support. Nevertheless, we believe that the tests presented in this section represent a useful starting point for future theoretical research. Specifically, they suggest that there is room for a factor model inspired by *relative leverage*, which not only has a strong explanatory power, but also a clear economic interpretation.

6.1 Factor-mimicking portfolios

To define a factor mimicking portfolio for *relative leverage*, we base our approach on Chan, Karceski, and Lakonishok (1998), itself inspired by Fama and French (1993). We rank firms with respect to *relative leverage* at the end of June of each year t, and assign them to portfolios from July of year t to June of year $t+1$. Stocks are assigned to portfolios on the basis of the distribution of *relative leverage*s of NYSE firms only. We define the OMU (over- minus under-leveraged) factor as the difference between the average monthly return of stocks with *relative leverage* above the 80th percentile for NYSE firms, minus the average monthly return of stocks with *relative leverage* below the 20th percentile for NYSE firms.

In order to test the hypothesis that OMU is useful to price other assets, we choose 27 portfolios independently sorted on size, book-to-market equity, and *relative leverage* as test assets. In this way we can test whether the FF model explains average returns on a set of diversified assets that exhibit dispersion against size, book-to-market, and *relative leverage*. Individual stocks are re-assigned to equally-weighted portfolios every June on the basis of NYSE breakpoints for the three variables. They are grouped in terciles of size, book-to-market, and *relative leverage*.

To dispel the possibility that our results are driven by the specific test assets that we have chosen, we carry out additional tests. We select further sets of 25 portfolios following two-way independent sorts in quintiles. More precisely, two-way sorts are based on the following pairs of variables: size and book-to-market; size and *relative leverage*; book-to-market and *relative leverage*; momentum and size; momentum and book-to-market; momentum and *relative leverage*. The breakpoints and returns of these portfolios are determined with the same procedure described above.

6.2 Orthogonalizing regressions and factor model identification

In this section we test whether the FF factors, RMRF, SMB, HML, and OMU provide the same information for pricing assets. In particular, we want to assess whether OMU is redundant because it is proxied by the other factors.

The "orthogonalizing" regressions in Table 8 suggest that the explanatory power of OMU is not subsumed by RMRF, SMB, and HML. The regression of OMU on RMRF, SMB and HML in column 1 reports a statistically significant intercept which means that OMU cannot be replaced by a linear combination of the FF factors. This implies that, *ex-ante*, RMRF, SMB, and HML do not encompass OMU in the explanation of returns. Column 3 and 4 report similar results for the HML factor and the market factor RMRF respectively. Neither of these two factors can be regarded as redundant due to a significant intercept. On the contrary, as shown in column 2, when SMB is regressed on the other factors, the intercept is not statistically different from zero. This suggests that the pricing ability of SMB is proxied by the joint effects of RMRF, HML, and OMU[10].

(Insert Table 8 about here)

[10]Consider the FF's model augmented with the OMU factor, that is:

$$E[R_{i,t} - rf_t] = a_i + b_i E[RMRF_t] + s_i E[SMB_t] + h_i E[HML_t] + o_i E[OMU_t]$$

If the orthogonalizing regression of SMB on RMRF, HML and OMU yields to an estimated intercept

6.3 Horse race

From our discussion in the previous section we can use a parsimonious model that includes only RMRF, OMU, and HML, and excludes SMB. We then compare the pricing performance of this model with the FF model. For completeness, we also report the results for CAPM. Our results are displayed in Table 9.

Using the 27 portfolios sorted on size, book-to-market equity, and *relative leverage* as test assets, the table shows that the model including RMRF, HML and OMU dominates the FF model and CAPM. Panel A provides descriptive statistics for the raw monthly returns of the 27 portfolios in the 1965-2009 period, showing the spreads in mean returns associated with size, book-to-market equity, and *relative leverage*. Panels B, C and D report the estimated pricing errors a_i and t-statistics $t(a_i)$ for the hypothesis that $a_i = 0$. These estimations are based on the time series regressions of portfolio excess returns respectively on the factors of the FF model, of CAPM and of the model that contains RMRF, HML and OMU. T-tests are based on robust standard errors corrected for heteroskedasticity (Davidson and MacKinnon (1993)).

Panel B shows that the estimated intercepts for the FF model are generally high and statistically different from zero, with very high t-statistics. The FF model fails in pricing 18 out of 27 test assets at the 1% significance level, with monthly mean absolute and squared intercepts of 0.44 and 0.30 respectively. In particular, the FF model does not capture the spread in returns associated with *relative leverage*. This can be seen by the resulting trend in the pricing errors. Panel C shows that CAPM fails in pricing 21 out of

indistinguishable from zero, we have

$$E[SMB_t] = \beta E[RMRF_t] + \gamma E[HML_t] + \delta[OMU_t]$$

that is

$$E[R_{i,t} - rf_t] = a_i + (b_i + \beta)E[RMRF_t] + (h_i + \gamma)E[HML_t] + (o_i + \delta)E[OMU_t]$$

27 portfolios at the 1% significance level, with an average absolute monthly pricing error 0.58% per month. The mean squared pricing error is even higher than that of the FF model. Panel D tests the pricing performance of the model that contains RMRF, HML, and OMU. This model provides the best description of variation in expected returns for the 27 portfolios. Only 2 intercepts out of 27 are statistically distinguishable from zero at the 1% significance level. The pricing error is also lower than that of the FF model and CAPM. For RMRF, our results offer support to the explanation of Fama and French (1993) that the market factor helps explain why average stock returns are higher than the risk-free rate. While (unreported) factor loadings for HML and OMU vary across the test assets and explain variations in expected returns, estimated factor loadings for RMRF are close to one for all portfolios.

(Insert Table 9 about here)

In Table 10 we compare the pricing performance of the three factor models on the remaining test assets. For convenience, we only report the average absolute pricing error, the mean squared pricing error, the GRS test statistic (Gibbons, Ross, and Shanken (1989)), and the number of intercepts that are statistically different from zero at the 1% confidence level. Consistent with the results of Table 9, both the FF model and CAPM are unable to explain spreads in average returns when portfolios are sorted on *relative leverage*. More precisely, FF and CAPM report statistically significant intercepts for almost all portfolios sorted on *relative leverage*, market capitalization, book-to-market and momentum. The pricing errors are also high, with high values of the GRS statistics. On the contrary, the model with RMRF, HML and OMU reports statistically significant pricing errors only for 2 out of 25 portfolios sorted by size and *relative leverage*. None of the intercepts is significant for both the book-to-market/relative leverage and the momentum/relative leverage sorting. Average absolute and squared pricing errors, as well as GRS statistics, are much lower than those of the FF model and CAPM. In summary, on these three sets of assets, the multi-factor model with RMRF, HML, and OMU in the one that provides the best description of expected returns.

The pricing performance of the model with RMRF, HML, and OMU does not appear to be limited to the test assets that include *relative leverage* as a sorting variable. It performs well also on the 25 portfolios sorted on size and book-to-market, on size and momentum, and on book-to-market and momentum. Average absolute pricing errors never exceed 0.3% per month, and the model rarely produces statistically significant intercepts at the 1% level. The pricing performance of both CAPM and FF improves only if *relative leverage* is not used to identify assets. However, even under this condition, CAPM originates significant pricing errors for individual assets (15 for the size/book-to-market sorts, 10 for the size/momentum sorts, 18 for the book-to-market/momentum sorts), and generates high mean absolute and squared pricing errors. The FF model provides a good description of average returns for portfolios formed on size and book-to-market, and on size and momentum. On these two sets of assets, its mean absolute and squared pricing errors are slightly lower than those of the model including RMRF, HML and OMU. Finally, on the 25 portfolios sorted by book-to-market and momentum, the FF model reports significant pricing errors in 15 cases, even though the average absolute and squared pricing errors are not as high as for the sorting based on *relative leverage*.

In sum, the results of this section indicate that a factor based on *relative leverage* helps price expected returns across assets. In the APT framework, our findings are consistent with a rational *relative leverage premium*, that is with the existence of a source of systematic risk that should be considered to price assets under no arbitrage in the stock market.

(Insert Table 10 about here)

7 Discussion and conclusions

Leary and Roberts (2005) and Strebulaev (2007) show that in the presence of financial frictions firms cannot always reach the desired level of leverage. This implies that firms may be temporarily over- or under-leveraged, as their leverage is above or below the desired target. In this paper we start by estimating the difference between target and observed leverage, individually for each firm, and name it *relative leverage*. This allows us to remove part of the heterogeneity in the cross-section of leverage in a way that accounts for firm specific characteristics. We then employ *relative leverage* as a variable that explains expected equity returns.

We find that expected equity returns are strongly increasing in *relative leverage*. The relation is significant over all sub-periods after controlling for size, book-to-market, momentum, and observed leverage. On the contrary, observed leverage does not appear to play a relevant role in explaining equity returns. Our empirical evidence helps clarify the relationship between expected returns and financial leverage.

We envisage three possible explanations for our results. First, our findings may be sample specific. However, considering the remarkable stability of our results suggested by our sub-period evidence, we are skeptical about the possibility that the *relative leverage premium* is confined to our sample. A second possibility is that our findings are the result of mispricing. However, our tests in Section 6 suggest that the *relative leverage premium* is consistent with a linear multi-factor model in the absence of arbitrage (Ross (1976)). This brings in the third possibility, that the *relative leverage premium* can be explained within a framework of rational asset pricing. If we follow the interpretation that over-leveraged (under-leveraged) firms are riskier (safer) for investors, *relative leverage* has a clear meaning that can be immediately be related to expected equity returns.

We propose a possible story for a rational *relative leverage premium* in the framework of the trade-off theory of capital structure. According to the trade-off theory, there is a cost of being away from optimum leverage. Suppose that in a recession firm assets A decrease because of a systematic negative shock to the economy. As a consequence, *ceteris paribus*, a firm's leverage D/A increases because of the systematic shock that affects A.[11] As a result, in a recession over-leveraged firms tend to move further away from their desired target leverage. While, under-leveraged firms move towards the target. This implies that in bad times, payoffs will be higher for stocks of firms that are under-leveraged, and lower for stocks of over-leveraged firms. In sum, for a risk-averse investor, stocks of under-leveraged firms are counter-cyclical in that they deliver a higher payoff in bad times, when consumption is low and marginal utility of consumption is high. Symmetrically, over-leveraged firms are pro-cyclical because they allow investors to consume more when consumption is high. Thus, given a firm's *relative leverage*, risk-averse investors value under-leveraged (over-leveraged) firms more (less), and consequently require a lower (higher) expected return. It is worth stressing that the above interpretation relies on the assumption that firms have a target leverage, but it does not require firms to exhibit a targeting behavior. Therefore, it is not inconsistent with Chang and Dasgupta (2009) and Iliev and Welch (2010).

An important caveat in interpreting our results concerns the estimation of target leverage. As for other variables used to explain the cross-section of average returns, such as the post-ranking beta in Fama and French (1992), the trading strategies corresponding to our Fama-Macbeth coefficients are not directly implementable. Although in our tests we use full-sample information only to estimate the (constant) parameters of the partial adjustment model in Table 2, it would be interesting to examine implementable strategies as well. In Appendix A we explore this issue, and we provide evidence that our key results

[11] Potentially, also a firm's leverage targets may vary in a non-obvious way during a recession. We cannot completely rule out this possibility. However, Lemmon, Roberts, and Zender (2008) find that estimated target debt ratios tend to vary slowly over time. In addition, the interactions among the explanatory variables in the regressions of Table 2 indicate that a firm's target does not tend to move together with the state of the economy.

continue to hold if we estimate the partial adjustment model out of sample.

Finally, our findings indicate the need for a theoretical model that explains the *relative leverage premium* and its implications for linear factor asset pricing models, both in the consumption-based and in the investment-based asset pricing framework introduced by Cochrane (1991) and employed for instance by Cochrane (1996), and Zhang (2005).

Appendix A: out-of-sample robustness checks

In our asset pricing tests we follow the matching procedure in Fama and French (1992) to avoid look-ahead bias. However, in Section 3, we use full-sample information to estimate the constant coefficients of the partial-adjustment model of Flannery and Rangan (2006). In this way, we implicitly assume that investors are able to identify overleveraged and underleveraged stocks at time t on the basis of (i) the data series available up to time t, and (ii) the estimated model. In this appendix, we test whether there is still a *relative leverage* premium if we consider only information available at time t also to estimate the parameters of the partial adjustment model.

As Flannery and Hankins (2010) discuss, the estimation of dynamic panels is complicated by several econometric issues that may result in biased estimates in short panels. In our estimation of Equation 4 to work out target leverage for each firm, the main problem is the estimation of unobservable firm fixed effects. As we mentioned in Section 3, Lemmon, Roberts, and Zender (2008) provide evidence that firm fixed-effects are of paramount importance in the estimation of target leverage. However, regardless on whether the LSDV estimator or the Blundell and Bond (1998) system GMM is used, firm fixed effects are determined such that they make the sample mean of the *individual* time series of residuals equal to zero (Baltagi (2008)).[12] As for the other estimates of the coefficients in Equation 4, the properties of our fixed effect estimators are asymptotic. Thus, fixed effects estimates are consistent, but they may be biased in finite samples. In addition, firm fixed effect estimates are likely to be noisier than those of other coefficients because the length of the time-series of individual firms may be short in our unbalanced panel.

Using full-sample information to estimate the partial adjustment model is convenient

[12]Since the firm fixed effects are included in $X_{i,t}$ in Equation 4, the firm-specific constant that makes the mean residual equal to zero must be then divided by the estimate of λ in order to obtain the fixed effect for firm i in $MDR^*_{i,t+1}$.

for three main reasons. First, it allows to perform asset pricing tests on the whole period 1965-2009 without splitting it into an estimation and a testing period, as estimating the model completely out of sample would require. Second, it mitigates the finite-sample bias and the noise in the estimation of the fixed effect for firm i since, at every time t, the entire time series for firm i can be used. Finally, in order to obtain more reliable out-of-sample fixed effects estimates, we could require that firms have enough observations to be included in the asset pricing tests in a certain period t. However, doing so may introduce a selection bias towards mature firms, which can instead be avoided if the partial adjustment model is estimated using full-sample information.

Hence, our purpose is to check whether our results are driven by the use of full-sample information in the estimation of Equation 4. We first consider the period 1965-1987, whose lenght is approximately one half of our entire sample, as the initial estimation period. Then, for each year t between 1987 and 2009 we estimate Equation 4 on a rolling basis, that is using data from 1965 to t. Target leverage for the i-th stock is estimated in year t only if firm i's fixed effect estimate is stable enough with respect to the ones in previous periods. Since fixed effects estimates are consistent, a stable estimate should imply that convergence has been reached in year t. Specifically, we consider target leverage estimate for firm i in year t only if there exists a period t^* between 1989 and t such that the fixed effect estimate F_{i,t^*} is available[13] and satisfies

$$F_{i,t^*} - F_{i,t^*-1} < 0.05$$

and

$$F_{i,t^*} - F_{i,t^*-2} < 0.05.^{14}$$

[13] We require that there are no gaps in the firm i's time series of $F_{i,s}$, for $t^* < s < t$.

[14] In unreported analyses, we also consider different convergence criteria, with tighter (looser) bounds, or based on estimates for more than two consecutive years. This does not qualitatively affect our results.

After the convergence criterion is satisfied for firm i, the fixed effect estimate F_{i,t^*} at t^* is used to compute target leverage $MDR^*_{i,t}$ for every $t \geq t^*$ for which Equation 4 allows to work out target leverage for firm i.[15]

For computational convenience, in the rolling estimation described above we use the LSDV estimator instead of the Blundell and Bond (1998) system GMM. We do so to the extent that, as we discussed already, our previous asset pricing results are not very sensitive to the choice between these two econonometric techniques. Finally, after we obtain target leverage estimates for the period 1989-2009, we define relative leverage as in Equation 5, and we match annual series to monthly returns according to the procedure described in Section 4. As a result, we end up with monthly time series from July 1990 to December 2009.

Figure 4 depicts average monthly returns of firms sorted by our out-of-sample measure of *relative leverage* in the test period 1990-2009. As in Figure 3, an apparent *relative leverage* premium emerges. Consistent with our previous findings, this premium seems to be fairly symmetrical around the target.

(Insert Figure 4 about here)

The FMB regressions in columns 1-3 of Table 11 provide evidence that our key results are not driven by the use of full-sample information in the estimation of Equation 4. In the regression in column 1, *relative leverage* is highly significant after controlling for (log) size and (log) book-to-market equity, with a positive slope of 2.227, and a t-statistic of 8.804. Following the interpretation in Fama (1976), this slope can be interpreted as the average monthly return of a particular self-financing portfolio with unit *relative leverage*, and that hedges the effects of size and book-to-market in the period 1990-2009.

[15] Occasionally, due to missing data for one or more regressors in $X_{i,t-1}$, it is not possible to estimate $MDR^*_{i,t}$ for every $t \geq t^*$. When this occurs, we stop including the firm in the analysis, and we start checking again the convergence criteria for it.

In the Fama and MacBeth (1973) approach, the standard error is computed as the standard deviation of monthly returns on this portfolio, divided by the square root of the number of months in the sample (234 in this case). Hence, a t-statistic of 8.804 can be approximately translated into an annualized Sharpe ratio of 1.725, assuming an average monthly riskfree rate of 30 basis points (estimated using data from Kenneth French's website for the period from July 1990 to December 2009). The regression in column 2 shows that MDR is no longer statistically significant after controlling for *relative leverage*. Taking into account that we exclude firms for which fixed effect estimates are noisier, this finding is consistent with our interpretation of the residual significance of MDR in Section 5.3 as the result of noise in the estimation of target leverage. Column 3 documents the symmetry of the *relative leverage* premium. The overleverage and underleverage components of *relative leverage* have coefficients approximately equal in absolute value. A formal Wald test cannot reject this null hypothesis with a p-value of 0.605. In summary, our main results about (i) the existence of a *relative leverage* premium, (ii) the pivotal role of *relative leverage* rather than observed leverage to explain cross-sectional returns, and (iii) the symmetry of the *relative leverage* premium appear to be robust to the out-of-sample estimation of the partial adjustment model.

In addition, the regressions in columns 4-6 provide evidence that our out-of-sample results are qualitatively unchanged if we measure *relative leverage* using full-sample information by the Blundell and Bond (1998) system GMM. Finally, the regressions in columns 7-9 employ the LSDV estimator and full-sample information to work out *relative leverage*. Since the estimated coefficients are close to those in columns 4-6, we conclude that our choice to use the LSDV estimator for computational convenience is not likely to affect our findings, consistent with the evidence in Flannery and Hankins (2010).

(Insert Table 11 about here)

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Figure 1: Average Return for 25 Portfolios Sorted by Relative Leverage and Observed Leverage

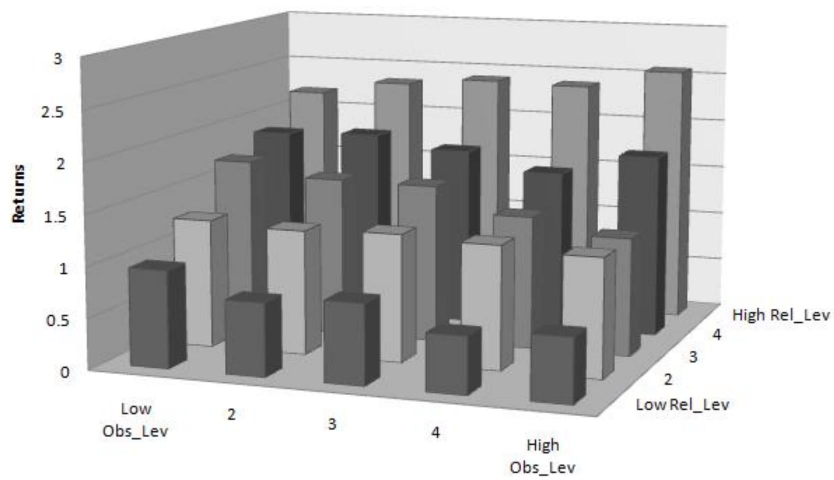

Figure 2: Market Capitalization and Deviations from Target Debt Ratio

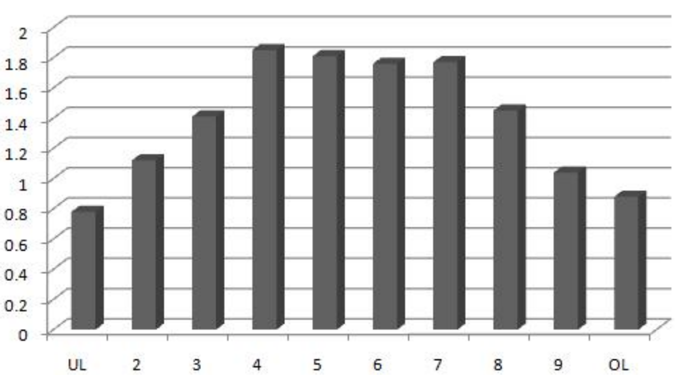

Figure 3: Average return for 9 portfolios sorted by relative leverage

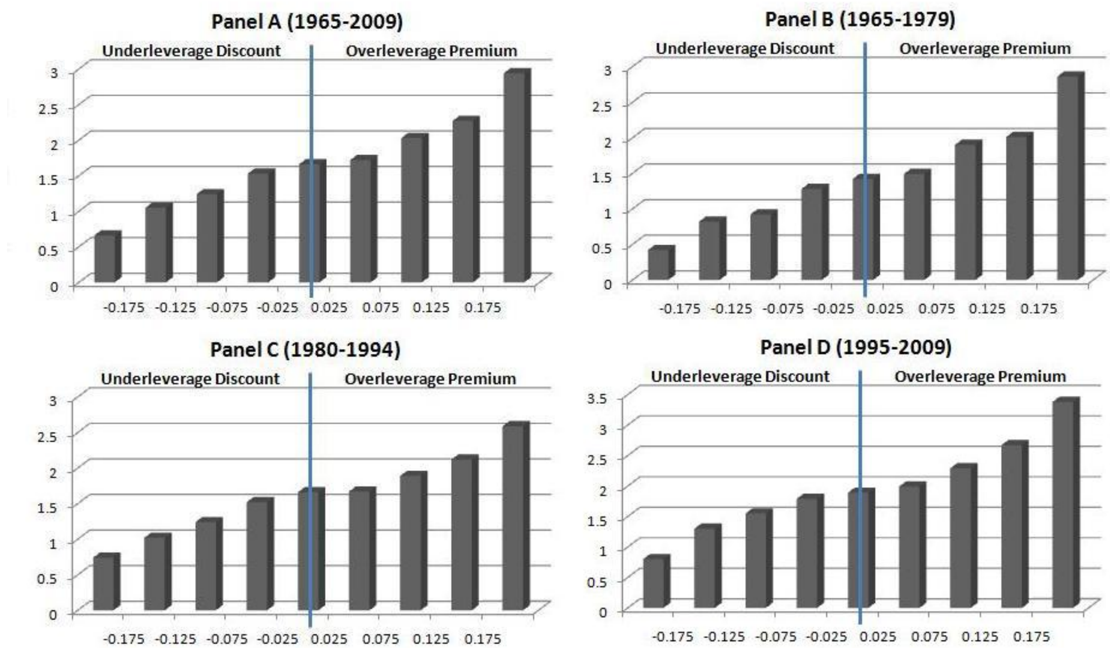

Figure 4: Average return for 9 portfolios sorted by out-of-sample relative leverage (1990-2009)

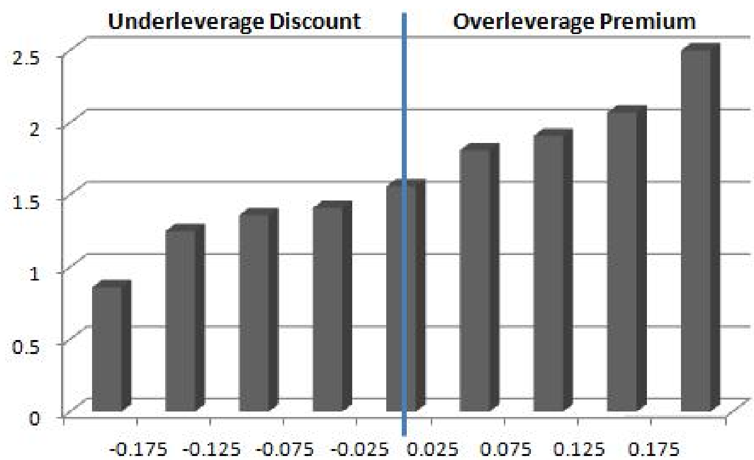

Table 1: Flannery and Rangan (2006) decomposition: Summary statistics.
Sample includes all Compustat firms traded on NYSE,AMEX and NASDAQ between 1965 and 2009. Financial firms and utilities are excluded. In the sample there are 9,058 firms and 115,710 firm-year observations. All variables are winsorized at the 1% level.

Variable	**Mean**	**Std. Dev.**	**Min.**	**Max.**
MDR	0.24	0.23	0	0.87
EBIT_TA	0.06	0.17	-0.76	0.36
MB	1.61	1.5	0.33	9.49
DEP_TA	0.04	0.03	0	0.18
LnTA	18.69	1.85	14.73	23.49
FA_TA	0.3	0.22	0.01	0.89
R&D_DUM	0.04	0.08	0	0.47
R&D_TA	0.52	0.5	0	1
Ind_Median	0.19	0.14	0	0.98

Table 2: Panel regressions estimating target leverage.
Columns (1),(2),(3) report estimates for the model:
$MDR_{i,t+1} = (\lambda\beta)X_{i,t} + (1-\lambda)MDR_{i,t} + \epsilon_{i,t+1}$
Column (1) reports pooled OLS estimates; Column (2) reports fixed-effects estimates as in Flannery and Rangan (2006); and column (3) reports Blundell and Bond's system GMM estimates. All variables are winsorized at the 1% level. The dependent variable in all regressions is MDR. All right-hand side variables are lagged by one year.

	(1)	(2)	(3)
	OLS	LSDV	BB
VARIABLES			
λ	0.155**	0.353**	0.238**
	(450.1)	(244.3)	(94.28)
EBIT_TA	-0.259**	-0.207**	-0.240**
	(-14.61)	(-19.14)	(-5.844)
MB	-0.0111**	-0.0026**	-0.0089**
	(-6.473)	(-2.677)	(-3.496)
DEP_TA	-1.419**	-0.799**	-2.181**
	(-15.92)	(-13.44)	(-9.545)
LnTA	0.0164**	0.0646**	0.0295**
	(12.41)	(36.28)	(5.569)
FA_TA(-1)	0.206**	0.160**	0.279**
	(15.32)	(12.94)	(5.971)
R&D_DUM	0.0566**	0.0035	0.1168**
	(10.41)	(0.737)	(6.262)
R&D_TA	-0.501**	-0.116**	-0.344**
	(-11.77)	(-3.781)	(-4.299)
Ind_Median	0.178**	0.018	-0.022
	(7.949)	(0.995)	(-0.408)
Constant	-0.247**	-1.020**	-0.403**
	(-5.452)	(-28.46)	(-3.876)
Adjusted R-squared	0.779	0.466	-
Firm FE	No	Yes	Yes
Year FE	Yes	Yes	Yes

t-statistics in parentheses
** $p<0.01$, * $p<0.05$

Table 3: Time-series average of cross-sectional correlations.

We report time-series averages of monthly cross-sectional correlations using monthly data from July 1965 to December 2009. MDR is the market debt ratio. Log(size) is the natural logarithm of market capitalization. Log(bm) is the natural logarithm of book-to-market equity, Rel_Lev is *relative leverage*, distance is the distance from target leverage, overlev is over-leverage, and underlev is under-leverage. All the reported variables are defined and measured as specified in the text.

	MDR	Rel_Lev	Distance	Overlev	Underlev	log(size)	log(bm)	Momentum
MDR	1.000							
Rel_Lev	0.425	1.000						
Distance	0.162	-0.130	1.000					
Overlev	0.467	0.774	0.450	1.000				
Underlev	-0.233	-0.840	0.597	-0.361	1.000			
log(size)	-0.167	-0.090	-0.121	-0.152	-0.004	1.000		
log(bm)	0.435	0.138	0.071	0.163	-0.063	-0.318	1.000	
Momentum	0.034	0.142	0.006	0.118	-0.106	-0.015	0.017	1.000

Table 4: Cross-sectional patterns: *relative leverage* vs MDR.

Using monthly data from July 1965 to December 2009, stocks are sorted independently every June in quintiles based on their values of MDR and *relative leverage*. Time-series averages of monthly cross-sectional firm characteristics are reported. Average return is the percent average monthly return, number of firms is the average number of companies each month in each group, MDR is the market debt ratio, log(size) is the natural logarithm of market capitalization, BE/ME is book-to-market equity, momentum is the percent 12-month cumulated return from month t-1 to month t-12. All the reported variables are defined and measured as specified in the text.

	LowRL	2	3	4	HighRL	LowRL	2	3	4	HighRL
	Average Return					Number of firms				
LowMDR	0.96	1.27	1.71	1.87	2.19	191.84	182.19	174.78	113.59	34.45
2	0.72	1.23	1.58	1.90	2.33	104.71	86.73	80.40	67.84	25.74
3	0.79	1.26	1.57	1.78	2.40	75.82	61.70	66.44	75.57	52.55
4	0.56	1.22	1.32	1.60	2.38	54.97	45.80	53.52	77.54	101.52
HighMDR	0.63	1.17	1.17	1.82	2.57	36.46	33.94	40.66	72.09	208.84
	MDR					log(size)				
LowMDR	0.03	0.03	0.03	0.03	0.03	4.87	5.22	5.11	4.83	4.58
2	0.13	0.13	0.14	0.14	0.15	5.18	5.56	5.61	5.28	4.51
3	0.24	0.24	0.24	0.24	0.25	4.96	5.45	5.53	5.35	4.71
4	0.36	0.36	0.37	0.36	0.37	4.64	5.08	5.09	5.10	4.64
HighMDR	0.56	0.57	0.57	0.58	0.62	4.00	4.30	4.42	4.47	4.12
	BE/ME					Momentum				
LowMDR	0.64	0.53	0.55	0.52	0.45	13.25	14.85	18.43	20.70	27.17
2	0.68	0.63	0.64	0.67	0.67	10.19	14.47	17.87	21.69	25.91
3	0.80	0.80	0.79	0.79	0.82	8.63	13.74	16.58	19.34	26.39
4	0.98	0.97	0.94	0.97	0.95	5.79	12.87	14.65	16.83	25.41
HighMDR	1.23	1.23	1.24	1.28	1.25	3.32	10.98	13.75	17.47	26.62

Table 5: Relative Leverage, size, book-to-market, momentum.

Each month between July 1965 to December 2009, we estimate cross-sectional regression of stock returns on size, book-to-market ratio, *relative leverage* and momentum. These variables are matched to monthly returns in line with Fama and French (1992), as specified in the text. We report Fama-MacBeth coefficient estimates and t-statitics based on Newey-West standard errors with a lag length of 2.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	ret	ret	ret	ret	ret	ret	ret	ret
Panel A: 1965-2009 (534 months)								
log(size)	-0.273			-0.237	-0.243		-0.221	-0.204
	(-5.964)			(-4.915)	(-5.384)		(-4.644)	(-4.519)
log(bm)		0.383		0.173		0.288	0.0960	0.139
		(5.080)		(2.157)		(3.947)	(1.228)	(1.885)
Rel_Lev			4.003		3.655	3.706	3.509	3.617
			(18.68)		(18.96)	(20.71)	(20.73)	(22.27)
Momentum								-0.170
								(-0.917)
Constant	1.047	1.677	1.628	1.171	1.193	1.738	1.270	1.248
	(4.045)	(5.695)	(5.244)	(4.837)	(4.528)	(5.797)	(5.141)	(5.060)

t-statistics in parentheses

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	ret	ret	ret	ret	ret	ret	ret	ret
Panel B: 1965-1979 (174 months)								
log(size)	-0.242			-0.213	-0.189		-0.177	-0.133
	(-2.578)			(-2.245)	(-2.067)		(-1.914)	(-1.565)
log(bm)		0.383		0.136		0.279	0.0709	0.150
		(2.540)		(0.968)		(1.930)	(0.532)	(1.104)
Rel_Lev			4.252		3.689	3.906	3.410	3.374
			(13.02)		(15.14)	(15.33)	(15.95)	(15.06)
Momentum								0.0178
								(0.0459)
Constant	0.690	1.280	1.327	0.795	0.894	1.364	0.963	0.972
	(1.707)	(2.442)	(2.280)	(2.206)	(2.090)	(2.496)	(2.498)	(2.447)

t-statistics in parentheses

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	ret	ret	ret	ret	ret	ret	ret	ret
Panel C: 1980-1994 (180 months)								
log(size)	-0.199			-0.162	-0.172		-0.150	-0.154
	(-3.226)			(-2.645)	(-2.849)		(-2.481)	(-2.568)
log(bm)		0.391		0.277		0.250	0.151	0.168
		(3.415)		(2.368)		(2.221)	(1.295)	(1.563)
Rel_Lev			3.403		3.101	3.180	3.043	2.998
			(10.47)		(10.96)	(12.62)	(13.04)	(12.96)
Momentum								0.145
								(0.685)
Constant	1.142	1.783	1.609	1.355	1.199	1.753	1.354	1.352
	(2.778)	(4.025)	(3.480)	(3.570)	(2.894)	(3.944)	(3.544)	(3.595)

t-statistics in parentheses

VARIABLES	(1) ret	(2) ret	(3) ret	(4) ret	(5) ret	(6) ret	(7) ret	(8) ret
Panel D: 1995-2009 (180 months)								
log(size)	-0.377			-0.335	-0.366		-0.336	-0.322
	(-4.787)			(-3.724)	(-4.662)		(-3.730)	(-3.777)
log(bm)		0.376		0.105		0.335	0.0650	0.0988
		(2.966)		(0.672)		(2.745)	(0.424)	(0.716)
Rel_Lev			4.361		4.176	4.038	4.071	4.471
			(9.975)		(9.757)	(10.38)	(10.63)	(13.29)
Momentum								-0.668
								(-1.986)
Constant	1.296	1.955	1.937	1.350	1.475	2.085	1.482	1.410
	(2.513)	(3.521)	(3.440)	(2.708)	(2.854)	(3.728)	(2.956)	(2.838)

t-statistics in parentheses

Table 6: Relative Leverage, Over-leverage, Under-leverage and Distance.

Each month between July 1965 to December 2009, we estimate cross-sectional regressions of stock returns on size, book-to-market ratio, *relative leverage*, distance, over-leverage and under-leverage. These variables are matched to monthly returns in line with Fama and French (1992), as specified in the text. We report Fama-MacBeth coefficient estimates and and t-statitics based on Newey-West standard errors with a lag length of 2. Distance, Overlev and Underlev are defined as:

$Distance_{i,t} = abs\{Rel\_Lev_{i,t}, 0\}$

$Overlev_{i,t} = max\{Rel\_Lev_{i,t}, 0\}$

$Underlev_{i,t} = -min\{Rel\_Lev_{i,t}, 0\}$

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	ret	ret	ret	ret	ret	ret
Panel A: 1965-2009 (534 months)						
log(size)	-0.221	-0.222	-0.234	-0.222	-0.222	-0.222
	(-4.644)	(-4.700)	(-4.905)	(-4.700)	(-4.700)	(-4.700)
log(bm)	0.0960	0.0962	0.153	0.0962	0.0962	0.0962
	(1.228)	(1.230)	(1.915)	(1.230)	(1.230)	(1.230)
Overlev		3.496		0.0457		
		(7.690)		(0.0716)		
Underlev		-3.450			0.0457	
		(-11.01)			(0.0716)	
Rel_Lev	3.509			3.450	3.496	3.473
	(20.73)			(11.01)	(7.690)	(15.44)
Distance			-0.709			0.0229
			(-2.278)			(0.0716)
Constant	1.270	1.270	1.304	1.270	1.270	1.270
	(5.141)	(5.358)	(5.478)	(5.358)	(5.358)	(5.358)

t-statistics in parentheses

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	ret	ret	ret	ret	ret	ret
Panel B: 1965-1979 (174 months)						
log(size)	-0.177	-0.173	-0.191	-0.173	-0.173	-0.173
	(-1.914)	(-1.896)	(-2.044)	(-1.896)	(-1.896)	(-1.896)
log(bm)	0.0709	0.0656	0.0815	0.0656	0.0656	0.0656
	(0.532)	(0.487)	(0.585)	(0.487)	(0.487)	(0.487)
Overlev		4.377		1.555		
		(5.203)		(1.384)		
Underlev		-2.822			1.555	
		(-5.636)			(1.384)	
Rel_Lev	3.410			2.822	4.377	3.599
	(15.95)			(5.636)	(5.203)	(8.905)
Distance			0.662			0.778
			(1.344)			(1.384)
Constant	0.963	0.895	0.847	0.895	0.895	0.895
	(2.498)	(2.332)	(2.202)	(2.332)	(2.332)	(2.332)

t-statistics in parentheses

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	ret	ret	ret	ret	ret	ret
Panel C: 1980-1994 (180 months)						
log(size)	-0.150	-0.156	-0.168	-0.156	-0.156	-0.156
	(-2.481)	(-2.629)	(-2.794)	(-2.629)	(-2.629)	(-2.629)
log(bm)	0.151	0.155	0.261	0.155	0.155	0.155
	(1.295)	(1.321)	(2.228)	(1.321)	(1.321)	(1.321)
Overlev		2.426		-1.037		
		(4.253)		(-1.306)		
Underlev		-3.463			-1.037	
		(-9.161)			(-1.306)	
Rel_Lev	3.043			3.463	2.426	2.944
	(13.04)			(9.161)	(4.253)	(10.64)
Distance			-0.841			-0.518
			(-2.061)			(-1.306)
Constant	1.354	1.400	1.443	1.400	1.400	1.400
	(3.544)	(3.744)	(3.844)	(3.744)	(3.744)	(3.744)

t-statistics in parentheses

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	ret	ret	ret	ret	ret	ret
Panel D: 1995-2009 (180 months)						
log(size)	-0.336	-0.335	-0.342	-0.335	-0.335	-0.335
	(-3.730)	(-3.733)	(-3.814)	(-3.733)	(-3.733)	(-3.733)
log(bm)	0.0650	0.0672	0.115	0.0672	0.0672	0.0672
	(0.424)	(0.442)	(0.737)	(0.442)	(0.442)	(0.442)
Overlev		3.715		-0.331		
		(4.137)		(-0.251)		
Underlev		-4.046			-0.331	
		(-5.834)			(-0.251)	
Rel_Lev	4.071			4.046	3.715	3.881
	(10.63)			(5.834)	(4.137)	(8.466)
Distance			-1.901			-0.165
			(-2.969)			(-0.251)
Constant	1.482	1.501	1.606	1.501	1.501	1.501
	(2.956)	(3.239)	(3.456)	(3.239)	(3.239)	(3.239)

t-statistics in parentheses

Table 7: Relative Leverage, Market Leverage, Book Leverage.

Each month between July 1965 to December 2009, we estimate cross-sectional regressions of stock returns on size, book-to-market ratio, *relative leverage*, market leverage, and book leverage. These variables are matched to monthly returns in line with Fama and French (1992), as specified in the text. We report Fama-MacBeth coefficient estimates and t-statitics based on Newey-West standard errors with a lag length of 2.

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	ret	ret	ret	ret	ret	ret
Panel A: 1965-2009 (534 months)						
log(size)		-0.233	-0.223		-0.236	-0.221
		(-4.931)	(-4.749)		(-5.025)	(-4.682)
log(bm)		0.135	0.186		0.163	0.198
		(1.798)	(2.488)		(2.082)	(2.501)
MDR	0.987	0.282	-1.000			
	(3.296)	(1.140)	(-3.725)			
Rel_Lev			3.992			
			(21.32)			
BDR				0.332	0.146	-0.386
				(1.833)	(0.701)	(-1.775)
Rel_Lev (book)						1.542
						(12.17)
Constant	1.285	1.101	1.573	1.455	1.137	1.385
	(4.397)	(4.806)	(6.706)	(5.099)	(4.888)	(6.053)

t-statistics in parentheses

VARIABLES	(1) ret	(2) ret	(3) ret	(4) ret	(5) ret	(6) ret
Panel B: 1965-1979 (174 months)						
log(size)		-0.201	-0.181		-0.209	-0.190
		(-2.189)	(-1.986)		(-2.264)	(-2.039)
log(bm)		0.0587	0.150		0.115	0.161
		(0.383)	(0.987)		(0.828)	(1.148)
MDR	1.378	0.576	-0.847			
	(2.768)	(1.482)	(-1.875)			
Rel_Lev			3.791			
			(12.68)			
BDR				0.722	0.312	-0.364
				(1.808)	(0.938)	(-0.937)
Rel_Lev(book)						1.662
						(7.448)
Constant	0.861	0.660	1.246	1.059	0.723	1.041
	(1.812)	(2.059)	(3.562)	(2.322)	(2.275)	(3.302)

t-statistics in parentheses

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	ret	ret	ret	ret	ret	ret
Panel C: 1980-1994 (180 months)						
log(size)		-0.163	-0.158		-0.164	-0.145
		(-2.698)	(-2.642)		(-2.705)	(-2.388)
log(bm)		0.260	0.273		0.267	0.302
		(2.210)	(2.342)		(2.295)	(2.608)
MDR	0.816	0.0656	-1.330			
	(2.448)	(0.265)	(-4.936)			
Rel_Lev			3.853			
			(15.02)			
BDR				0.203	-0.0287	-0.596
				(1.038)	(-0.129)	(-2.482)
Rel_Lev(book)						1.635
						(9.295)
Constant	1.385	1.330	1.740	1.548	1.358	1.629
	(3.103)	(3.751)	(4.847)	(3.629)	(3.784)	(4.509)

t-statistics in parentheses

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	ret	ret	ret	ret	ret	ret
Panel D: 1995-2009 (180 months)						
log(size)		-0.334	-0.329		-0.335	-0.329
		(-3.751)	(-3.707)		(-3.833)	(-3.751)
log(bm)		0.0851	0.133		0.106	0.128
		(0.724)	(1.132)		(0.707)	(0.843)
MDR	0.780	0.214	-0.818			
	(1.166)	(0.369)	(-1.341)			
Rel_Lev			4.327			
			(10.90)			
BDR				0.0831	0.161	-0.197
				(0.265)	(0.334)	(-0.422)
Rel_Lev(book)						1.333
						(5.300)
Constant	1.594	1.299	1.722	1.744	1.317	1.474
	(2.742)	(2.667)	(3.514)	(2.997)	(2.631)	(3.037)

t-statistics in parentheses

Table 8: Orthogonalizing regressions.

We report orthogonalizing time-series regressions of factors OMU, SMB, HML, and RMRF using monthly data from July 1965 to December 2009. Monthly series of the Fama and French factors are from Kenneth French's website, while OMU (Overleveraged Minus Underleveraged) is defined as the difference between the average monthly return of stocks with *relative leverage* above the 80th percentile for NYSE firms, minus the average monthly return of stocks with *relative leverage* below the 20th percentile for NYSE firms. In order to define OMU, firms are assigned to portfolios at the end of June of each year. Reported t-statistics are based on standard errors corrected for heteroskedasticity as suggested by Davidson and MacKinnon (1993).

VARIABLES	(1) OMU	(2) SMB	(3) HML	(4) RMRF
RMRF	-0.0245	0.178***	-0.136***	
	(-0.918)	(4.632)	(-3.680)	
SMB	0.125***		-0.194***	0.353***
	(3.810)		(-3.239)	(3.753)
HML	0.285***	-0.266***		-0.370***
	(6.708)	(-2.811)		(-3.582)
OMU		0.352***	0.585***	-0.136
		(3.475)	(6.657)	(-0.942)
Constant	1.532***	-0.285	-0.462**	0.693**
	(19.61)	(-1.465)	(-2.583)	(2.423)
Observations	534	534	534	534
R-squared	0.196	0.153	0.274	0.162

Robust t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 9: Comparison of pricing performance of factor models.

At the end on June of each year between 1965 and 2009, stocks are allocated to 27 portfolios by independently ranking them into three groups on the basis of their values of size, book-to-market equity, and *relative leverage*. Individual stocks are re-assigned to equally-weighted portfolios every June on the basis of NYSE breakpoints for the three variables. UL (OL) denotes the portfolio of stocks with *relative leverage* below (above) that of the lowest (highest) tercile of NYSE firms. Low (High) denotes the portfolio of stocks with book-to-market equity below (above) that of the lowest (highest) tercile of NYSE firms. Small (Large) denotes the portfolio of stocks with market capitalization below (above) that of the lowest (highest) tercile of NYSE firms. Panel A shows average returns for the 27 portfolios and their standard deviations. Panel B reports estimated pricing errors from time-series regressions of the excess returns of the 27 portfolios on the Fama and French factors. Panel C reports estimated pricing errors from time-series regressions of the excess returns of the 27 portfolios on the market factor RMRF. Panel D reports estimated pricing errors from time-series regressions of the excess return of the 27 portfolios on RMRF, OMU, and HML. Reported t-statistics are based on standard errors corrected for heteroskedasticity as suggested by Davidson and MacKinnon (1993).

Panel A: Descriptive Statistics

		Average Return			St. Dev		
RL	Size/BM	Low	2	High	Low	2	High
	Small	0.61	0.74	0.99	8.62	6.98	6.56
UL	2	0.10	0.47	0.47	7.40	6.40	6.38
	Large	0.09	0.24	0.42	5.83	5.61	5.94
	Small	1.27	1.25	1.47	8.61	6.73	6.55
2	2	0.87	0.91	1.02	6.58	5.92	5.96
	Large	0.68	0.70	0.78	5.25	5.18	5.50
	Small	2.28	1.83	2.06	8.45	7.03	6.68
OL	2	1.39	1.34	1.45	6.86	6.07	6.61
	Large	1.05	0.96	1.00	5.65	5.51	5.86

Panel B: FF Model ($R_{i,t} - rf_t = a_i + b_i RMRF_t + s_i SMB_t + h_i HML_t + \epsilon_{i,t}$)

		a_i			$t(a_i)$		
RL	Size/BM	Low	2	High	Low	2	High
	Small	-0.14	-0.05	0.07	-0.89	-0.41	0.58
UL	2	-0.49	-0.29	-0.41	-3.79	-2.79	-3.55
	Large	-0.28	-0.35	-0.26	-3.30	-3.73	-1.88
	Small	0.61	0.48	0.55	3.74	4.41	5.36
2	2	0.36	0.20	0.21	3.84	1.99	1.98
	Large	0.35	0.10	0.12	5.27	1.21	1.10
	Small	1.45	0.97	1.10	10.04	7.44	10.50
UL	2	0.75	0.58	0.51	7.30	5.04	4.46
	Large	0.68	0.27	0.17	7.29	2.66	1.46

Panel C: CAPM ($R_{i,t} - rf_t = a_i + b_i RMRF_t + \epsilon_{i,t}$)							
		a_i			$t(a_i)$		
RL	Size/BM	Low	2	High	Low	2	High
	Small	0.03	0.25	0.54	0.12	1.42	3.03
UL	2	-0.47	-0.03	0.00	-2.97	-0.21	0.01
	Large	-0.39	-0.22	-0.02	-4.67	-2.20	-0.16
	Small	0.68	0.77	1.03	2.87	4.46	5.75
2	2	0.35	0.45	0.57	2.73	3.64	4.20
	Large	0.24	0.28	0.36	3.37	2.95	2.97
	Small	1.71	1.34	1.60	7.21	7.17	8.82
OL	2	0.86	0.88	0.97	6.15	6.43	6.04
	Large	0.59	0.53	0.56	6.12	4.74	4.04

Panel D: $R_{i,t} - rf_t = a_i + b_i RMRF_t + h_i HML_t + o_i OMU_t + \epsilon_{i,t}$							
		a_i			$t(a_i)$		
RL	Size/BM	Low	2	High	Low	2	High
	Small	0.39	0.23	0.07	0.83	0.63	0.21
UL	2	-0.01	0.21	0.12	-0.04	0.72	0.44
	Large	0.15	0.25	0.23	1.19	1.61	1.21
	Small	0.48	0.33	0.16	1.11	1.07	0.45
2	2	0.27	0.02	0.12	1.42	0.10	0.61
	Large	0.41	0.25	0.36	3.96	1.89	2.38
	Small	0.66	0.43	0.18	1.66	1.25	0.53
OL	2	0.59	0.15	0.26	2.31	0.73	0.80
	Large	0.50	0.02	0.28	3.53	0.15	1.36

Table 10: Comparison of pricing performance of factor models.

At the end on June of each year between 1965 and 2009, stocks are allocated to 25 portfolios by independently ranking them into five groups on the basis of their values of size (S), book-to-market equity (BM), momentum (M), and *relative leverage* (RL). Individual stocks are re-assigned to equally-weighted portfolios every June on the basis of NYSE breakpoints for the four variables. The table shows average absolute pricing errors, average squared pricing errors, GRS test statistics, and number of failures "#Fail" for the Fama and French model, the CAPM, and a model including the market factor RMRF, HML, and OMU. #Fail is defined as the number of pricing errors out of 25 that are significantly different from zero at the 1% level. These tests are t-tests based on time-series regressions with standard errors corrected for heteroskedasticity as suggested by Davidson and MacKinnon (1993).

	FF Model				CAPM				RMRF+HML+OMU			
Test Assets	Avg($\|a_i\|$)	Avg(a_i^2)	GRS	#Fail	Avg($\|a_i\|$)	Avg(a_i^2)	GRS	#Fail	Avg($\|a_i\|$)	Avg(a_i^2)	GRS	#Fail
25 port. (5 S, 5 BM)	0.202	0.086	3.401	5	0.425	0.287	3.808	15	0.279	0.103	2.984	3
25 port. (5 RL, 5 BM)	0.513	0.380	19.953	19	0.719	0.724	18.979	18	0.217	0.058	1.846	0
25 port. (5 RL, 5 S)	0.428	0.269	19.210	20	0.565	0.485	19.468	20	0.238	0.067	2.413	2
25 port. (5 S, 5 M)	0.250	0.106	3.216	9	0.399	0.257	3.087	10	0.276	0.145	2.335	1
25 port. (5 BM, 5 M)	0.354	0.167	4.310	15	0.618	0.494	3.916	18	0.284	0.117	1.741	0
25 port. (5 RL, 5 M)	0.509	0.369	20.408	19	0.672	0.682	20.467	17	0.221	0.099	2.769	0

Table 11: Out-of-sample robustness checks.

Each month between July 1990 to December 2009, we estimate cross-sectional regressions of stock returns on size, book-to-market ratio, *relative leverage*, underleverage, overleverage, and market leverage. In the regressions in columns 1-3, *relative leverage*, underleverage, and overleverage are estimated out-of-sample, as described in Appendix A. In the regressions in columns 4-6, they are estimated using Blundell and Bond (1998) system GMM, as described in Section 3. In the regressions in columns 7-9, they are estimated using the LSDV estimator, using the specification in column 2 of table 2. All variables are matched to monthly returns in line with Fama and French (1992), as specified in the text. We report Fama and MacBeth (1973) coefficient estimates and and t-statitics.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
VARIABLES	ret	ret	ret	ret	ret	ret	ret	ret	ret
	Out-of-sample Estimator			BB Estimator			LSDV Estimator		
log(size)	-0.235	-0.223	-0.232	-0.250	-0.239	-0.249	-0.237	-0.219	-0.236
	(-3.691)	(-3.621)	(-3.651)	(-3.912)	(-3.834)	(-3.887)	(-3.698)	(-3.525)	(-3.672)
log(bm)	0.0679	0.127	0.0699	0.0514	0.148	0.0499	0.0390	0.161	0.0398
	(0.607)	(1.385)	(0.632)	(0.458)	(1.613)	(0.447)	(0.350)	(1.759)	(0.359)
MDR		-0.648			-1.145			-1.506	
		(-1.505)			(-2.555)			(-3.278)	
Rel_Lev	2.227	2.614		3.473	4.214		3.851	5.085	
	(8.804)	(8.785)		(12.76)	(11.61)		(12.70)	(12.57)	
Overlev			2.315			3.471			3.623
			(4.200)			(5.008)			(5.193)
Underlev			-1.889			-3.023			-3.666
			(-4.486)			(-5.291)			(-5.964)
Constant	1.331	1.514	1.318	1.342	1.675	1.327	1.340	1.773	1.348
	(3.889)	(4.556)	(4.083)	(3.901)	(4.946)	(4.150)	(3.899)	(5.260)	(4.248)

t-statistics in parentheses