Back to the Beginning: Persistence and the Cross-Section of Corporate Capital Structure*

Michael L. Lemmon
Eccles School of Business, University of Utah

Michael R. Roberts
The Wharton School, University of Pennsylvania

Jaime F. Zender
Leeds School of Business, University of Colorado at Boulder

First Draft: February 14, 2005
Current Draft: March 10, 2006

---

*We thank Franklin Allen, Lincoln Berger, William Goetzmann, Vidhan Goyal, John Graham, Mark Leary, Andrew Metrick, Roni Michaely, Vinay Nair, Ivo Welch, Bilge Yilmaz; seminar participants at Babson College, Cornell University, Drexel University, University of Colorado, University of Maryland, University of Michigan, University of North Carolina, University of Pennsylvania, Queens University, the University of Western Ontario; and conference participants at the 2005 Five-Star Conference and 2005 HKUST Finance Conference for helpful discussions. Roberts gratefully acknowledges financial support from a Rodney L White Grant and an NYSE Research Fellowship. Lemmon: (801) 585-5210, finmll@business.utah.edu; Roberts: (215) 573-9780, mrrobert@wharton.upenn.edu; Zender: (303) 492-4689, jaime.zender@colorado.edu.

Back to the Beginning: Persistence and the Cross-Section of Corporate Capital Structure

Abstract:

We examine the evolution of the cross-sectional distribution of capital structure and find that capital structure is remarkably stable over time; firms with high (low) leverage remain relatively high (low) levered for over 20 years. Additionally, this relative ranking is observed for both public and private firms, and is largely unaffected by the process of going public. These persistent differences in leverage across firms are associated with the presence of an unobserved firm specific effect that is responsible for the majority of variation in capital structure. Over 90% of the explained variation in leverage is captured by firm fixed effects, whereas previously identified determinants (e.g., size, market-to-book, industry) are responsible for less than 10%. Our findings show that firms use net security issuances to maintain their leverage ratios in relatively confined regions around their long run means, consistent with a dynamic rebalancing of capital structure. Importantly, our results imply that the primary determinants of cross-sectional variation in corporate capital structures are largely time invariant, which significantly reduces the set of candidate explanations to those based on factors that remain relatively stable over long periods of time.

A fundamental challenge for corporate finance lies in understanding the determinants of capital structure heterogeneity. To this end, recent research has examined the dynamic behavior of leverage ratios in order to distinguish among competing explanations. Several studies have focused on how firms respond to various shocks affecting capital structure (e.g., Alti (2005), Flannery and Rangan (2005), Leary and Roberts (2005a), and Strebulaev (2004)), while others have focused on how historical factors affect current capital structure (e.g. Baker and Wurgler (2002), Welch (2004), and Kayhan and Titman (2004)).

In this study we take a somewhat broader approach, examining the evolution of the cross-sectional distribution of leverage ratios and analyzing the implications of our findings for various theories of capital structure, as well as previous empirical findings. Our analysis, while shedding light on several issues, also presents some new challenges to understanding capital structure.

We begin by showing that leverage is remarkably stable over time. This fact is illustrated in Figure 1 which, despite showing significant convergence over time, illustrates that firms with relatively high (low) leverage at time *t* tend to maintain high (low) leverage for at least 20 years. Moreover, these differences in leverage ratios are statistically and economically large, and cannot be explained by differences in previously identified determinants (e.g., size, profitability, market-to-book, industry, etc.) or firm entry and exit. The magnitude of these differences is quantified by regression analysis identifying firms' initial leverage ratios as the single most important determinant of future capital structure. Simply put, firms tend to maintain their relative rankings – in terms of leverage ratios – for a very long time.

These results suggest that corporate capital structures are characterized by an important firm specific effect. How important? The *adjusted* R-square from a regression of leverage on firm fixed effects alone is 60%, implying that the majority of variation in capital structure is time invariant. To put this estimate in perspective, the adjusted R-square from a similar regression of investment on firm fixed effects is 35%. Similarly, the adjusted R-squares from traditional leverage regressions consisting of previously identified determinants (e.g., size, market-to-book, profitability, industry, etc.) range from 18% to 29%, depending on the specification. Moreover, we show that existing determinants are highly correlated with the firm specific effect. When we incorporate firm fixed effects into traditional specifications, a variance decomposition reveals that over 90% of the explained sum of squares is attributable to the fixed effects, with the remaining percentage accounted for by traditional determinants.

We then investigate the implications of these findings for existing empirical evidence, as well as theories of capital structure. First, the estimated association between leverage and previously identified determinants is highly sensitive to the inclusion of firm fixed effects. Several coefficient estimates experience a decrease in magnitude exceeding 80% and, in some cases (e.g., market-to-book, dummy for dividend paying firms), lose all statistical significance. However, other estimates, such as for firm size and cash flow volatility, experience an increase in magnitude of over 70% and 700%, respectively. Given the importance of firm specific heterogeneity in leverage, as well as other aspects of the firm (e.g, investment and production), parameter estimates ignoring firm specific effects are suspect.

Second, we find that the incremental contribution of existing determinants in identifying target leverage is negligible after controlling for firm specific effects. Consistent with Flannery and Rangan (2005), including firm fixed effects in the target specification leads to a significant increase in the rate at which firms close the gap between their current leverage and their target leverage from 12% per year to 22% per year. However, contrary to Flannery and Rangan, we find that including time varying factors in the target specification has a negligible effect on this rate of adjustment. Thus, firms' target leverage ratios are largely time-invariant, which is consistent with our other findings and further stresses the relative importance of cross-sectional, as opposed to time-series, variation in capital structure.

Third, our results suggest that, on average, firms maintain their leverage ratios in relatively narrow bands. An analysis of security issuance behavior identifies debt policy as an important mechanism for controlling corporate leverage, while equity policy plays a secondary role. These findings are consistent with capital structure being governed by a dynamic tradeoff strategy. However, our results are difficult to reconcile with either the pecking order (Myers and Majluf (1984)) or market timing (Baker and Wurgler (2002)) hypotheses, which leave little role for a target capital structure or dynamic rebalancing of leverage. Thus, our results tie in nicely with a number of recent studies that support rebalancing behavior, but question the pecking order and market timing hypotheses.[1]

Finally, perhaps the most important implication of our findings is a significant reduction in the set of candidate explanations for the cross-sectional distribution of

[1] Studies by Flannery and Rangan (2005), Hovakimian (2005), Kayhan and Titman (2004), Leary and Roberts (2005a), and Liu (2005) find that firms gradually adjust their capital structure in response to various shocks, counter to the market timing hypothesis. Studies by Frank and Goyal (2003), Fama and French (2005) and Leary and Roberts (2005b) question the empirical validity of the pecking order.

capital structure. The fact that most of the variation in leverage is driven by a largely time-invariant factor(s) suggests that the economic determinants behind this variation are relatively stable for long periods of time. While identifying these determinants is beyond the scope of this paper, we take a step towards this goal by showing that differences in leverage also persist *back* in time, pre-dating the IPO. In other words, high (low) levered private firms remain so even after going public. Additionally, we show that private firms in the United Kingdom - for which we are able to obtain data - also exhibit a pronounced tendency to maintain their leverage rankings over long periods of time.

These findings are interesting for two reasons. First, they cast further suspicion on market timing or equity price inertia (Welch (2004)) as explanations for the cross-sectional distribution of leverage since these hypotheses are largely inapplicable to private firms. Second, the IPO represents a dramatic change in the information environment, the distribution of control, and the access to capital markets. Our finding that leverage rankings are largely unaffected by this event suggests that information asymmetry, the distribution of control, and capital market access are unlikely first order determinants of firms' relative leverage choices.

The remainder of the paper is organized as follows. Section 1 discusses the data and sample selection. In section 2, we examine the dynamic behavior of capital structure from several perspectives. Section 3 presents a variance decomposition of leverage to identify the relative importance of the factors driving variation in leverage. Section 4 considers the implications of our results for existing empirical evidence and theories of capital structure. Section 5 investigates how far back leverage differences persist by examining the behavior of IPO firms and a sample of private firms from the United Kingdom. Section 6 concludes.

1. Data and Sample Selection

Our primary sample consists of all nonfinancial firm-year observations in the intersection of the monthly CRSP and annual Compustat databases between 1971 and 2003. We require that all firm-years have nonmissing data for book assets. All multivariate analysis implicitly assumes nonmissing data for the relevant variables. We require leverage – both book and market – to lie in the closed unit interval. Any market-to-book ratios in excess of 20 are set equal to missing. All other ratios are trimmed at the upper and lower 1-percentiles to mitigate the effect of outliers and eradicate errors in the data. For some of our analysis, we also require an identifiable IPO date.[2] The construction of all of the variables used in the study is detailed in the Appendix.

Panel A of Table 1 presents summary statistics for all of our firms, as well as a subsample of firms having at least 20 years worth of nonmissing data on book leverage. We refer to this subsample as "Survivors" since selection is predicated on at least twenty years of existence. The potential for survivorship bias in our analysis motivates our examination of this sample in all subsequent analysis as a robustness check; however, due to space considerations and the similarity of the findings, we often suppress these results.

A quick comparison between the samples reveals several unsurprising differences. Survivors tend to be larger, more profitable, and have fewer growth opportunities (i.e., lower market-to-book) but more tangible assets relative to the general population.

---

[2] The IPO information is obtained from SDC and Jay Ritter, whom we kindly thank. Additionally, we thank Malcolm Baker and Jeffrey Wurgler for providing the list of IPO firms used in Baker and Wurgler (2002).

Interestingly, survivors tend to have higher leverage, both in terms of market and book measures. This suggests that firm exits due to buyouts and acquisitions are potentially as important as those due to bankruptcy. Alternatively, it may be an artifact of confounding effects – survivor firms are larger and larger firms tend to have higher leverage (Titman and Wessels (1988)). At this point, we merely note that these summary statistics are broadly consistent with intuition and enable a straightforward comparison with previous capital structure studies to ensure consistency.

2. The Evolution of Leverage

2.1 Event Time Evolution

We begin our analysis by studying the evolution of leverage for our cross-section of firms. Figure 1 presents the average leverage of four portfolios in "event time." The figure is constructed in the following manner. Each year we rank firms according to their leverage ratios into quartiles (i.e., four portfolios) which we denote: Very High, High, Medium, and Low. This portfolio formation year is denoted event year "0". We then compute the average leverage for each portfolio in each of the subsequent 20 years holding the portfolios constant.[3] We repeat these two steps of sorting and averaging for every year in the sample period. This process generates 33 sets of event time averages, one for each calendar year in our sample. We then compute the average leverage of each portfolio across the 33 sets within each event year. We perform this exercise for both book leverage and market leverage, the results of which are presented as solid lines in

[3] Of course, because of firm exit the portfolio composition will inevitably change over time, which raises concerns over survivorship bias. We address this concern below.

Panels A and C, respectively. The dashed lines surrounding these portfolio averages correspond to 95% confidence intervals.[4]

Several features of the graphs are worth noting. First, there is a great deal of cross-sectional dispersion in the initial portfolio formation period. The range of average book (market) leverage is 56% (62%). Second, there is noticeable convergence among the four portfolio averages over time. After 20 years, the Very High book leverage portfolio has declined from 60% to 36%; whereas the Low portfolio has increased from 3% to 21% (The market leverage portfolios display a similar pattern.). More importantly, however, despite this convergence, the average leverage across the portfolios 20 years later remains significantly different, both statistically and economically. The average book leverage ratios in the Very High, High, Medium, and Low portfolios after 20 years are 36%, 31%, 27%, and 21%, respectively. This implies an average differential of 5%, which, when compared to the within firm standard deviation of book leverage (11.4%), is economically large. Therefore, a preliminary examination of leverage ratios suggests leverage differences are highly persistent.

A potential concern with this analysis is survivorship bias. First, as we progress further away from the portfolio formation period, firms will naturally drop out of the sample due to exit through bankruptcy, acquisitions, or buyouts. Second, from 1984 onward, the length of time for which we can follow each portfolio is censored because we only have data through 2003. To address this issue, we repeat the analysis described above for our subsample of Survivors. The results for this subset of firms are presented in

[4] The confidence interval is defined as a two-standard error interval around the estimated mean. The standard error is estimated as the average standard error across the 33 sets of averages. Estimating the standard error using the standard error of the average across the 33 sets would greatly underestimate the true standard error because of the overlapping observations. Thus, we use a conservative estimate that ignores the effects of averaging across the 33 sets, effectively treating each set as redundant.

Panels B and D of Figure 1, which reveal negligible differences between the survivors and the general population in terms of the evolution of leverage.

A second potential concern with the results in Figure 1 is that the sorting of firms by leverage may simply be capturing cross-sectional variation in some underlying factor(s) associated with cross-sectional variation in leverage (e.g., bankruptcy costs, agency costs, etc.). For example, previous research (e.g., Titman and Wessels (1988)) has shown that leverage is positively correlated with firm size, so that members of the Very High portfolio may simply correspond to large firms, while members of the Low portfolio correspond to small firms. To address this possibility, we modify the sorting procedure.

Each calendar year we begin by estimating a cross-sectional regression of leverage on one-year lagged factors that have been previously identified by the literature as being relevant determinants of capital structure (e.g., Titman and Wessels (1988), Rajan and Zingales (1995), Mackay and Phillips (2005) and others).[5] Specifically, we regress leverage on firm size, profitability, tangibility, market-to-book, and industry indicator variables (Fama and French 38).[6] We then sort firms into four portfolios based on the residuals from this regression, which we term "unexpected leverage," and then track the average *actual* leverage of each portfolio over the subsequent 20 years. An attractive feature of this approach is that by estimating the regressions each year, we allow the marginal effect of each factor to vary over time.

[5] We also examined the effect of using contemporaneous determinants. The results are imperceptibly different.

[6] We also examined an alternative specification suggested by Frank and Goyal (2004) consisting of firm size, market-to-book, collateral, intangible assets, an indicator for whether the firm paid a dividend (Graham, Lemmon, and Schallheim (1998)), and year and industry indicators. The results are largely unchanged by these modifications and, as such, are not presented.

To the extent that the regression model is well-specified, the expectation is for less cross-sectional variation in the formation period and for any difference in the average leverage levels across portfolios to rapidly converge. This is not the case. Figure 2 presents the graphs for the unexpected leverage portfolios and shows that the results are quite similar to those presented in Figure 1.

In particular, leverage still varies over a large range in the portfolio formation period, suggesting that the most of the variation in capital structure is found in the residual of existing specifications. (We return to this issue below.) As time progresses, we see similar patterns of convergence across the portfolios. And, finally, while the spread in average leverage across the portfolios in each event year has decreased, there still remain significant differences for most periods. For example, even 20 years after the portfolio formation period, the average leverage of Low levered firms is significantly below that of all other portfolios, both in terms of book and market leverage. Additionally, the average leverage of Very High levered firms is significantly different from that of Medium levered firms. These differences are economically significant as well, with the range in leverage across the portfolios in event year 20 equal to 10% (13%) for book (market) leverage. Thus, even after removing all observable heterogeneity associated with traditional determinants of capital structure, leverage differences remain highly persistent.

Before continuing, it is worth distinguishing the persistence that we are observing in the figures from that traditionally referred to in the econometrics literature, as well as previous capital structure studies (e.g., Shyam-Sunder and Myers (1999), Fama and French (2002), Kayhan and Titman (2004)). The figures suggest that, on average, firms tend to maintain their leverage ratios in relatively confined regions for extended periods of time. This is distinct from the econometric notion of persistence that shocks to firms' leverage ratios have long lasting effects – an issue we examine below. The figures also suggest that the effects of within firm shocks to leverage are on average quite small when compared to the differences in firms' average leverage ratios. This contention is supported by the fact that the within firm standard deviation of book (market) leverage is 11.4% (14.6%), while the between firm standard deviation is 19.3% (24.3%). Thus, variation across firms' means is significantly larger then variation within firms over time.

2.2 The Effect of Initial Leverage

An alternative approach to identify the effect revealed by the figures is to examine this persistence in a regression setting. However, unlike traditional approaches that estimate partial adjustment models incorporating lagged leverage as an explanatory variable, we include the firm's initial leverage, which we proxy for with the first non-missing value for leverage. The model that we estimate is:

$$Leverage_{it} = \alpha + \beta X_{it-1} + \gamma Leverage_{i0} + \varepsilon_{it}\,, \qquad (1)$$

compared to partial adjustment models that estimate

$$Leverage_{it} = \alpha + \beta X_{it-1} + \gamma Leverage_{it-k} + \varepsilon_{it}\,, \qquad (2)$$

where i indexes firms, t indexes years, X is a set of control variables often assumed to be strictly exogenous or predetermined, and k is typically taken to be equal to 1.[7] The random error, ε, is assumed to be correlated within firm observations but independent

[7] Partial adjustment models are commonly expressed as:

$$Leverage_t - Leverage_{t-1} = \alpha + \lambda\left(\mu_t - Leverage_{t-1}\right) + \varepsilon_t\,,$$

which is simply a reparameterization of the first order autoregressive specification presented in equation (2).

across firms. We also include year indicator variables to capture any common component in leverage shared by firms at a given point in time (see Petersen (2005)). The distinction between the two specifications is that the lagged leverage in equation (1) is fixed at the initial value for all *t*, whereas the lagged leverage in equation (2) updates with each *t*.

The results from estimating equation (1) using book and market leverage are presented in Table 2. Panel A presents the results using the full sample, while Panel B presents the results using the subsample of survivors. Because the results are so similar, we focus on Panel A. In order to ease coefficient comparisons, we have standardized the right hand side variables to have zero mean and unit variance.[8] The Table presents results from three specifications. The first restricts the vector β to equal 0, so that leverage at time *t* is regressed on only initial leverage. The estimate suggests that a one standard deviation change in a firm's initial book leverage ratio (*Initial Leverage*) corresponds to an average change of 7% in future values of book leverage. An even larger effect is found for market leverage. These results are consistent with the findings of Figure 1.

Next, we incorporate two sets of determinants into the specification. The first set consists of those variables suggested by Rajan and Zingales (1995) and subsequently used in many capital structure studies (e.g., Baker and Wurgler (2002), Frank and Goyal (2003), and Lemmon and Zender (2004)), augmented with calendar year fixed effects. The coefficient estimates are largely consistent with previous evidence, in terms of sign and statistical significance. Yet, *Initial Leverage* remains highly significant and reveals a small (economic) change from 0.07 to 0.06, in the case of book leverage, and a slightly

[8] We recognize that this transformation can potentially induce a correlation between the error term and the covariates if the covariates are not strictly exogenous. However, the standardization improves the clarity of the results and eases the comparison of parameter estimates. Results using non-standardized variables produce qualitatively similar results and are available upon request.

larger change from 0.11 to 0.08 for market leverage. Despite the change, however, the statistical and economic magnitude of these effects is dramatic, particularly when compared to the marginal effect of the other determinants. In fact, *Initial Leverage* is the single most important determinant of future capital structure. These results are consistent with Figure 2, though the regression specification here presents a more stringent test of persistence in leverage differences since the determinants update each period.

The final specification incorporates additional variables motivated, in part, by Frank and Goyal (2004), who perform an exhaustive analysis of capital structure determinants. Despite statistically significant marginal effects, the inclusion of these additional variables has little impact on the effect of firms' initial capital structures on future leverage. The estimated coefficient on *Initial Leverage* is still highly significant and larger in magnitude than all other determinants but for the indicator of whether a firm paid a dividend (*Dividend Payer*) and *Industry Median Leverage*. The results show that historical leverage is an important determinant of future leverage: Initially high (low) levered firms tend to remain so for many years.

2.3 The Probability of Transitioning across Leverage States

One concern common to the analysis in Figures 1 and 2, as well as that in Table 2 is the possible masking of firm-level behavior by averaging. Specifically, the averaging inherent in the figures and regressions may conceal offsetting firm level behavior. To address this possibility, we examine the probability of firms switching from one unexpected leverage portfolio to another through time. We do so by first sorting firms each year into four unexpected leverage portfolios (using the regression approach outlined in the context of Figure 2). We then compute the fraction of firms in portfolio *i* at time *t-k* that transition to portfolio *j* at time *t*, for *i,j* in {Low, Medium, High, Very High} and *k* in {1,5}. We view this simply as a non-parametric robustness test of our earlier findings.

The results are presented in Table 3. Panel A (B) presents the results for one (five) year transitions. The large diagonal elements in both panels reveal a strong propensity to remain in a particular unexpected leverage portfolio through time.[9] Specifically, we find that firms have a 64% probability of staying in the same unexpected leverage portfolio from year-to-year. Even over five year time spans, firms have a 46% probability of remaining in the same unexpected leverage portfolio. Further, when firms do change states, it is almost always to an adjacent state. In unreported analysis, we find that for the firms that switch to adjacent states, their leverage is generally already close to the boundary so that the magnitude of the leverage change is commonly quite small. Only 6% (17%) of the time do firms move to a non-adjacent state after one (five) year. Thus, even at a disaggregated level, leverage differences are highly persistent.

3. Variance Decomposition of Leverage

The fact that leverage differences across firms are highly persistent is indicative of important firm specific effects. That is, corporate leverage tends to vary around firm specific means, the differences in which appear to be responsible for a substantial fraction of the variation in leverage. This claim is supported by the spread across portfolios in Figures 1 and 2, as well as the regression evidence in Table 2. In this section, our goal is

[9] This result is consistent with some of the findings in Mackay and Phillips (2005) and an earlier working paper version of Frank and Goyal (2005).

to quantify the importance of this firm specific effect. To accomplish this, we perform an analysis of covariance (i.e., ANCOVA) or, loosely speaking, a variance decomposition.

We begin by specifying the following general model of leverage using notation identical to that found in equations (1) and (2) above:

$$Leverage_{it} = \alpha + \beta X_{it-1} + \eta_i + \nu_t + \varepsilon_{it}\,, \tag{3}$$

where η is a time invariant component and v is a firm invariant component of leverage. The disturbances, ε, likely violate the assumptions underlying ANCOVA: normal distribution, independent, and homoskedastic. However, at this stage, the purpose of this analysis is *not* hypothesis testing. Rather, we only use the ANCOVA technique as a tool for decomposing the variance of leverage. All hypothesis tests performed below account for these statistical issues by explicitly modeling the error dependence structure and relying on asymptotic theory.

Panel A of Table 4 presents the results of the variance decomposition for several different specifications. However, because of the large number of firms (19,777) in our panel and computer memory limitations, performing the variance decomposition on the entire sample is not feasible. As such, we randomly sample 10% of the firms in the panel and perform the analysis for this subsample. To minimize sampling error, we repeat the process of sampling and performing the variance decomposition 100 times and then average over the results.

Each column in Panel A of the table corresponds to a different specification. The numbers in the body of the table - excluding the last row - correspond to the fraction of the total Type III partial sum of squares for a particular model.[10] That is, we divide the partial sum of squares for each effect by the aggregate partial sum of squares across all effects in the model. This provides a normalization that forces the columns to sum to one. Intuitively, what the figures in the table correspond to is the fraction of the model sum of squares attributable to a particular "effect" (e.g., firm, year, size, market-to-book, etc.). When only one effect is included in the model, the entire explained sum of squares is attributable to that effect. For example, when we examine only the firm effect (η_i) in column (a) the reported estimate takes a value of 1.00, or 100%. The same is true in column (b) which examines the year effect in isolation.

The last row of Panel A presents the adjusted R-square corresponding to each specification. Firm specific effects alone, column (a), capture 60% of the variation in book leverage, compared to 1% captured by the time effects, column (b). To place this finding into context, a similar (unreported) analysis performed on capital expenditures reveals an adjusted R-square of 35% corresponding to the firm fixed effect specification. Thus, the majority of variation in capital structure is due to time invariant factors, whereas the majority of variation in investment is due to time varying factors. And, we emphasize that throughout this (and all) analysis, we examine only adjusted R-squares to account for differences in the model degrees of freedom.

Column (d) presents the results from the Rajan and Zingales (1995) inspired specification and shows that asset tangibility (*Tangibility)* and industry fixed effects (*Industry FE*) account for most of the explanatory power in this specification. However,

[10] We use Type III sum of squares for two reasons. First, Type I sum of squares is sensitive to the ordering of the covariates because the computation involves sequentially projecting the dependent variable onto each variable. Second, our data is "unbalanced" in the sense that the number of observations corresponding to each effect is not the same (some firms have more observations than others). For a discussion of the methods used here, see Scheffe (1959).

the adjusted R-square is 18% for book leverage (31% for market leverage), significantly lower, both statistically and practically speaking, than the initial firm fixed effect regression. In column (e), we augment the specification in column (d) with firm fixed effects and note the following.[11] First, the adjusted R-square for book leverage more than triples from 18% to 63%, highlighting the incremental contribution of the firm fixed effects. Second, and most striking, almost all of the explanatory power in this specification, 95%, is captured by the firm fixed effects.

Columns (f) and (g) present similar results using the specification inspired by Frank and Goyal (2004). Including firm fixed effects into the book leverage specification leads to a dramatic increase in the adjusted R-square from 29% to 65%, with most of the explanatory power attributed to the firm fixed effects (92%). The results using market leverage are analogous. These findings confirm that the persistence of leverage differences across firms is due to the presence of an important firm specific effect. They also suggest that existing determinants are highly correlated with this effect, which captures most of the explanatory power previously attributed to these determinants.

In unreported results, we also examine the effect of further expanding the specification to include measures of cash flow and asset volatility (Faulkender and Petersen (2005)), proxies for the marginal tax rate (Graham (1996)), and higher order polynomial terms of each determinant to capture potential nonlinear associations. All of these modifications have little effect on our results. In fact, a kitchen sink model that includes linear, quadratic, and cubic terms for all of the determinants mentioned reduces the relative contribution of the firm fixed effects to 88% and increases the adjusted R-square by less than 8% for book leverage.

[11] To avoid perfect collinearity, we are also forced to drop the industry fixed effects from this specification.

It is important to note that these firm specific effects are not without economic content. Differences in technologies or managerial ability/behavior, unobserved by the econometrician, have long motivated the incorporation of firm specific effects in investment (e.g., Kuh (1963) and Fazzari, Hubbard, and Petersen (1988)) and production function regressions (e.g., Mundlak (1962) and Hoch (1962)). Furthermore, Bertrand and Schoar (2003) provide direct evidence that managerial differences affect capital structures. In so far as these unobserved factors are slowly changing, if not strictly time invariant, their impact on capital structure is absorbed by the firm specific effect.

To summarize, corporate capital structures are characterized by an important firm specific component that is responsible for a majority of the total variation in leverage. That is, most of the variation in capital structure is due to cross-sectional differences in firm specific means (i.e., within variation), as opposed to time series variation around these means (i.e., between variation). Additionally, many of the previously identified empirical determinants appear to be correlated with leverage, in part, because of their correlation with this firm specific component. Our next goal is to understand the implications of these findings for empirical research and theories of capital structure.

4. Implications for Empirical Research and Theories of Capital Structure

4.1 Existing Determinants of Capital Structure

In their texts on panel data econometrics, both Arellano (2003) and Hsiao (2003) identify the ability to control for unobserved heterogeneity as one of the primary motivations for using panel data. By including either time or firm invariant effects in the model, researchers can often sidestep the problem of omitted variables bias in so far as these missing variables are either fixed over time within cross-sectional units or fixed across cross-sectional units for each time period, respectively. Given the importance of unobserved heterogeneity in both investment and production, as well as the direct evidence on managerial import provided by Bertrand and Schoar (2003), a potential concern with existing estimates of capital structure regressions ignoring this firm specific heterogeneity is that these estimates may be tainted by omitted variable bias.

Panel B of Table 4 examines this concern by presenting the results of estimating capital structure regressions using a pooled ordinary least squares approach that ignores firm specific effects and a within group (a.k.a., least squares dummy variable or covariance) approach that incorporates firm fixed effects. This latter approach simply transforms the left and right hand sides of the regression by subtracting the firm specific means from each variable and, for the remainder of the paper, all specifications including firm fixed effects use this approach unless explicitly stated otherwise. As such, we are no longer constrained by an excessively large design matrix when estimating the firm fixed effect specifications. Therefore, Panel B presents results using the entire sample, although similar results are obtained if we instead estimate the regressions on the 100 random samples used in Panel A of Table 4 and then average the results. All t-statistics are computed using standard errors robust to both heteroskedasticity and within firm correlation (Petersen (2005)).

The results illustrate that almost every determinant is highly statistically significant regardless of whether we incorporate firm fixed effects or not. However, the estimated magnitudes - and sometimes statistical significance - are highly sensitive to the inclusion of firm fixed effects. Focusing on the book leverage results, every coefficient estimate experiences a dramatic decline in magnitude moving from the pooled OLS specification to the fixed effect specification except for firm size and cash flow volatility. For example, moving from specification (d) to (e) we see that the coefficient on market-to-book falls by 49%, that on profitability falls by 34%, and that on tangibility falls by 41%. These differences are both statistically (as suggested by a Hausman test) and economically significant. Similarly, moving from (f) to (g), we see that all coefficients, but for firm size and cash flow volatility, fall by at least 51%. Cash flow volatility, on the other hand, increases by over 700%, becoming statistically significant in the process. The results for market leverage reveal similar sensitivities.

The magnitudes of these differences are striking, suggesting that omitted variables bias is severe and parameter estimates from models ignoring firm specific heterogeneity should be treated as suspect. Though, this conclusion is not without qualification. The firm fixed effect transformation potentially raises new econometric concerns and amplifies existing specification problems.[12] More importantly, by including firm fixed effects, only within firm variation remains for the independent variables to explain. Therefore, some of the cross-sectional variation that was originally captured by existing determinants (e.g., asset tangibility) is now removed by the fixed effect transformation. However, when one considers all of the evidence presented thus far, it is clear that this is at best a partial explanation for the findings in Panel B. The results in Table 2 show that

[12] The firm fixed effect transformation requires strict exogeneity of the independent variables, as opposed to predeterminancy (Chamberlain (1982)); however, most previous studies to which we benchmark our results implicitly assume strict exogeneity of the independent variables. Additionally, by purging the data of firm specific effects, we are implicitly reducing the amount of variation in the independent variables that we are using to identify their coefficients. As such, other misspecifications, such as measurement error, may have a larger impact on the results (Grilliches and Mairesse (1995)).

initial leverage is one of the most important determinants of leverage. Similarly, Panel A of Table 4 shows a doubling or tripling – depending on specification - of the adjusted R-square due to the inclusion of firm fixed effects. Thus, the firm specific effects are capturing much more than what can be attributed to existing determinants, which motivates our cautionary note regarding specifications ignoring these effects.

4.2 Partial Adjustment Models

A number of empirical studies estimate partial adjustment models (equation (2)) in order to determine the speed at which firms adjust their capital structures towards a target. This measure is important for understanding capital structure because it identifies whether the cross-sectional distribution reflects only recent factors (i.e., fast adjustment), or historical factors as well (i.e., slow adjustment). Additionally, studies have used estimates of adjustment speed to make claims concerning the importance of a target for firms' financial policies (e.g., Jalilvand and Harris (1984) and Shyam-Sunder and Myers (1999)).

A recent study by Flannery and Rangan (2005) takes an important step towards identifying the speed of adjustment by recognizing the potential impact of firm fixed effects. These authors estimate that firms close 34% of the gap between their actual and target leverage in a given year. This result is in contrast to previous studies that ignore the impact of firm fixed effects, estimating that firms close less than 12% of the gap between actual and target leverage each year (e.g., Shyam-Sunder and Myers (1999) and Fama and French (2002)). However, Flannery and Rangan suggest that target debt ratios are quite volatile over time, which seems at odds with our earlier findings. As such we take a closer look at this claim and, in the process, their estimation strategy.

Flannery and Rangan note that their cross-sectional average target debt ratio varies from 64% in 1974 to 27% in 2001. However, this finding is more a result of a changing sample composition and firm entry and exit, as opposed to time variation in firm specific targets. Consider the timing of these extremes: the start of the oil crisis and the peak of the internet bubble, respectively. The "average" firm in the sample during each of these years is quite different and, consequently, so is the average target leverage.

A more direct way to quantify the importance of time varying effects in identifying target leverage is to examine the impact they have on the estimated speed of adjustment. In particular, if time varying characteristics are a crucial component of firms' target leverage then omitting them should substantially reduce the estimated speed of adjustment since firms will be adjusting to a target that is different from the one modeled by the econometrician. This exercise is equivalent to adding measurement error to the target, precisely as Flannery and Rangan do to illustrate the reduction in adjustment speed that accompanies decreases in the target's signal to noise ratio.

Table 5 presents the results of estimating two partial adjustment models for book leverage: one in which the target is time invariant and the other in which the target is time varying through the inclusion of traditional leverage determinants. While our determinants differ somewhat from Flannery and Rangan's, unreported results using their variables have no effect on our results or conclusions. We estimate both specifications using three different approaches to benchmark our results with previous studies and reinforce our findings. We first note that the Pooled OLS and Firm Fixed Effects estimated adjustment speeds closely match those found in Fama and French (2002) and Flannery and Rangan (2005), suggesting that firms close 12%-15% or 35%-37% of the gap between last period's leverage and this period's target, ($Target_t^* - Leverage_{t-1}$), respectively. Next, we note that moving from the Pooled OLS to the Firm Fixed Effects regression results in an increase in the speed of adjustment of approximately 22% (35%-12%) in absolute terms and over 150% in relative terms ((35%-12%)/12%), consistent with the importance of firm specific effects for identifying leverage targets and mitigating omitted variables bias.

However, within these two estimation methods we see that the difference in adjustment speeds arising from the inclusion of time varying determinants in the target specification is negligible. Even in the Pooled OLS regressions in which all firms share the same constant target, adding time varying determinants increases the speed of adjustment from 12.1% to 14.7%, a difference of only 2.6%. In the Firm Fixed Effects regressions, including time varying determinants increases the speed of adjustment from 34.8% to 37.1%, a difference of 2.3%. Thus, what is most important for identifying target leverage is simply firms' long-run mean leverage ratios, as opposed to firm characteristics or macroeconomic factors, consistent with our earlier results highlighting the relatively small time series variation in capital structures.

Columns five and six in Table 5 present results using a system GMM estimation (Blundell and Bond (1998)) specifically designed to address the econometric concerns associated with estimating dynamic panel data models in the presence of firm fixed effects.[13] The results confirm that including time-varying characteristics in the target

[13] In particular, the system GMM approach includes variable levels, as well as differences, in the instrument set to address the problem of persistent regressors. Intuitively, using differences of persistent

specification have little effect on the estimated speed of adjustment (21.4% versus 22.6%) and, consequently, contribute little towards the identification of firms' target leverage ratios. Thus, these results further reinforce our finding that target leverage is largely time invariant.

The GMM method also reveals a less extreme estimate of the speed of adjustment, approximately equal to the midpoint of the Pooled OLS and Firm Fixed Effects estimates. This distinction from Flannery and Rangan's estimate is due to differences in the instruments used, as well as estimation strategies, and highlights the difficulty in obtaining accurate parameter estimates in these models.[14]

In sum, the adjustment estimates presented here in conjunction with previous evidence suggest the existence of a largely time-invariant firm specific target leverage. While the adjustment is far from instantaneous, implying that firms do drift away from their targets, the results are consistent with a costly adjustment process, such as that suggested by Fischer, Heinkel, and Zechner (1989) and Strebulaev (2004). Additionally, the GMM estimates of the *Leverage Half Life* are quantitatively consistent with the empirical evidence in Leary and Roberts (2005a), who suggest that most firms rebalance their capital structures within a two- to four-year period following certain shocks. This type of behavior suggests that theories predicated on the absence of a leverage target or theories that lack dynamic rebalancing are unlikely to be consistent with the data, though we discuss this issue more fully in the next subsection.

---

regressors leads to a weak instrument problem since the differenced series is much like an innovation and, therefore, contains relatively little information for parameter identification.

[14] The system GMM utilizes lagged levels and differences of the dependent variable and exogenous variables and does so in an optimal (i.e., asymptotically efficient) manner. Flannery and Rangan rely on book leverage and their exogenous covariates. We also note that small sample biases (Huang and Ritter (2005)) and nonlinearities (Caballero and Engle (2004)) may also be relevant for the specification and estimation of these models, though these issues fall outside the scope of this study.

4.3 Existing Theories of Capital Structure

To provide additional insight into the mechanism responsible for maintaining leverage near firms' long run means, we examine the security issuance activity of firms in the four unexpected leverage portfolios described earlier. The results are presented in Figure 3, Panels A and B. To ease the presentation, we suppress the confidence intervals.

Focusing first on net debt issuing activity (panel A), we find that initially, the tendency to issue debt differs quite dramatically across the portfolios. What is interesting is that the propensity to issue debt is monotonically negatively related to firms' leverage. Firms issue progressively more debt as we move from the Very High portfolio to the Low portfolio. These differences remain for four or five years before becoming largely indistinguishable. This finding is consistent with Leary and Roberts (2005a) and Hovakimian (2004), who suggest that an important motivation behind debt policy is capital structure rebalancing. It also helps identify the mechanism behind the initial convergence of leverage ratios observed in Figures 1 and 2.

Panel B, which displays net equity issuing activity, presents a different story.[15] In particular, we find that firms with low leverage are significantly more likely to issue equity. This result appears counter-intuitive for a rebalancing story; however, because these firms have low leverage to begin with – in many cases zero leverage – net equity issuances have little or no affect on their capital structure and, therefore, are largely irrelevant in terms of their impact on the cross-sectional distribution of leverage. We also note that firms with Very High leverage appear to issue a significant amount of equity, on

[15] See Dittmar (2000) and Dittmar and Thakor (2005) for recent investigations into why firms retire and issue equity, respectively.

average, relative to the Medium and Low portfolios. This finding is consistent with very highly levered firms using equity to reduce their leverage and also helps to further explain the decline in leverage for the Very High portfolio in Figures 1 and 2. As for the Medium and High portfolios, there is little systematic difference between the two though, relative to the other two portfolios, these firms appear to use less equity on average. Thus, firms' financial policies tend to keep their leverage ratios relatively close to their long run mean values.

Our findings are more difficult to reconcile with Myers' (1984) pecking order theory or Baker and Wurgler's (2002) market timing theory, both of which suggest that firms are indifferent toward different levels of leverage and that movement towards any particular level is serendipitous. While mean reversion in leverage is not necessarily inconsistent with pecking order behavior (Shyam-Sunder and Myers (1999)), the fact that this reversion occurs around very different firm specific levels suggests that firms' first order concern does not likely arise from a simple desire to offset their financing deficits with changes in debt. Similarly, Figure 3 shows that firms gear their debt policy to offset variation in leverage, while also showing that differences in net equity issuances cannot be the sole factor behind the results in Figure 2. Thus, our findings tie in nicely with a number of other recent studies supporting the idea that firms rebalance their capital structures and questioning the empirical validity of the pecking order and market timing theories.[16] Our analysis adds to this debate by highlighting the fact that variation in

[16] Studies by Frank and Goyal (2003), Fama and French (2005), and Leary and Roberts (2005b) suggest that firms violate the pecking order's financing hierarchy more often than they adhere to it. Studies by Alti (2005), Flannery and Rangan (2005), Hennessy and Whited (2005), Hovakimian (2005), Kayhan and Titman (2004), Leary and Roberts (2005a), and Liu (2005) suggest that firms do rebalance their capital structures towards an optimum.

leverage is largely time invariant, which significantly reduces the set of possible explanations for the observed variation in capital structure.

5. What Lies Behind the Firm Specific Effects?

The key question at this point is: what is the economic mechanism driving the heterogeneity in the firm specific mean values of leverage? Or, more simply, why do some firms always have high leverage and others always have low leverage? While a complete answer to this question is beyond the scope of this paper, we take a step towards this goal by investigating whether differences in leverage persist *back* in time.

5.1 How Far Back Does the Firm Specific Effect Go?

To answer this question, we form unexpected leverage portfolios at the time of the IPO. Because of a significant reduction in the number of observations (approximately 5,000 IPO firms), we modify slightly the analysis in Figure 2. We begin by computing "initial" leverage as the average of the first three public observations on leverage in event years 0 (year of the IPO), 1, and 2. We compute initial values of the corresponding determinants (size, market-to-book, profitability, and tangibility) in a similar manner. Averaging helps minimize noise and mitigate the effect of extreme observations in this smaller sample. We then estimate a regression of initial leverage on the initial values for the determinants, as well as indicator variables for calendar year and industry as of the time of the IPO. The calendar year variables help address the differential effect of IPOs in hot versus cold markets. The residuals from this regression are then used to sort firms into four unexpected leverage portfolios, as before.

Figure 4 plots the average actual leverage and 95% confidence interval for each of the four portfolios in event time, where now event year 0 is the year of the IPO. We note the following. First, the regression eliminates any meaningful difference between the Low and Medium portfolio. Second, primarily because of the reduced number of observations, the results are somewhat noisier compared to those in Figure 2. Regardless, the general patterns and implications are quite similar. Differences in leverage across firms appear to persist for quite some time. More importantly, for book leverage, we see that these differences persist back prior to the IPO. Firms with high (low) leverage as private firms, also appear to have high (low) leverage as public firms.

While the evidence is suggestive that firms maintain their relative rankings from prior to the IPO, we acknowledge the following potential concern. Leverage in the year prior to the IPO may not be representative of leverage as a private firm, more generally. That is, in the year prior to the IPO, the decision to go public is most likely known and, therefore, the capital structure of the firm may have been altered in anticipation of this change. However, we make two remarks in response to this concern. First, the differences in leverage across the portfolios in event year -1 are very large: 18% between the Very High and High portfolios and 12% between the High and Medium portfolios. We believe that it is unlikely that firms are altering the capital structure by these magnitudes in the year or two preceding this event. Second, this belief is supported by the evidence in Kaplan, Sensoy, and Stromberg (2005), who show that other than human capital, the operations, assets, and investment policy of firms remain very stable from the literal birth of a firm to several years after the IPO.

Although data on private firms in the US is limited, the FAME database from Bureau van Dijk contains data on a significant number of both public and private firms in the United Kingdom. Rajan and Zingales (1995) argue that, except for differences in the rights of creditors (driven by differences in bankruptcy laws between the US and the UK), UK firms operate in an environment that is very similar to that of US firms. We recognize, however, that other differences across the two countries, sample selection concerns, and other potential confounding effects limit the extrapolation of any inferences to US firms. Nonetheless, given the paucity of information on the capital structures of private firms, we believe the following analysis can provide new insight into the behavior of capital structures for private firms, as well as provide a robustness check for our results based on U.S. data.

Figure 5 replicates the analysis in Figure 2 using data on public (Panel A) and privately held (Panel B) firms from the United Kingdom contained in the FAME database for the period 1993 – 2002.[17] The results illustrate a pattern for the UK firms that is virtually identical to that for the public US firms in Figure 2. There are relatively large differences between the average leverage of the unexpected leverage portfolios in the formation period (event date 0), convergence in average leverage ratios for the portfolios across time, and significant differences in average leverage across the portfolios persist throughout the entire period. Additionally, the differences in the patterns of leverage across public and private UK firms are miniscule. Figure 5 suggests that the remarkable

[17] Specifically, we focus only on quoted (i.e., public) and unquoted (i.e., private) firms with a market capitalization of at least ₤700,000 or classified as medium or large by the Companies House. Since market-to-book is unobserved for private firms, we use the percentage change in sales as a proxy. The remaining variables in the portfolio formation regressions are the similar to those used for the CRSP-Compustat sample: the ratio of tangible assets to total assets, the log of total assets deflated by the UK cpi, the ratio of operating profits to total assets, year dummies, and Fama and French 38 industries dummies.

stability of leverage ratios documented above for public firms in the US also characterizes the financing behavior of firms (both public and private) in the UK.

Overall, the findings indicate that differences in firms' capital structures may be largely determined prior to the time that they go public. The finding that the general level of leverage is established prior to the IPO casts further doubt on either market timing or equity price inertia as explanations for the cross-section of capital structure since both of these forces are largely irrelevant for private firms. Additionally, it appears that the significant changes in the distribution of control, the information environment, and the access to capital markets that accompany the IPO do little to alter the relative costs and benefits that determine firms' desired leverage.

6. Conclusion

We examine the dynamic behavior of the cross-section of corporate capital structures. Our primary result is that differences in leverage across firms are highly persistent with firms that are initially high (low) levered remaining as such for over 20 years. This result exists even after controlling for firm entry and exit, as well as factors previously identified by the empirical literature as important determinants of capital structure.

We then show that this persistence is due to a time invariant firm specific component in leverage that is responsible for the majority of variation in leverage. This effect is so dominant that firm fixed effects leverage regressions reveal that over 90% of the explained sum of squares is attributable to differences in firm specific means, while between 5% and 8% is attributable to traditional determinants such as firm characteristics, industry effects, and macroeconomic factors. Additionally, we find that the precise treatment of these firm specific effects has a profound impact on estimates of the adjustment process of leverage and, consequently, our understanding of how capital structure responds to various shocks.

The theoretical implications of our findings suggest that capital structure is best characterized by a dynamic tradeoff strategy with costly adjustment, consistent with several other recent studies. Firms tend to maintain their leverage ratios in relatively narrow bands by rebalancing their capital structures with their debt policy and, to a lesser extent, their equity policy. However, our findings are less consistent with the pecking order, market timing, or equity price inertia as explanations for the cross-section of capital structure.

The challenge going forward lies in identifying the factors behind the firm specific effects. To this end, we show that these factors remain relatively stable over long periods of time, are largely unaffected by the process of going public, and appear to be present in both private and public firms. We hope to see future research that moves closer to identifying the economic mechanisms behind these effects.

References

Arellano, Manuel, 2003, *Panel Data Econometrics*, Oxford University Press, Oxford, United Kingdom

Alti, Aydogan, 2005, How persistent is the impact of market timing on capital structure forthcoming *Journal of Finance*

Baker, Malcolm and Jeffrey Wurgler, 2002, The market timing theory of capital structure, *Journal of Finance* 57: 1-30

Bertrand, Marianne and Antoinette Schoar, 2003, Managing with style: The effect of managers on firm policies, *Quarterly Journal of Economics* 118: 1169-1208

Blundell, Richard and Stephen Bond, 1998, Initial conditions and moment restrictions in dynamic panel data models, *Journal of Econometrics* 87: 115-143

Caballero, Ricardo J. and Eduardo M. R. A. Engel, 2004, Three strikes and you're out: Reply to Cooper and Willis, *Working Paper*, Yale University

Chamberlain, Gary, 1982, Multivariate regression models for panel data, *Journal of Econometrics* 18: 5-46

Dittmar, Amy, 2000, Why do firms repurchase stock? *Journal of Business* 73: 331-355

Dittmar, Amy and Anjan Thakor, 2005, Why do firms issue equity? f*orthcoming Journal of Finance*

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

Fama, Eugene F. and Kenneth R. French, 2005, Financing decisions: Who issues stock?, *forthcoming Journal of Financial Economics*

Faulkender, Michael and Mitchell Petersen, 2005, Does the source of capital affect capital structure?, forthcoming *Review of Financial Studies*

Fazzari, Steven, R. Glenn Hubbard and Bruce Petersen, 1988, Financing constraints and corporate investment, *Brookings Papers on Economic Activity* 141-195

Fischer, Edwin, Robert Heinkel, and Josef Zechner, 1989, Dynamic capital structure choice: Theory and tests, *Journal of Finance* 44: 19-40

Flannery, Mark and K Rangan, 2005, Partial adjustment toward target capital structures, *forthcoming Journal of Financial Economics*

Frank, Murray Z. and Vidhan K. Goyal, 2003, Testing the pecking order theory of capital structure, *Journal of Financial Economics* 67: 217-248

Frank, Murray Z. and Vidhan K. Goyal, 2004, Capital structure decisions: Which factors are reliably important?, *Working Paper,* University of British Columbia

Frank, Murray Z. and Vidhan K. Goyal, 2005, Tradeoff and pecking order theories of debt, *Working Paper,* University of British Columbia

Graham, John R., 1996, Proxies for the corporate marginal tax rate, *Journal of Financial Economics* 42: 187-221

Graham, John R. and Campbell Harvey, 2001, The theory and practice of corporate finance: Evidence from the field, *Journal of Financial Economics* 60: 187-243

Graham, John R., Michael Lemmon and James Schallheim, 1998, Debt, leases, taxes, and the endogeneity of corporate tax status, *Journal of Finance* 53: 131-161

Grilliches, Zvi and Jacques Mairesse, 1995, Production functions: The search for identification, *NBER Working Paper*

Hennessy, Christopher A. and Toni M. Whited, 2005, Debt dynamics, *Journal of Finance* 60: 1129-1165

Hoch, Irving, 1962, Estimation of production function parameters combining time-series and cross-section data, *Econometrica* 30: 34-53

Hovakimian, Armen 2004, Are observed capital structures determined by equity market timing?, *forthcoming Journal of Financial and Quantitative Analysis*

Hsiao, Cheng, 2003, *Analysis of Panel Data*, Cambridge University Press, Cambridge, united Kingdom

Huang, Rongbing and Jay Ritter, 2005, Testing the market timing theory of capital structure, *Working Paper*, University of Florida

Jalilvand, A and R. S. Harris, 1984, Corporate behavior in adjusting to capital structure and dividend targets: An econometric study, *Journal of Finance* 39: 127-145

Kaplan, Steven N., Berk A. Sensoy, and Per Stromberg, 2005, What are firms? Evolution from birth to public companies, *Working Paper*, University of Chicago

Kayhan, Ayla, and Sheridan Titman, 2004, Firms histories and their capital structures, forthcoming *Journal of Financial Economics*

Kuh, Edwin, 1963, *Capital stock growth: A micro-econometric approach,* Amsterdam: North-Holland

Leary, Mark T. and Michael R. Roberts, 2005a, Do firms rebalance their capital structures?, *Journal of Finance* 60: 2575 – 2619.

Leary, Mark T. and Michael R. Roberts, 2005b, The pecking order, debt capacity, and information asymmetry, *Working Paper*, University of Pennsylvania

Lemmon, Michael and Jaime Zender, 2004, Debt capacity and tests of capital structure, *Working Paper,* University of Utah

Liu, Laura, 2005, Do firms have target leverage ratios? Evidence from historical market-to-book and past returns, *Working Paper*, Honk Kong University of Science and Technology

Mackay, Peter, and Gordon Phillips, 2005, How does industry affect firm financial structure?, *Review of Financial Studies* 18, 1433 – 1466.

Mundlak, Yair, 1962, Empirical production function free of management bias, *Journal of Farm Economics* 43: 44-56

Myers, Stewart and Nicholas Majluf, 1984, Corporate financing and investment decisions when firm have information investors do not have, *Journal of Financial Economics* 13: 187-221

Petersen, Mitchell A., 2005, Estimating standard errors in finance panel data sets: Comparing approaches, *Working Paper*, Northwestern University

Rajan, Raghuram G. and Luigi Zingales, 1995, What do we know about capital structure: Some evidence from international data, *Journal of Finance* 50: 1421-1460

Scheffe, Henri, 1959, *The Analysis of Variance*, John Wiley and Sons, New York, New York

Shyam-Sunder, Lakshmi and Stewart C. Myers, 1999, Testing static tradeoff against pecking order models of capital structure, *Journal of Financial Economics* 51(2): 219-244

Spies, R. R., 1974, The dynamics of corporate capital budgeting, *Journal of Finance*, 29: 829-845

Strebulaev, Ilya, 2004, Do tests of capital structure mean what they say?, *Working Paper*, Stanford University

Taggart, Robert, 1977, A model of corporate financing decisions, *Journal of Finance*, 32: 1467 - 1500

Titman, Sheridan and Roberto Wessels, 1988, The determinants of capital structure, *Journal of Finance* 43: 1-19

Welch, Ivo, 2004, Stock prices and capital structure, *Journal of Political Economy*, 112: 106-131

Appendix: Variable Definitions

This appendix details the variable construction for analysis of the CRSP-Compustat sample. All numbers in parentheses refer to the annual Compustat item number.

Total Debt = short term debt (34) + long term debt (9).

Book Leverage = total debt / book assets (6).

Firm Size = log(book assets), where assets are deflated by the GDP-deflator.

Profitability = operating income before depreciation (13) / book assets.

Cash Flow Volatility = the standard deviation of historical operating income requiring at least three years of data.

Marginal Tax Rate = simulated marginal tax rates obtained from John Graham.

Market Equity = Stock Price (199) * Shares Outstanding (54)

Market Leverage = Total Debt / (Total Debt + Market Equity).

Market-to-Book = (market equity + total debt + preferred stock liquidating value (10)– deferred taxes and investment tax credits (35)) / book assets.

Collateral = Inventory (3) + net PPE (8) / book assets.

Capital Expenditures = capital expenditures (128) / book assets.

Z-Score = 3.3 * Pre-Tax Income (170) + Sales (12) + 1.4 * Retained Earnings (36) + 1.2 * (Current Assets (4) – Current Liabilities (5)) / book assets.

Tangibility = net PPE / book assets.

R&D / Sales = R&D expenditures (46) / Total Sales (12).

Equity Returns = Monthly compounded annual equity returns from the CRSP monthly stock price file. “5-Year” denotes monthly compounded equity returns over five years.

Net Debt Issuance = the change in total debt from year *t-1* to year *t* divided by the end of year *t-1* total assets. "5-Year" denotes the sum of net debt issuance over five years.

Net Equity Issuance = The split adjusted change in shares outstanding ($data25_t$ – $data25_{t-1}$ * ($data27_{t-1}$ / $data27_t$) times the split adjusted average stock price ($data199_t$ + $data199_{t-1}$ * ($data27_t$ / $data27_{t-1}$) dividend by the end of year *t-1* total assets. "5-Year" denotes the sum of net debt issuance over five years.

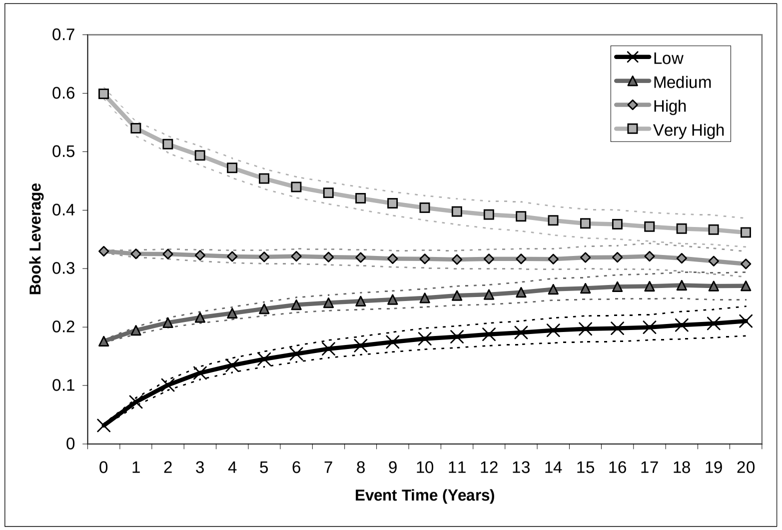
Industry Dummies = binary variables corresponding to the Fama and French 38 industry classification available on Ken French's website.

Figure 1

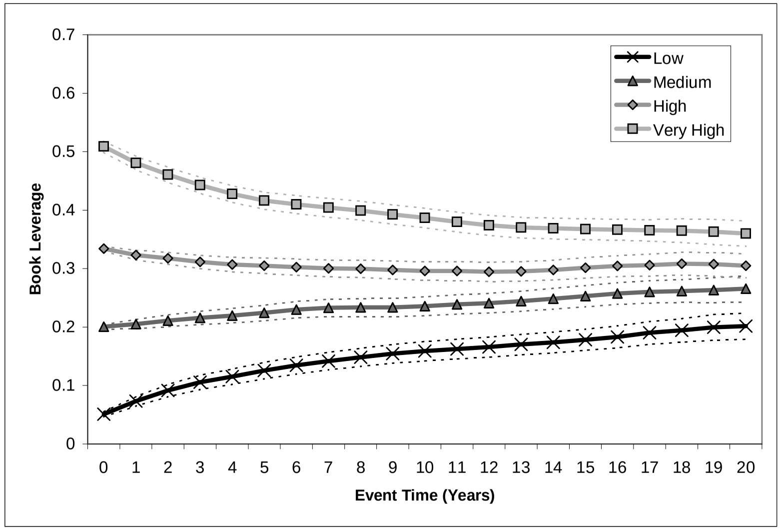
Average Leverage of Actual Leverage Portfolios in Event Time

The sample is all firms in the merged CRSP/Compustat database (excluding financial firms) from 1971-2003. Each Panel presents the average leverage of four portfolios in event time, where year zero is the portfolio formation period. That is, for each calendar year, we form four portfolios by ranking firms based on their actual leverage. Holding the portfolios fixed for the next twenty years we compute the average leverage for each portfolio. For example, in 1975 we sort firms into four groups based on their leverage ratios. For each year from 1975 to 1994, we compute the average leverage for each of these four portfolios. We repeat this sorting in 1976 and averaging from 1976 to 1995 and so on for every year in our sample horizon. After performing this sorting and averaging for each year from 1971 to 2003, we then average the average leverages across "event time" to obtain the bold lines in the figure. The surrounding dashed lines represent 95% confidence intervals. The results for book and market leverage are presented in Panels A and C, where book (market) leverage is defined as the ratio of total debt to total assets (sum of total debt and market equity). Panels B and D present similar results for book and market leverage, respectively, but for a subsample of firms required to exist for at least 20 years (consequently, we can only perform the portfolio formation through 1984 for this sample).

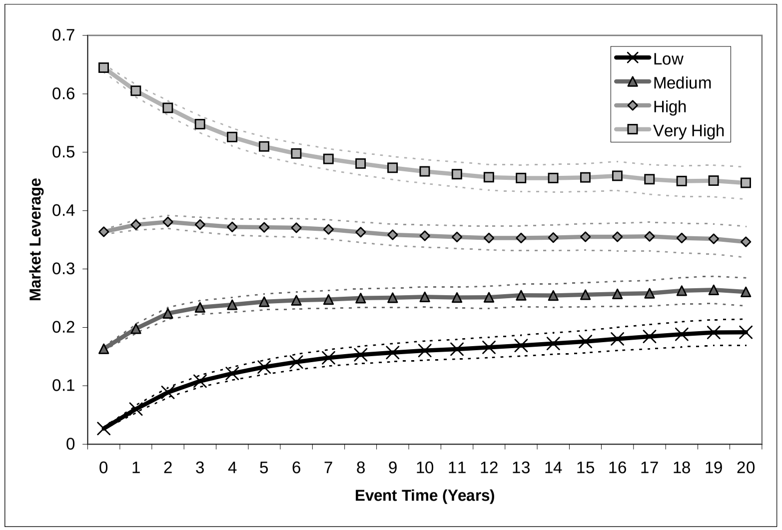
Panel A: Book Leverage Portfolios



Panel B: Book Leverage Portfolios (Survivors)



Panel C: Market Leverage Portfolios



Panel D: Market Leverage Portfolios (Survivors)

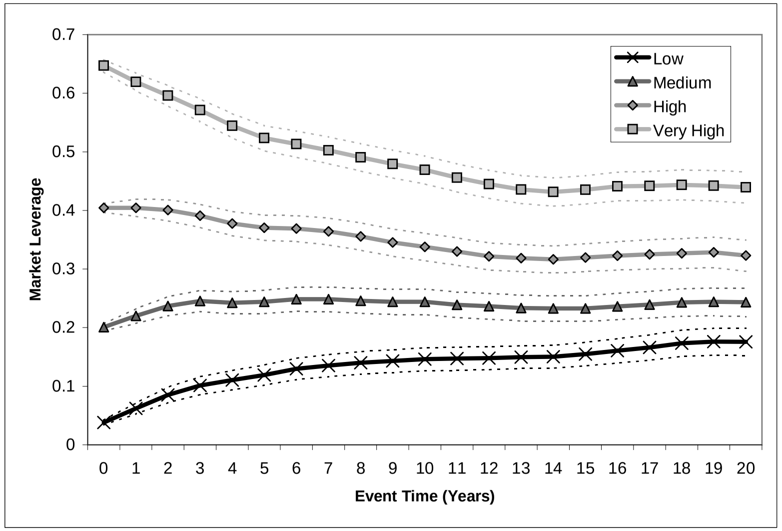
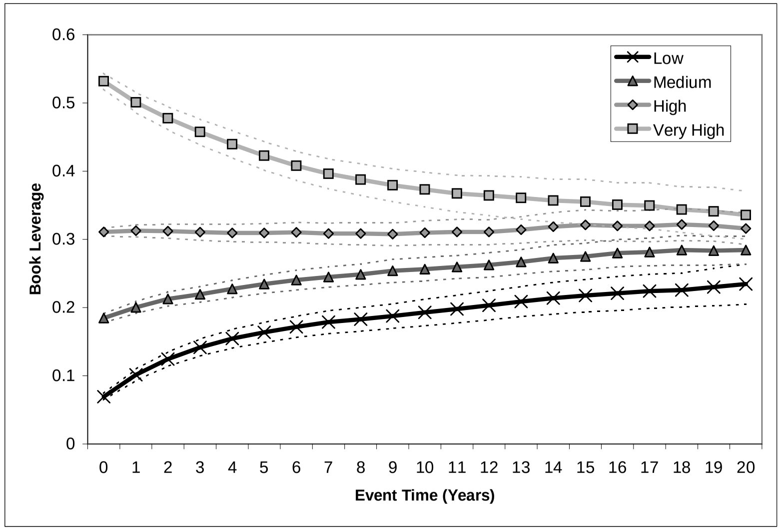


Figure 2

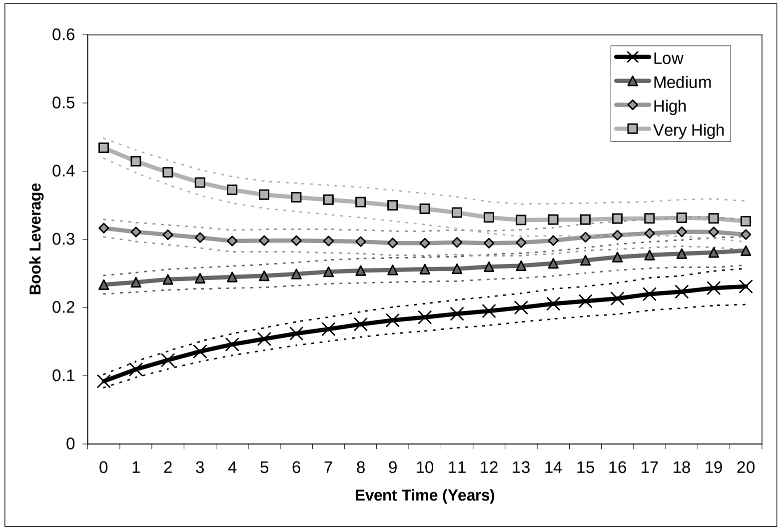
Average Leverage of Unexpected Leverage Portfolios in Event Time

The sample is all firms in the merged CRSP/Compustat database (excluding financial firms) from 1971-2003. Each Panel presents the average leverage of four portfolios in event time, where year zero is the portfolio formation period. That is, for each calendar year, we form four portfolios by ranking firms based on their unexpected leverage (defined below). Holding the portfolios fixed for the next twenty years we compute the average actual (book and market) leverage for each portfolio. For example, in 1975 we sort firms into four groups based on the unexpected leverage ratios. For each year from 1975 to 1994, we compute the average actual leverage for each of these four portfolios. We repeat this sorting in 1976 and averaging from 1976 to 1995 and so on for every year in our sample horizon. After performing this sorting and averaging for each year from 1971 to 2003, we then average the average leverages across "event time" to obtain the bold lines in the figure. The surrounding dashed lines represent 95% confidence intervals. The results for book and market leverage are presented in Panels A and C, where book (market) leverage is defined as the ratio of total debt to total assets (sum of total debt and market equity). Panels B and D present similar results for book and market leverage, respectively, but for a subsample of firms required to exist for at least 20 years (consequently, we can only perform the portfolio formation through 1984 for this sample). Unexpected leverage is defined as the residuals from a cross-sectional regression of leverage on firm size, profitability, market-to-book, and tangibility. Also included in the regression are year and industry indicator variables (38 Fama and French). Variable definitions are provided in the Appendix.

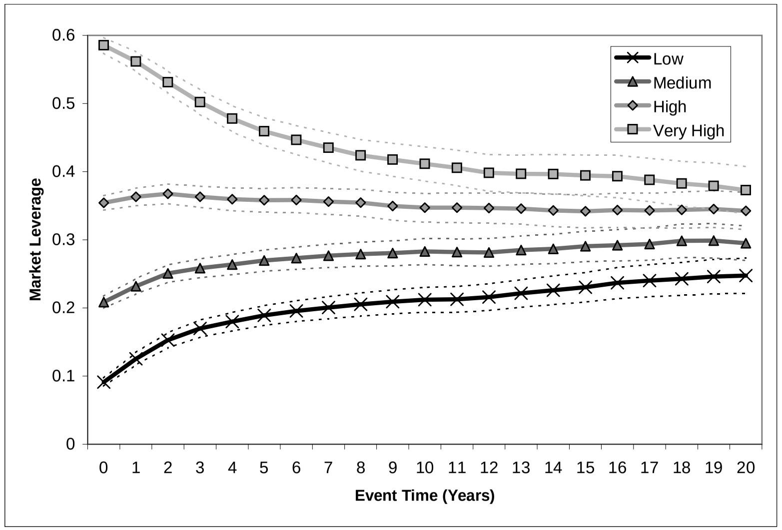
Panel A: Unexpected Book Leverage Portfolios



Panel B: Unexpected Book Leverage Portfolios (Survivors)



Panel C: Unexpected Market Leverage Portfolios



Panel D: Unexpected Market Leverage Portfolios (Survivors)

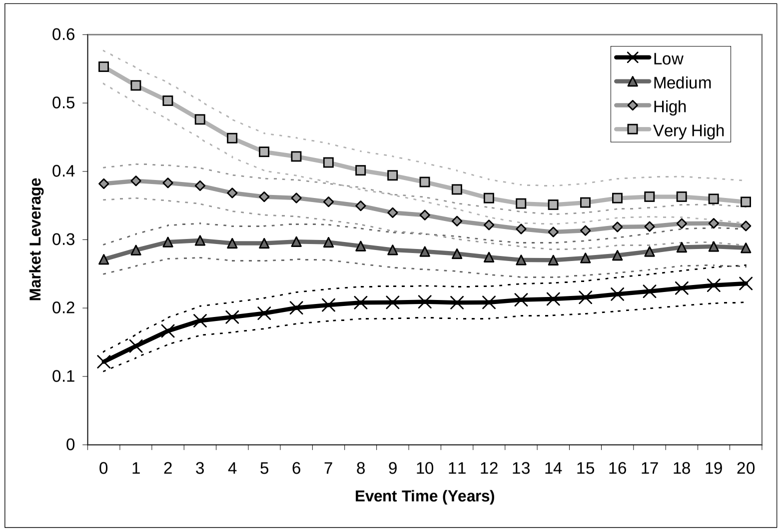
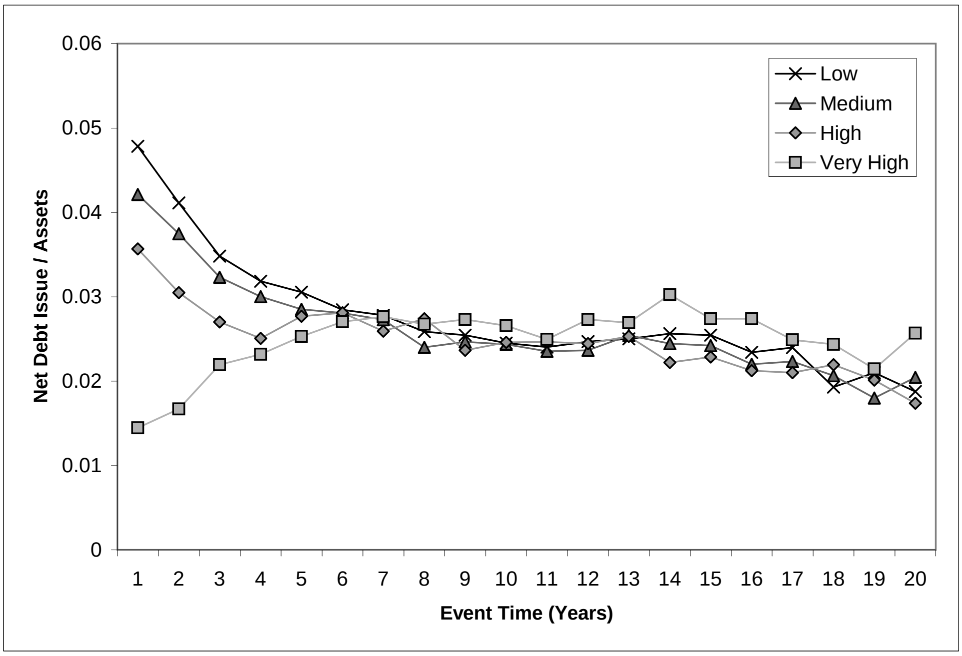


Figure 3

Financing Behavior of Unexpected Leverage Portfolios in Event Time

The sample is all firms in the merged CRSP/Compustat database (excluding financial firms) from 1971-2003. Panel A (B) presents the average net debt (net equity) issuance activity scaled by beginning of period assets for each of four unexpected leverage portfolios. That is, for each calendar year, we form four portfolios by ranking firms based on their unexpected leverage (defined below). Holding the portfolios fixed for the next twenty years we compute the average net debt (net equity) issuances scaled by assets for each portfolio. For example, in 1975 we sort firms into four groups based on the unexpected leverage ratios. For each year from 1975 to 1994, we compute the average net debt (net equity) issued for each of these four portfolios. We repeat this sorting in 1976 and averaging from 1976 to 1995 and so on for every year in our sample horizon. After performing this sorting and averaging for each year from 1971 to 2003, we then average the average net issuances across "event time" to obtain the lines in the figure. Net debt issued is defined as the change in total debt from period $t-1$ to t divided by total assets in period $t-1$. Net equity issued is defined as the split adjusted change in shares outstanding from $t-1$ to t times the average share price during the year divided by total assets in period $t-1$. Unexpected leverage is defined as the residuals from a cross-sectional regression of leverage on firm size, profitability, market-to-book, and tangibility. Also included in the regression are year and industry indicator variables (38 Fama and French). Variable definitions are provided in the Appendix.

Panel A: Net Debt Issuing Activity



Panel B: Net Equity Issuing Activity

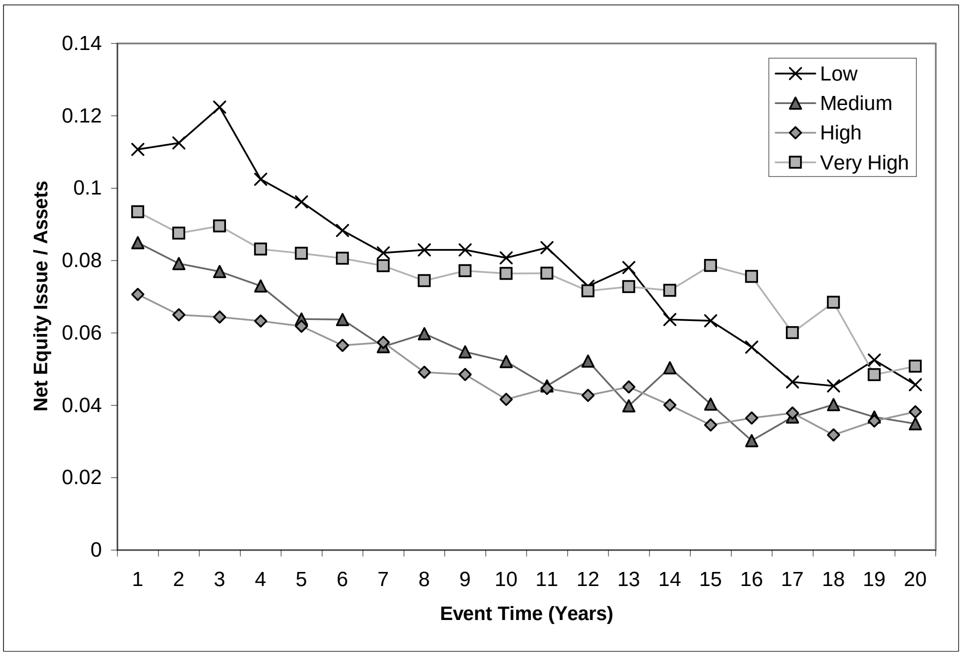
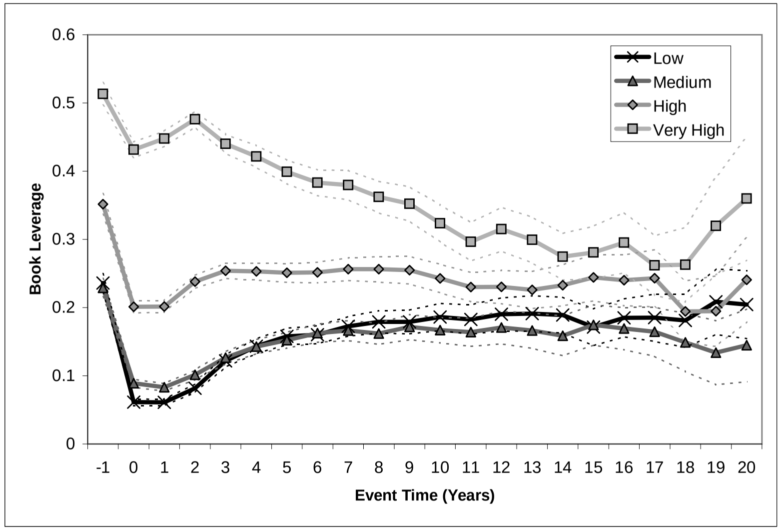


Figure 4

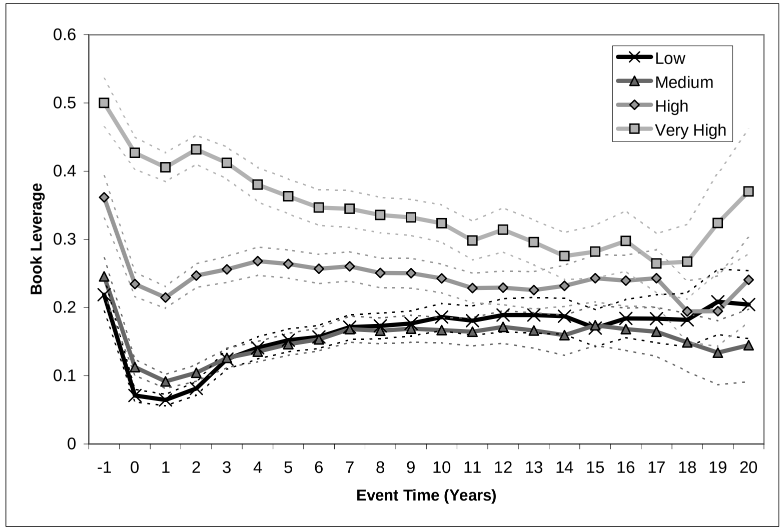
Average Leverage of Unexpected Leverage Portfolios in Event Time (IPO Subsample)

The sample is all firms in the merged CRSP/Compustat database (excluding financial firms) from 1971-2003 for which we have an IPO date. Each Panel presents the average leverage of four portfolios in event time, where year zero is the firm's IPO. Portfolios are formed based on quartiles of firms' unexpected initial leverage ratios, defined as the residuals from a cross-sectional regression of initial values for leverage on initial values for firm size, profitability, market-to-book, and tangibility. Also included in the regression are year and industry indicator variables (Fama and French 38). Variable definitions are provided in the Appendix. The initial values for continuous variables are computed as the average over the first three years of the firm's public existence (including the IPO year). Binary variables in the regression are measured at the IPO date. The average leverage for each quartile and event year, measured from the IPO, is plotted in the figure. Panels A and C (B and D) present results for all firms in the sample (firms that survive at least ten years).

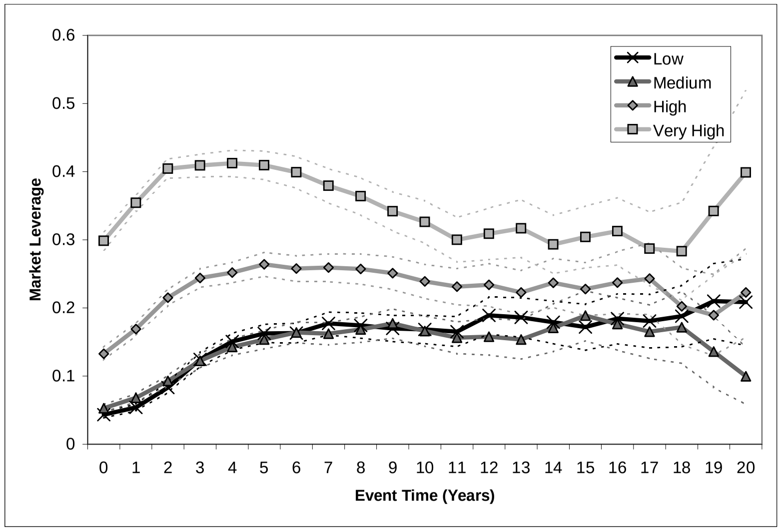
Panel A: Unexpected Book Leverage Portfolios (IPO Firms)



Panel B: Unexpected Book Leverage Portfolios (IPO Firms - Survivors)



Panel C: Unexpected Market Leverage Portfolios (IPO Firms)



Panel D: Unexpected Market Leverage Portfolios (IPO Firms - Survivors)

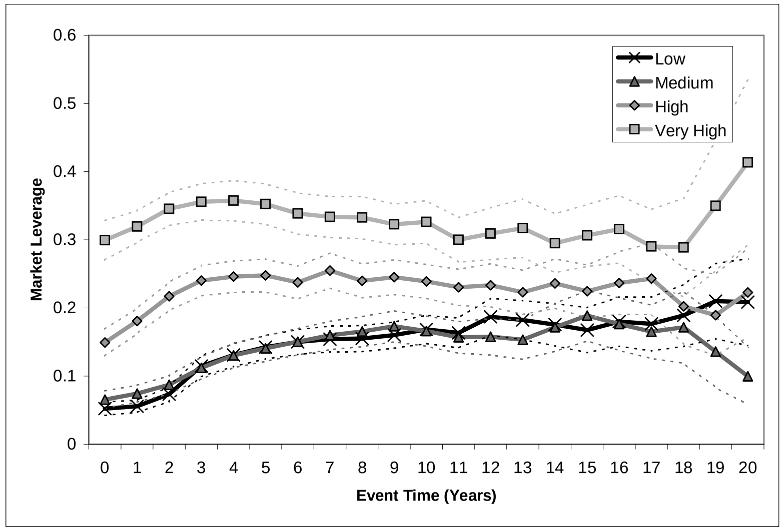
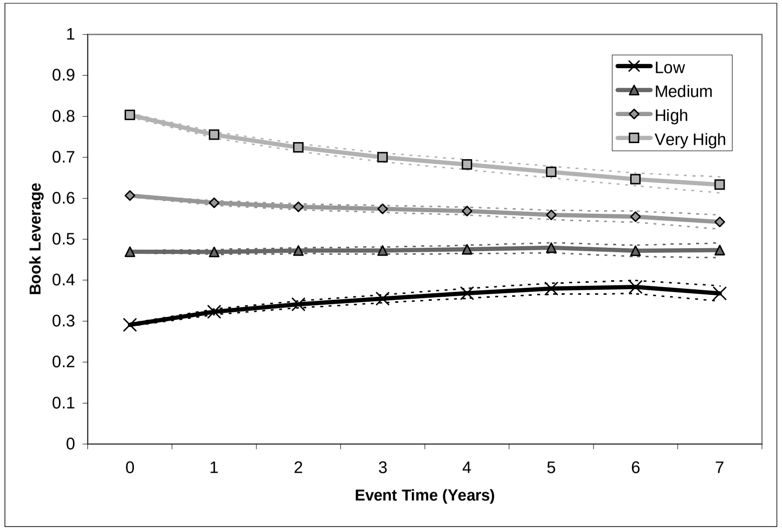


Figure 5

Average Leverage of Unexpected Leverage Portfolios in Event Time (UK Firms)

The sample consists of non-financial privately held (unlisted) firms in the United Kingdom in the FAME database during the period 1993 - 2002. Each Panel presents the average book leverage of four portfolios in event time, where year zero is the portfolio formation period. That is, for each calendar year, we form four portfolios by ranking firms based on their unexpected leverage (defined below). Holding the portfolios fixed for the entire sample period, we compute the average actual book leverage for each portfolio. Unexpected leverage is defined as the residuals from a cross-sectional regression of leverage on firm size, profitability, market-to-book, and tangibility. Also included in the regression are year and industry indicator variables (38 Fama and French). Variable definitions are provided in the Appendix. The average leverage for each quartile and event year is plotted in the figure. Panel A presents the results for the sample of Public Firms. Panel B presents the results for the sample of Private Firms.

Panel A: Unexpected Book Leverage Portfolios (Public Firms)



Panel B: Unexpected Book Leverage Portfolios (Private Firms)

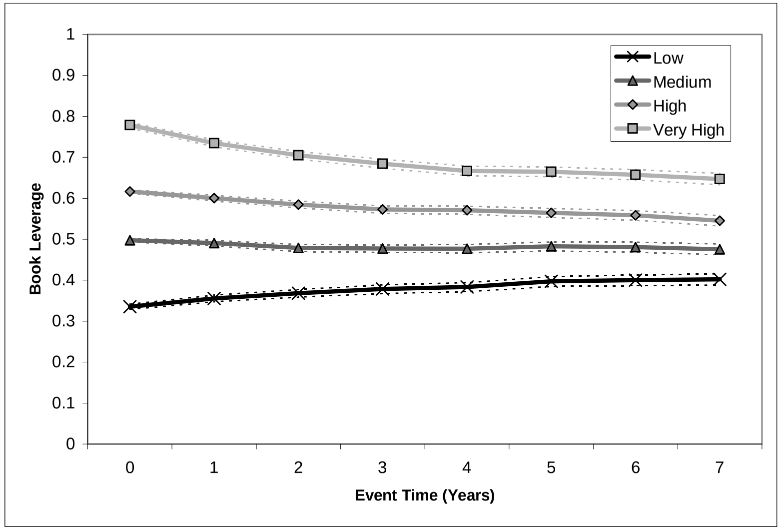


Table 1
Summary Statistics

The sample is all firms in the merged CRSP/Compustat database (excluding financial firms) from 1971-2003. Panel A presents variable averages, medians (in brackets) and standard deviations (SD) for the entire sample and the subsample of firms required to survive for at least 20 years. Panel B presents variable averages, medians (in brackets) and standard deviations (SD) for the subsample of firms that had an IPO sometime between 1971 and 2000. Variable definitions are provided in the Appendix.

Panel A: CRSP/Compustat

	All Firms		Survivors	
Variable	Mean [Median]	(SD)	Mean [Median]	(SD)
Book Leverage	0.26	(0.21)	0.26	(0.18)
	[0.24]		[0.25]	
Market Leverage	0.28	(0.25)	0.30	(0.24)
	[0.22]		[0.27]	
Log(Assets)	4.48	(2.40)	5.47	(2.18)
	[4.43]		[5.45]	
Market-to-Book	1.57	(1.84)	1.22	(1.16)
	[1.00]		[0.90]	
Profitability	0.05	(0.42)	0.13	(0.13)
	[0.12]		[0.14]	
Tangibility	0.35	(0.25)	0.39	(0.24)
	[0.29]		[0.33]	
Cash Flow Vol	0.10	(0.20)	0.07	(0.09)
	[0.06]		[0.05]	
Net Equity Issuance	0.15	(1.02)	0.04	(0.27)
	[0.00]		[0.00]	
Net Debt Issuance	0.04	(0.20)	0.03	(0.14)
	[0.00]		[0.00]	
Obs	243,010		112,084	

Panel B: IPO Firms

	All Firms		Survivors	
Variable	Mean [Median]	(SD)	Mean [Median]	(SD)
Book Leverage	0.23	(0.23)	0.22	(0.21)
	[0.17]		[0.17]	
Market Leverage	0.21	(0.25)	0.21	(0.24)
	[0.11]		[0.12]	
Log(Assets)	3.97	(1.99)	4.12	(2.02)
	[3.96]		[4.11]	
Market-to-Book	1.99	(2.08)	1.94	(1.99)
	[1.30]		[1.29]	
Profitability	0.01	(0.33)	0.05	(0.29)
	[0.10]		[0.11]	
Tangibility	0.26	(0.22)	0.28	(0.22)
	[0.19]		[0.21]	
Cash Flow Vol	0.16	(0.25)	0.15	(0.21)
	[0.09]		[0.09]	
Net Equity Issuance	0.21	(0.67)	0.17	(0.55)
	[0.01]		[0.01]	
Net Debt Issuance	0.05	(0.27)	0.04	(0.22)
	[0.00]		[0.00]	
Obs	53,288		25,356	

Table 2

The Effect of Initial Leverage on Future Leverage

The sample is all firms in the merged CRSP/Compustat database (excluding financial firms) from 1971-2003. The table presents parameter estimates from panel regressions of book and market leverage on several different specifications. Panel A presents results using the entire sample. Panel B presents results using a subsample of firms required to survive for at least 20 years. All variables are trimmed at the upper and lower 0.5-percentiles. Variable definitions are provided in the Appendix. Year Fixed Effects denote whether calendar year fixed effects are included in the specification. t-stats are computed using standard errors adjusted for clustering (i.e., dependence) at the firm level.

Panel A: Full Sample

Variable	Book leverage			Market Leverage		
Intercept	0.26	0.20	0.20	0.30	0.21	0.21
	(167.16)	(59.93)	(61.96)	(148.16)	(60.33)	(60.77)
Initial Leverage	0.07	0.06	0.04	0.11	0.08	0.06
	(39.31)	(36.25)	(26.12)	(49.79)	(40.78)	(30.99)
Log(Assets)	.	0.02	0.03	.	0.02	0.03
	(.)	(13.27)	(18.52)	(.)	(13.14)	(18.05)
Market-to-Book	.	-0.02	-0.01	.	-0.07	-0.05
	(.)	(-22.69)	(-14.90)	(.)	(-43.38)	(-39.48)
Profitability	.	-0.02	-0.02	.	-0.03	-0.03
	(.)	(-14.83)	(-14.39)	(.)	(-17.61)	(-16.80)
Tangibility	.	0.04	0.02	.	0.04	0.02
	(.)	(25.05)	(14.62)	(.)	(21.89)	(11.83)
Industry Median Leverage	.	.	0.06	.	.	0.09
	(.)	(.)	(45.04)	(.)	(.)	(50.07)
Cash Flow Vol	.	.	-0.00	.	.	-0.01
	(.)	(.)	(-2.30)	(.)	(.)	(-4.96)
Dividend Payer	.	.	-0.04	.	.	-0.05
	(.)	(.)	(-25.36)	(.)	(.)	(-29.71)
Year Fixed Effects	No	Yes	Yes	No	Yes	Yes
Adj. R^2	0.12	0.21	0.31	0.18	0.35	0.44
Obs.	121,359	121,359	121,359	121,359	121,359	121,359

Panel B: Survivor Sample

Variable	Book leverage			Market Leverage		
Intercept	0.25	0.21	0.21	0.31	0.23	0.22
	(124.73)	(41.38)	(44.46)	(108.09)	(36.66)	(39.17)
Initial Leverage	0.06	0.05	0.03	0.09	0.07	0.05
	(28.22)	(23.77)	(17.02)	(30.55)	(24.86)	(18.63)
Log(Assets)	.	0.02	0.03	.	0.03	0.03
	(.)	(11.61)	(14.04)	(.)	(12.42)	(13.51)
Market-to-Book	.	-0.02	-0.01	.	-0.06	-0.05
	(.)	(-12.47)	(-8.10)	(.)	(-27.02)	(-23.36)
Profitability	.	-0.03	-0.03	.	-0.05	-0.04
	(.)	(-15.64)	(-15.87)	(.)	(-19.52)	(-19.44)
Tangibility	.	0.03	0.02	.	0.04	0.02
	(.)	(16.11)	(8.65)	(.)	(17.35)	(8.41)
Industry Median Leverage	.	.	0.06	.	.	0.08
	(.)	(.)	(30.07)	(.)	(.)	(36.06)
Cash Flow Vol	.	.	-0.01	.	.	-0.01
	(.)	(.)	(-3.92)	(.)	(.)	(-4.53)
Dividend Payer	.	.	-0.03	.	.	-0.04
	(.)	(.)	(-17.20)	(.)	(.)	(-19.19)
Year Fixed Effects	No	Yes	Yes	No	Yes	Yes
Adj. R^2	0.13	0.24	0.34	0.15	0.38	0.46
Obs.	77,812	77,812	77,812	77,812	77,812	77,812

Table 3

Unexpected Leverage State Transition Probabilities

The sample is all firms in the merged CRSP/Compustat database (excluding financial firms) from 1971-2003. The table presents the empirical estimates of the 1-Year (Panel A) and 5-Year (Panel B) probability transition matrices for four unexpected leverage portfolios: Low, Medium, High, and Very High. Each year cross-sectional regression of leverage on firm size (log assets), profitability (earnings / assets), market-to-book, and tangibility (tangible assets / assets), and dummy variables corresponding to Fama and French's 38 industries is estimated. Using the residuals from these regressions, we sort firms into the unexpected leverage portfolios (quartiles) each year. Panel A presents the empirical probability that a firm transitions from quartile i at time $t-1$ to quartile j at time t. Panel B presents the empirical probability that a firm transitions from quartile i at time $t-5$ to quartile j at time t.

Panel A: 1-Year Transition Matrix

	Period t State			
Period $t-1$ State	Low	Medium	High	Very High
Low	0.18	0.05	0.01	0.01
Medium	0.05	0.14	0.05	0.01
High	0.01	0.05	0.14	0.05
Very High	0.01	0.01	0.04	0.18

Panel B: 5-Year Transition Matrix

	Period t State			
Period $t-1$ State	Low	Medium	High	Very High
Low	0.13	0.06	0.04	0.02
Medium	0.06	0.10	0.07	0.03
High	0.03	0.07	0.11	0.06
Very High	0.02	0.03	0.06	0.12

Table 4

Variance Decompositions

The sample is all firms in the merged CRSP/Compustat database (excluding financial firms) from 1971-2003. Panel A presents a variance decomposition for several different model specifications, with adjusted R-squares at the bottom. We compute the type III partial sum of squares for each effect in the model and then normalize each estimate by the sum across effects. Thus, each column sums to one. For example, in model (d) for book leverage, 4% of the explained sum of squares captured by the included covariates can be attributed to Log(Assets). Panel B presents the corresponding parameter estimates and t-statistics in parentheses (adjusted for serial correlation and heteroskedasticity) for specifications (d) through (g). Also presented are the percent change in the magnitude of the coefficient when moving from model specification (d) to (e) and from (f) to (g). *Firm FE* are firm fixed effects. *Year FE* are calendar year fixed effects. Variable definitions are provided in the Appendix.

Panel A: Variance Decomposition

	Book Leverage							Market Leverage						
Variable	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(a)	(b)	(c)	(d)	(e)	(f)	(g)
Firm FE	1.00	.	0.98	.	0.95	.	0.92	1.00	.	0.94	.	0.89	.	0.85
Year FE	.	1.00	0.02	0.11	0.01	0.05	0.01	.	1.00	0.06	0.21	0.06	0.12	0.05
Log(Assets)	.	.	.	0.04	0.01	0.07	0.02	.	.	.	0.02	0.02	0.04	0.03
Market-to-Book	.	.	.	0.09	0.00	0.03	0.00	.	.	.	0.31	0.01	0.19	0.01
Profitability	.	.	.	0.11	0.01	0.06	0.01	.	.	.	0.08	0.01	0.05	0.01
Tangibility	.	.	.	0.27	0.01	0.08	0.01	.	.	.	0.09	0.01	0.03	0.01
Industry Med Lev	.	.	.	.	.	0.46	0.02	.	.	.	.	.	0.35	0.03
Cash Flow Vol	.	.	.	.	.	0.00	0.00	.	.	.	.	.	0.01	0.00
Dividend Payer	.	.	.	.	.	0.16	0.01	.	.	.	.	.	0.13	0.01
Industry FE	.	.	.	0.38	.	0.09	.	.	.	.	0.29	.	0.08	.
Adj. R^2	0.60	0.01	0.61	0.18	0.63	0.29	0.65	0.61	0.06	0.65	0.31	0.68	0.41	0.70

Panel B: Coefficient Estimates and T-Statistics

	Book Leverage						Market Leverage					
Variable	Pooled OLS (d)	Firm Fixed Effects (e)	(d) to (e) % Change	Pooled OLS (f)	Firm Fixed Effects (g)	(f) to (g) % Change	Pooled OLS (d)	Firm Fixed Effects (e)	(d) to (e) % Change	Pooled OLS (f)	Firm Fixed Effects (g)	(f) to (g) % Change
Log(Assets)	0.014	0.023	70.21%	0.020	0.023	13.58%	0.035	0.050	43.42%	0.035	0.049	40.45%
	(21.81)	(20.87)		(20.56)	(20.08)		(27.17)	(36.01)		(29.32)	(35.4)	
Market-to-Book	-0.004	-0.002	-49.12%	-0.005	-0.002	-64.27%	-0.028	0.000	-99.16%	-0.024	0.000	-99.32%
	(-11.62)	(-5.32)		(-8.84)	(-5.25)		(-33.32)	(-0.5)		(-32.19)	(-0.35)	
Profitability	-0.028	-0.019	-33.54%	-0.090	-0.017	-81.12%	-0.133	-0.035	-73.74%	-0.120	-0.034	-71.51%
	(-12.77)	(-7.63)		(-11.3)	(-6.66)		(13.43)	(11.39)		(-13.24)	(-10.88)	
Tangibility	0.144	0.085	-40.84%	0.172	0.084	-51.25%	0.211	0.116	-45.17%	0.170	0.113	-33.40%
	(33.38)	(16.11)		(21.52)	(15.84)		(21.63)	(17.7)		(18.75)	(17.33)	
Median Leverage				0.373	0.038	-89.75%				0.375	0.063	-83.30%
				(37.34)	(6.33)					(44)	(11.57)	
Cash Flow Vol				-0.004	-0.037	724.92%				-0.020	0.001	-104.03%
				(-0.52)	(-3.19)					(-2.29)	(0.06)	
Dividend Payer				-0.047	-0.001	-98.90%				-0.062	0.001	-101.85%
				(18.18)	(-0.31)					(-19.29)	(0.55)	
Obs	106,781	106,781		106,781	106,781		106,781	106,781		106,781	106,781	

Table 5

Speed of Adjustment

The sample is all firms in the merged CRSP/Compustat database (excluding financial firms) from 1971-2003. The table provides estimates for the following autoregressive model of book leverage:

$$\Delta Leverage_{it} = \alpha + \lambda\left(Target^*_{it} - Leverage_{it-1}\right) + \eta_i + \mu_t + \varepsilon_{it}$$
$$Target^*_{it} = \beta X_{it-1}$$

where X is a set of predetermined covariates, η is a time-invariant effect potentially correlated with X, μ is a firm-invariant effect potentially correlated with X, and ε is a random error term that is potentially heteroskedastic and autocorrelated within firms. (This is simply a reparameterization of a partial adjustment model.) Pooled OLS estimate the parameters by ordinary least squares restricting $\eta_i = 0$. Firm Fixed Effects estimate the parameters by transforming the original data into deviations from firm-specific means and then estimating the transformed data by OLS. GMM estimate the parameters using the GMM approach of Blundell and Bond (1998). For each estimation technique, two model specifications are estimated: one restricts $\beta = 0$, the other does not. Leverage half life is defined as the time in years in which it takes firm to adjust back to the target leverage: $\ln(0.5)/\ln(1-\hat{\lambda})$. The coefficient Variable definitions are provided in the Appendix. t-statistics are in parentheses and are robust to heteroscedasticity and within firm correlation.

	Estimation Method					
Variable	Pooled OLS		Firm Fixed Effects		GMM	
Speed of Adjustment (λ)	0.121	0.147	0.348	0.371	0.214	0.226
	(48.53)	(47.67)	(71.33)	(71.11)	(20.84)	(24.89)
Log(Assets)		0.003		0.032		0.012
		(2.3)		(14.04)		(2.77)
Market-to-Book		-0.011		-0.004		-0.003
		(-4.96)		(-2.47)		(-0.93)
Profitability		-0.173		-0.074		-0.014
		(-7.05)		(-5.13)		(-0.51)
Tangibility		0.101		0.094		0.205
		(8.6)		(6.71)		(5.38)
Median Leverage		0.399		0.109		0.077
		(17.63)		(6.96)		(1.67)
Year Fixed Effects	No	Yes	No	Yes	No	Yes
Leverage Half Life (Years)	5.387	4.349	1.623	1.496	2.885	2.707
	(45.48)	(43.97)	(57.18)	(55.9)	(18.44)	(21.84)
Obs	93,579	93,579	93,579	93,579	93,579	93,579