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

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First Draft: February 14, 2005
Current Draft: September 19, 2005

Preliminary: Please do not quote without permission

*We thank Franklin Allen, Mark Leary, Andrew Metrick, Roni Michaely, Vinay Nair, Bilge Yilmaz and seminar participants at the University of Colorado for helpful discussions. Roberts gratefully acknowledges financial support from a Rodney L White grant and an NYSE Research Fellowship.

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Abstract:

We examine the dynamic behavior of corporate capital structures in order to determine the empirical relevance of recent theories. We begin by showing that capital structure is highly persistent, so much so that the cross-sectional distribution of leverage in the year prior to the IPO is largely unchanged almost twenty years later. Moreover, our analysis suggests that market timing (Baker and Wurgler (2002)) and inertia (Welch (2004)) are unlikely explanations for the observed cross-sectional variation in capital structures, which exists prior to firms' IPOs. Rather, our results indicate that factors associated with debt policy have significant and long lasting effects on capital structure, as opposed to factors associated with equity policy. Further analysis of capital structures at the time of and prior to the IPO reveal heterogeneity in private financing decisions and debt contracts consistent with segmented capital markets. While suggestive, ultimately our results suggest a critical need for understanding variation in corporate debt policies and the determination of private firms' capital structures in order to better understand public firms' capital structures, the latter of which are largely a reflection of the former.

A common theme among recent investigations into corporate capital structure is the extent to which shocks to leverage have a persistent effect and the corresponding implication for the cross-sectional distribution of leverage. For example, Baker and Wurgler (2002) suggest that managerial efforts to time security issuances with equity market conditions result in a cross-sectional distribution that reflects the cumulative effects of historical timing efforts.[1] Welch (2004) suggests that a general indifference on the part of managers results in a cross-sectional distribution who's only "known" component is historical variation in equity prices.

In contrast, studies by Alti (2004), Flannery and Rangan (2004), and Hovakimian (2004) suggest that this persistence is overstated and that firms respond relatively quickly to shocks perturbing their capital structures. These studies suggest that the cross-sectional distribution of capital structure reflects primarily the current costs and benefits associated with different forms of financing, as suggested by traditional static tradeoff theories.

Finally, studies by Fischer, Heinkel, and Zechner (1989), Leary and Roberts (2004), and Strebulaev (2004)) suggest that market frictions result in shocks to leverage having a persistent effect on capital structure, despite firms following an optimal financial policy.[2] Thus, the cross-sectional distribution of leverage reflects both historical shocks, as well as current costs and benefits associated with different forms of financing, as suggested by dynamic tradeoff theories.

At the heart of this debate lie the following questions. First, to what extent is capital structure persistent? This question is important not only because of the lack of

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[1] Chen and Zhao (2004) and Huang and Ritter (2005) also argue that the empirical evidence is consistent with the market timing view.

[2] Hennessy and Whited (2005) present a similar result; however, the persistence of capital structure in their model is driven by tax regimes, as opposed to transaction costs.

consensus in the literature but also because of its implications for the cross-sectional distribution of capital structure. Specifically, persistence in leverage suggests that either deviations from an optimal leverage are not costly (Baker and Wurgler (2002) and Welch (2004)), adjustment costs are important (Leary and Roberts (2005)), and/or estimates of target leverage are missing something important. Thus, the second question arising from this debate is which of these three explanations is behind the cross-sectional distribution of capital structures? The goal of this paper is to address these questions by examining the evolution of capital structure and its corresponding cross-sectional distribution. Our results, while shedding light on several issues, also present new challenges to our understanding of how firms choose their capital structures.

Our first result is that capital structure is highly persistent, so much so that the cross-sectional distribution of leverage in the year prior to the IPO is largely unchanged almost twenty years later. This fact is illustrated in Figure 1, which shows that firms with relatively high (low) leverage prior to their IPO (Year -1) tend to maintain high (low) leverage levels for over 20 years. Moreover, these persistent differences in leverage cannot be explained by differences in previously identified observable firm characteristics (e.g., size, profitability, market-to-book, etc.) or survivorship issues. Interestingly, this sorting of firms into high and low leverage categories precedes the IPO, so that high (low) levered firms were as such even before gaining access to the public equity market. This pre-IPO sorting of firms casts doubt on theories attempting to explain heterogeneity in capital structure with equity market timing considerations (Baker and Wurgler (2002)) or stock price variation (Welch (2004)) since neither of these considerations present a plausible explanation for the development of the cross section of capital structures prior to the IPO. It also suggests that the process of going public does little to ameliorate any market imperfections that drive cross-sectional heterogeneity in capital structure.

Further analysis confirms these conclusions by revealing the following facts. First, the single most important determinant of cross-sectional variation in leverage at almost every point in time is a firm's initial, post-IPO leverage. Event time cross-sectional regressions during the twenty years following the IPO reveal that a firm's initial leverage is a statistically and economically significant determinant of future capital structure in every year. The average coefficient estimate reveals that a one standard deviation increase in initial leverage corresponds to an 8% increase in future leverage; an effect that swamps that of all other variables even when allowing these other covariates to update each year. That is, event after controlling for the evolution of firm characteristics, initial leverage is one of the most important determinants of capital structure. Additionally, these results are not dependent on an event-time analysis of IPO firms, as otherwise similar calendar time regressions on the entire merged CRSP/Compustat database show that past leverage, even twenty years earlier, is a more powerful predictor of current leverage than most contemporaneous characteristics. Simply put, leverage is highly persistent and this persistence can be traced back prior to the IPO.

Our analysis also reveals several implications for existing theories of capital structure. First, our results cast further suspicion on the role of market timing or inertia in determining the cross-section of capital structures. The event time regressions reveal that the effect of post-IPO market-to-book ratios, equity returns, the amount of equity financing, and the external finance weighted market-to-book ratio (Baker and Wurgler

(2002)) have little effect on capital structure, once initial leverage is taken into account. The calendar time regressions reveal that even contemporaneous equity factors do little to diminish the importance of firms' leverage ratios from twenty years earlier. Additionally, we find that higher historical equity returns and larger equity issuances lead to *higher* future leverage ratios, counter the predictions of market timing and/or inertia but consistent with a dynamic rebalancing of capital structures.

Rather, our results suggest that factors associated with differences in debt policy are the more relevant source of the observed heterogeneity in capital structures. The frequency of debt issues early in a firm's public life, as well as the relative amount of collateralizable assets, both have a significant impact on capital structures for many years. Additionally, the fraction of assets that are tangible, and most easily collateralized, has a significant effect on leverage even twenty years later. We also find that initially highly levered firms are more than 60% more likely to issue short-term debt and 40% more likely to issue long term debt than their initially low levered counterparts in almost every year during the two decades following the IPO. Initially highly levered firms are less likely to use equity financing than initially low levered firms, however this difference is much less dramatic (14%). Thus, our evidence suggests that the key determinant(s) behind the cross-section of capital structures is more likely found in heterogeneity in corporate *debt* policy, as opposed to equity policy – the focus of recent hypotheses.

Second, estimates of target or optimal leverage relying on functions of firm characteristics (e.g., size, book-to-market, industry, etc.) provide at best only a marginal improvement over a specification consisting solely of initial leverage. The R-squared from regressions based on commonly used specifications (e.g., those found in Rajan and

Zingales (1995) and Frank and Goyal (2004)) varies from 19% to 32%, whereas the R-squared from a regression using only initial leverage is 29%. Thus, tests of tradeoff theories relying on empirical proxies for target leverage likely provide a noisy measure of the target, making the identification of adjustment behavior difficult. More importantly, however, is that these results, in conjunction with the high degree of persistence, suggest that despite explaining a significant fraction of the cross-sectional distribution of capital structure, existing studies leave much variation unexplained.

This leads us to our last set of analyses aimed at understanding the determinants of firms' initial (i.e., pre-IPO) capital structures. This analysis, while limited because of space and data constraints, is crucial in understanding the observed variation in the capital structures of public firms since they are largely a reflection of that found among private firms. Our results uncover a number of significant differences in the circumstances under which firms transition to public markets as well as differences in the features of debt contracts in which they enter. We find that highly levered firms are: three times more likely to have previously been involved in a leverage buyout, seven times more likely to have a credit rating, almost half as likely to be backed by a venture capitalist, and almost two years older at the time of IPO than low levered firms. Additionally, highly levered firms tend to enter into "term" loans with longer maturities offered by larger lending syndicates than low levered firms who are more likely to enter into short-term revolving lines of credit from just one lender. Importantly, these differences exist *after* controlling for observable differences in firm characteristics and the macroeconomic environment. Our discussion of these results suggest that segmented capital markets is, in part, responsible for these discrepancies and draws a parallel to recent findings by Faulkender and Petersen (2004) and Leary (2005), who find that segmented capital markets impact the capital structure of public firms.

The remainder of the paper is organized as follows. The data and sample selection are discussed in Section 1, where we also present summary statistics and some preliminary analysis. In section 2, we examine the persistence in capital structure and the proposed causes of this persistence. Section 3 examines the implications of the persistence in capital structure. Section 4 investigates potential determinants for the cross-section of capital structures in firms just prior to their IPO. Section 5 concludes.

1. Data, Sample Selection and Preliminary Analysis

The sample consists of all nonfinancial, nonutility firm-year observations in the merged annual CRSP/Compustat database between 1971 and 2003. We further require that all firm-years have nonmissing data for book assets. All multivariate analysis implicitly assumes nonmissing data for the relevant variables. All variables used in the analysis are trimmed at the upper and lower 1-percentiles to mitigate the effect of outliers and eradicate errors in the data. For most of our analysis, we impose the additional requirement that each firm have an IPO date falling between 1971 and 2000.[3]

To ease the presentation of results and facilitate the discussion, we focus our attention on book leverage, noting any differences obtained using market leverage. Generally speaking, any differences in our results due to alternative measures of leverage are usually small and have no effect on our inferences or conclusions. The construction of all of our variables is detailed in Appendix A.

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

Table 1 presents the distribution of firms and average firm characteristics by event time, where 0 equals the year of the IPO. To ease the presentation and because of small samples (less than 100 firms), the results are truncated 20 years after the IPO. Additionally, we present results for a subsample of firms required to survive as stand-alone entities for at least 10 years. A few points are worth mentioning. First, there are a significant number of pre-IPO observations. Over 76% of the IPO firms have data available for the year prior to the IPO, a consequence of "back-filling" by Standard and Poors. Second, there is a monotonic decline in the number of firms after the IPO because of firm exit through bankruptcies, acquisitions, and buyouts. Finally, note that, on average, the IPO is a significant leverage decreasing event.[4]

The potential for survivorship bias in our analysis motivates our examination of the subsample of survivors in all subsequent analysis as a robustness check; however, because of space considerations and similar findings, we suppress most of these results. A quick comparison between the averages of both samples in Table 1 reveals that, at an aggregate level, the two samples share remarkably similar characteristics, with the exception of operating income. Perhaps unsurprisingly, the average survivor firm immediately generates significantly positive cash flow whereas the sample as a whole experiences losses on average in the years just after the IPO. Of course, as our subsequent analysis is primarily conditional, this difference is of little consequence though all of our analysis is repeated for both full and survivor samples. Finally, note that in the survivor

[4] While this may seem tautological, in fact theoretically, there is no reason why firms cannot issue debt just after the IPO in order to maintain their pre-IPO leverage (or even increase it). Indeed, without alternative market frictions and/or a significant change in the optimal leverage, a static tradeoff theory would predict precisely such a response to the IPO.

sample, the number of firms changes slightly during the first 10 years after the IPO. This is simply due to missing data items for a few firms.

2. Is Leverage Persistent?

In this section we provide several pieces of evidence illustrating the degree to which leverage is persistent, while also discussing previous studies that comment on this issue. We begin by revisiting the popular partial adjustment model in an effort to review the relevant literature and further motivate our investigation. This discussion is followed by an analysis of capital structure evolution in event time and calendar time.

2.1 Partial Adjustment Models and Mean Reversion in Leverage

Much of the debate over the persistence of leverage has revolved around the estimation and interpretation of the mean reversion parameter, λ, in partial adjustment models such as:

$$\Delta Leverage_t = \lambda(\mu_t - Leverage_{t-1}) + \varepsilon_t, \tag{1}$$

where $\Delta Leverage$ is the change in actual leverage from time $t-1$ to time t, μ_t is the time t target leverage, and ε_t is an i.i.d. error term. Intuitively, λ, which generally lies between 0 and 1, estimates the fraction of the gap between last period's leverage and the target that the firm closes each period through its financial policy.

Despite over 30 years of research, the existing evidence on the rate at which firms adjust towards a target is largely inconclusive. Early estimates of the adjustment rate suggest both a slow (Taggart (1977)) and a fast (Jalilvand and Harris (1984) and Spies (1974)) rate of adjustment, with Jalilvand and Harris finding that firms close more than half the distance from their target each year. More recent work by Shyam-Sunder and Myers (1999) and Fama and French (2002) suggest a slow adjustment of leverage towards its target, which Fama and French characterize as "a snail's pace" (P. 24). Flannery and Rangan (2005), accounting for the effect of unexpected changes in equity prices, argue that firms, in fact, close more than 30% of the gap between their actual and target leverage each year. However, Huang and Ritter (2005) argue that small sample biases in Flannery and Rangan's estimates lead them to overstate the rate of adjustment.

Of course, all of these analyses are predicated on the partial adjustment model providing an accurate description of the data generating process. However, recent theoretical and empirical evidence suggests that this may not be the case. Studies by Fischer, Heinkel, and Zechner (1989), Mauer and Triantis (1994), Goldstein, Ju, and Leland (2001), and Strebulaev (2004) introduce market frictions (e.g., transaction costs) into dynamic models of capital structure. The consequence of these frictions is that the optimal financial policy takes the form of an (S,s)-rule in which firms adjust their leverages relatively infrequently. Empirical support for this view includes studies identifying the importance of market frictions such as the direct costs associated with issuing and retiring securities (e.g., Smith (1986), Lee et al. (1996), and Altinkilic and Hansen (2000)) and credit rationing in the debt markets (e.g., Faulkender and Petersen (2004) and Leary (2005)). Further support comes from recent studies identifying the "lumpy" behavior of financial policy (e.g., Leary and Roberts (2004) and Fama and French (2005)).

In a world with infrequent adjustment, the partial adjustment model suffers from two problems. First, as Leary and Roberts (2004) show, the mean reversion parameter in partial adjustment models provides little insight into the frequency of adjustment or underlying motives of the firm's financial policy. Depending on the nature of the adjustment cost function facing the firm, leverage can be highly persistent ($\lambda \approx 0.10$) despite firms actively adjusting their capital structure. As such, the speed of adjustment provides little insight into the motives behind financial policy. Second, as Caballero and Engel (2004) show, OLS estimates of λ are biased upward when the adjustment process is discontinuous and this bias does **not** attenuate with larger samples. Specifically, estimates of λ are inconsistent and the corresponding bias can be significant. While the parameter estimate can be bias-corrected by the incorporation of moving average terms, the precise correction is ultimately subjective and still subject to small sample biases (Huang and Ritter (2005)). Thus, the general lack of consensus, coupled with the statistical problems, suggest that an alternative approach to addressing the persistence question may prove informative.

2.2 The Evolution of Leverage

To quantify the apparent persistence in leverage, we begin by studying the evolution of the cross-sectional distribution of leverage in both event and calendar time. Panels A and B of Figure 1 present the average leverage of four portfolios of firms from the whole sample and survivor sample, respectively, sorted on what we term "initial leverage," defined as the average leverage of the firm during the first three years of its public existence (i.e., event years 0, 1, and 2). We average over these first few years to mitigate the effect of extreme observations that may occur in any one year.[5] The figures clearly

[5] Using either pre- or post-IPO leverage produces qualitatively similar results, which we illustrate below.

illustrate that there is little convergence in the average leverage of these portfolios over time. Even after twelve years, the relative ranking across the portfolios remains unchanged and the differences in average leverage are economically large. For those firms in the "Very High" leverage portfolio, their average leverage (0.34) is more than 35% larger than that of the firms in the "High" leverage portfolio (0.24), almost twice that of firms in the "Medium" (0.19) portfolio, and more than twice that of firms in the "Low" (0.13) leverage portfolios. While there is some convergence among the Low, Medium, and High portfolios after eighteen years, the Very High portfolio exhibits an average leverage that is dramatically larger than the other three portfolios. Additionally, it is interesting that the cross-sectional variation in leverage that persists into the future also exists prior to the IPO.

While suggestive, a concern with this analysis is that the sorting may simply be capturing cross-sectional variation in some underlying factor that is associated with cross-sectional variation in leverage (e.g., bankruptcy costs, agency costs, etc.). As such, we first estimate a cross-sectional regression of initial leverage on factors previously identified by the literature as being relevant determinants of capital structure (e.g., Titman and Wessels (1988), Rajan and Zingales (1995), Baker and Wurgler (2002), Fama and French (2002), Phillips and Mackay (2004) and others). Specifically, we regress initial leverage on initial values of firm size, profitability, tangibility, market-to-book, and year and industry (Fama and French 38) fixed effects.[6] The initial values of the continuous variables are computed by averaging the first three annual observations occurring from the IPO year onward (i.e., event years 0, 1, and 2). Binary variables are

[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 or not the firm paid a dividend, and year and industry indicators. The results are largely unchanged and, as such, are not presented.

measured as of the year of the IPO, though using measures based on year 1 or year 2 have no effect on the results. We now sort firms into four portfolios based on the regression residuals, what we will term "unexpected leverage", and track the average actual leverage of each portfolio from one year prior to the IPO to twenty years after the IPO. An attractive feature of this approach is that it allows for a transparent analysis examining the four portfolios, while simultaneously controlling for factors known to be correlated with leverage.

Panels C and D of Figure 1 present the results for the entire sample and for the subsample of 10-year survivors, respectively. To the extent that the factors included in the regression capture the cross-sectional heterogeneity in capital structure, the expectation is for the average leverage levels across portfolios to converge as time progresses. This is not the case. The results are very similar to those presented earlier, with the exception of the "Low" and "Medium" leverage portfolios, which are now largely indistinguishable from each other. Nonetheless, the Very High and High leverage portfolios show significant differences in leverage over this horizon both relative to one another as well as the Low and Medium portfolios. Further, this result is not due to any sort of survivorship bias, as evidenced by the similarity between Panels C and D (also A and B), nor is it unique to book leverage as market leverage (not presented) exhibit similar patterns. The average leverage for the Very High portfolio sixteen years after the IPO is 29%, compared to 24% for the High, 17% for the Medium, and 19% for the Low portfolio. Thus, even after removing all observable heterogeneity associated with traditional determinants of capital structure, leverage appears highly persistent.

Though we discuss the implications of this persistence in detail below, it is worth mentioning the following. These results suggest that the "usual" factors appear to capture most of the cross-sectional variation among relatively low levered firms, which follows from the convergence in the Low and Medium portfolios. However, there is a significant amount of residual variation among more highly levered firms that is left unexplained. Thus, in so far as these firms are relatively heavy users of debt (a conjecture we confirm later), these results point to a shortcoming of existing models, namely, their inability to explain high debt usage. We return to this issue below.

To further verify the persistence present in leverage, Panel A of Table 2 presents cross-sectional leverage regressions run in event time where all of the covariates other than initial leverage update each year. Mathematically, the regression is simply

$$Lev_t = \beta X_{t-1} + \gamma Lev_0 + \varepsilon_t ,$$

where the control variables (X_{t-1}) consist of: size, market-to-book, tangibility, and profitability. Initial leverage is computed as the average leverage over event years 0, 1, and 2. To ease comparison across the coefficients, we standardize each continuous variable to have zero-mean and unit variance so that the coefficients may be interpreted as the marginal effect on leverage of a one standard deviation change in the covariate. Also included in the regressions but not reported are indicator variables for calendar year and Fama and French 38-industries.

As the results illustrate, even after controlling for the evolution of firm characteristics, initial leverage remains both statistically and economically significant in every year after the IPO. Across all years, the marginal effect of the initial leverage on future values of leverage ranges from 0.15 three years after the IPO to 0.04 19 years after the IPO. The mean effect is 0.08, implying that, on average, a one standard deviation change in initial leverage translates to an 8% change in future values of leverage.[7] This effect is economically large in light of the unconditional mean of leverage (25%). We also note that in many years the effect of initial leverage is orders of magnitude larger than that of any other determinant. Indeed, the average affect of initial leverage on future values is anywhere from two to eight times greater than any other determinant. Thus, the starting point for a public firm's leverage has a profound economic effect on all of its future capital structures over the next twenty years; an effect that subsumes variation in most other observable factors and is robust to changes in firm characteristics.

To ensure that our results are not unique to our sample or event-time methodology, we perform calendar time panel regressions that mimic the spirit of those found in Panel A, but use the entire merged CRSP/Compustat database (excluding utilities and financial firms) as our sample. Specifically, we regress leverage in year *t* on size, market-to-book, profitability, and tangibility in year *t-1* and leverage in either year *t-10* or *t-20.* The results are reported in Panel B, where, again, all continuous variables are standardized to zero mean and unit variance. (Calendar year and industry indicator variable estimates are suppressed). As we saw in Panel A, lagged leverage is clearly the single most important determinant, economically and statistically, when we examine a 10-year lag of leverage. A one standard deviation change in leverage 10 years ago is associated with a 7% change in current leverage after controlling for current firm

[7] At the bottom of the table are the time series averages of the estimated coefficients, as well as Fama-MacBeth (1973) (FM) t-statistics (i.e., the time series average divided by the standard error of the mean). While the within year t-statistics are computed using appropriate standard errors, the FM t-statistics are presented only for descriptive purposes and relative comparisons across the covariates. An appropriate assessment of overall statistical significance is postponed until the calendar time regressions in which cross-sectional and longitudinal (i.e., time series) dependence in the data can be appropriately accounted for See Petersen (2005) for a detailed discussion of this issue.

heterogeneity. The 20-year lag specification results in a significant decline in observations but yields qualitatively similar results. With the exception of profitability, leverage 20 years ago has the largest effect on current leverage; and, this effect is economically large – a one standard deviation change in leverage today corresponds to a 4% change in leverage 20 years hence.

2.3 Firm Transitions across Unexpected Leverage Portfolios

Our final piece of evidence concerning the persistence of leverage comes from a more disaggregated examination of the data to address the possibility that the aggregate analyses above may mask important firm-level activity (Fama and French (2005) and Leary and Roberts (2005)). In particular, if leverage is persistent, as the above evidence indicates, than we should see that firm transitions from one unexpected leverage portfolio to another occur relatively infrequently. As such, for each event year after the initial period (i.e., beginning in event year +3), we regress leverage on contemporaneous firm size, profitability, tangibility, market-to-book, and year and industry (Fama and French 38) fixed effects. Using the residuals from each regression, we sort firms into four portfolios each year based on the quartiles of this unexpected leverage. We then estimate the empirical probability transition matrix corresponding to the probability of switching from portfolio *x* at time *t-1* to portfolio *y* at time *t*, where *x* and *y* are either Low, Medium, High, or Very High. The results are presented in Table 3.

The large diagonal elements indicate that the probability of remaining in a particular portfolio for two consecutive periods is often orders of magnitude larger than the probability of switching to a different portfolio. The unconditional probability of remaining in any particular portfolio for two consecutive periods is just over 60%. That is, large changes in corporate leverage, after controlling for firm characteristics, calendar time and industry, are relatively unlikely. Further, when firms do switch portfolios it is usually into an adjacent portfolio and rarely into a portfolio far removed from the starting portfolio. The estimated transition matrix provides yet another piece of evidence supporting the persistence of leverage.

In sum, leverage appears highly persistent, regardless of how one examines the data. Initial leverage values around the time of the IPO are highly significant indicators of leverage, even twenty years after the IPO. The effect of a firm's initial leverage dwarfs that of other economic determinants of capital structure and this result is robust to differences in observable firm characteristics and survivorship concerns. Calendar time panel regressions on the merged CRSP/Compustat database (excluding financial firms and utilities) reveal similar insights. Further, leverage dynamics suggest a strong likelihood that firms remain in a particular unexpected leverage portfolio, as opposed to switching through time.

3. Implications of Persistence in Leverage

In this section we discuss the implications of our results for various theories of capital structure.

3.1 Market Timing and Inertia

Two recent theories, market timing (Baker and Wurgler (2002)) and inertia (Welch (2004)), provide explanations for the variation in observed capital structures predicated on how managers respond to changes in the market value of the firm's equity. Market timing suggests that observed capital structures are the cumulative outcome of past attempts by managers to time their security issuance decisions with equity market conditions. Alternatively, inertia suggests that managers are largely indifferent toward capital structure and, as a result, the only "known" determinant of cross-sectional differences in leverage is changes in equity prices.

Despite recent studies challenging these hypotheses (e.g., Alti (2004), Flannery and Rangan (2005), Hennessy and Whited (2005), Hovakimian (2005), Kayhan and Titman (2004), Leary and Roberts (2004), and Strebulaev (2004)), the appropriateness of market timing and inertia as descriptors of capital structure has yet to be settled for two reasons. First, many of the follow-up studies simply provide alternative explanations for the findings of Baker and Wurgler and Welch, as opposed to dismissing their theories. Second, even more recent studies by Chen and Zhao (2004) and Huang and Ritter (2005) have, in fact, argued in favor of these hypotheses, in part, on the basis that leverage appears persistent. Thus, further evidence distinguishing among these alternative interpretations and clarifying the link to persistence in leverage is clearly needed.

Figure 1 reveals an interesting result that casts suspicion on these theories as explanations for the observed cross-sectional distribution of capital structure. Focusing on Panel C (and D), we see that the cross-sectional distribution of capital structure that exists even after controlling for firm, industry and calendar time heterogeneity persists both into the future *and* into the past. Specifically, we see that the average leverage of the Very High and High unexpected leverage portfolios retain their relative rankings in the pre-IPO period, before firms had publicly traded equity. If we treat the Low and Medium portfolios as one group, which they effectively are given their similar average leverage ratios, then we see that all portfolios retain their relative rankings prior to the IPO. This result casts doubt on market timing and inertia as viable explanations of cross-sectional variation in capital structure since both theories are based on equity market factors that are largely irrelevant for private firms.[8]

Table 4 presents regression results lending further support to these conclusions by examining the impact of historical determinants of capital structure. Panel A presents coefficient estimates (t-stats in parentheses) of event time regressions similar to those presented in Panel A of Table 2. The distinction is that *all* of the right hand side variables are held fixed each year at their initial value (i.e., average over event years 0, 1, and 2). Doing so enables us to examine precisely which variables have a persistent effect on future capital structures. Market timing and inertia suggests that equity issuances and equity returns, respectively, will have a persistent effect on the distribution of capital structures.

Looking at the results in Panel A provides little support for these hypotheses. Specifically, the dollar amount of equity issued (*Equity Iss ($)*) or the number of equity issuances (*Equity Iss (#)*) early in a firm's life (event years 0, 1 and 2) has little effect on capital structure even immediately after the issuances. In fact, there is not one year in which the initial number of equity issues has a significant effect on capital structure and there is only one year (16) in which the amount of equity issued is significant but has the wrong sign (i.e., positive). The coefficients on equity returns reveal similar results in that

[8] One might argue that firms adjust their leverage ratios prior to going public in anticipation of the event so that leverage ratios just prior to IPO are not truly reflective of firms' capital structures as private entities. While this explanation may account for some of the discrepancy that we observe, the magnitudes of the differences across the portfolios appear far too large for such an explanation to be complete.

in only two of the 18 regressions is the coefficient statistically significant. The market-to-book ratio does show some evidence of having a persistent effect (seven significant years) but, in light of recent evidence (Hovakimian (2004) and Kayhan and Titman (2004)), this is most likely attributable to long run growth opportunities, as opposed to market timing – an interpretation reinforced by unimportance of equity issuances.

In contrast, factors associated with corporate debt policy appear to have a significant effect on capital structures for many years. The fraction of assets most easily collateralized (*Collateral*) is significant in eight of the subsequent years following the initial period. Similarly, the dollar amount of debt issued (*Debt Iss ($)*) and the frequency of debt issues (*Debt iss (#)*) early in a firm's life appear to have a profound and lasting impact on corporate capital structures for many years. The variables appear significant in 5 and 9 of the regressions, respectively. Indeed, the average marginal effect of the number of debt issues across all of the regressions (0.02) is the second largest of all determinants behind initial leverage (0.06).

The calendar time regressions in Panel B of Table 3 provide further support for these inferences. Specifically, while equity market factors have a statistically significant effect on leverage 10-years later, in the case of equity returns and whether the firm issued equity, the coefficients have the "wrong" sign if market timing and inertia are at work. High past stock returns or a past equity issuance are associated with **higher** future leverage, suggesting that equity issuances prompt a dynamic rebalancing by firms (Hovakimian (2004), Leary and Roberts (2004)). None of the equity factors appear significant in the 20-year lag regression. Thus, the importance of equity market factors or equity policy, in terms of a lasting impact on capital structure, appears negligible.

This finding is in contrast to the importance of debt policy, which again appears to have a significant and lasting effect on capital structure. Panel B of Table 3 shows that collateral value and size, which are both positively associated with leverage, have a persistent positive effect on future values of leverage. Thus, past debt issuance decisions, as well as factors governing the ability of a firm to issue debt, appear to have profound and lasting effects on capital structure, consistent with the evidence in Hovakimian (2004).

We note that the empirical model in panel B bears a strong resemblance to that found in Baker and Wurgler (2002). Indeed, we incorporate their external finance weighted average market-to-book (EFWA) variable in an unreported set of regressions. While this variable is statistically significant, it does nothing to diminish the importance of a firm's initial leverage, whose coefficient is twice the magnitude of Baker and Wurgler's EFWA, or any of the other determinants. Thus, our analysis and results suggest an alternative interpretation of their empirical results; namely, the model they estimate is simply a partial adjustment model in which their external finance weighted average market-to-book variable is a component of target leverage. Recent studies by Kayhan and Titman (2004) and Hovakimian (2005) suggest that, in fact, this may be a more appropriate interpretation of Baker and Wurgler's results since both Kayhan and Titman and Hovakimian provide evidence that the external finance weighted average market-to-book measure more likely captures long-run growth opportunities, as opposed to market timing attempts.

These results highlight that the factors having a persistent effect on capital structures are associated with debt policies, as opposed to equity policies. We investigate this hypothesis further in Figure 2 and Table 5. The figure plots the empirical probabilities of issuing debt (Panel A) and equity (Panel B) for each of the initial unexpected leverage portfolios over the eighteen years following the initial period. Panel A shows results consistent with those found in the event time regressions in Table 2. Specifically, heavy debt users during the initial period continue to use debt relatively more frequently far into the future. As Table 5 shows, the average likelihood of Very High initial unexpected leverage firms issuing debt (short- or long-term) is 29%, whereas Low and Medium firms are less likely to issue debt (22% and 19% respectively). This is a relative difference of almost 50%, which is both economically and statistically significant. Even High initial unexpected leverage firms show a significantly different propensity to issue debt relative to the other three groups.

These results are in contrast to the propensity to issue equity. Panel B of Figure 2 shows that the propensity of the various portfolios to issue equity in the future appears independent of a firm's initial leverage. This fact is confirmed in Table 5, which shows little difference between any of the portfolio's average equity issuance propensities. While there is a statistically significant difference between the equity issuing of Very High and High (and Medium) unexpected leverage portfolios, the economic difference 3.4% (3.9%) is small when compared with the debt differentials. Panel B of Table 5 indicates that the different propensities to issue are not offset simply by those firms that issue less frequently issuing larger amounts.

In sum, while "timed" security issuances and equity returns can impact leverage, our evidence suggests that these factors are unlikely the primary determinants of cross-sectional variation in capital structures. Rather, it is factors associated with corporate debt policy that appear to have significant and lasting effects on corporate capital structures. Further, variation in debt policies appears more dramatic than variation in equity policies. Thus, our evidence suggests that rather than focusing on equity policy to understand the distribution of capital structure, a more fruitful avenue may lie in better understanding differences in corporate debt policies.

3.2 Tradeoff Theory

While it is well-known that dynamic tradeoff theories (e.g., Fischer, Heinkel, and Zechner (1989), Strebulaev (2004)) can generate persistence in leverage because of market frictions, the primary implication of many of these theories is that firms maintain a target capital structure that balances the costs (e.g., bankruptcy, agency) and benefits (e.g., tax shields, managerial discipline) associated with leverage and, that deviations from this target are offset by financing decisions.[9] Our results allow us to comment on empirical work estimating leverage targets, which are at the center of most tradeoff theories.[10] Our evidence thus far suggests that there is a large component of leverage that is both persistent and unrelated to observable differences in firm characteristics. Many prior studies use a number of firm characteristics to proxy for the firm's target leverage. In Table 6 we examine the relation between firm characteristics and leverage in more detail using the studies by Rajan and Zingales (1995) and Frank and Goyal (2004) as

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[9] The speed and pattern of adjustment depends on the form of adjustment costs. Dynamic models, such as those proposed by Fischer, Heinkel, and Zechner (1989), Leland (1994, 1998), Leland and Toft (1996), Goldstein, Ju, and Leland (2001), Mauer and Triantis (1994), and Strebulaev (2004), among others, show that persistent deviations from target leverage are a natural consequence of dynamic optimization in the face of adjustment costs.

[10] Empirical studies providing proxies for target leverage include Jalilvand and Harris (1984), Hovakimian, Opler, and Titman (2001), Fama and French (2002), Flannery and Rangan (2005), and Kayhan and Titman (2004).

benchmarks for our selection of covariates. The former study has provided the basis for many subsequent empirical specifications testing alternative theories (e.g., Baker and Wurgler (2002), Fama and French (2002), Frank and Goyal (2003)), while the latter provides an exhaustive look at the empirical determinants of capital structure.

Table 6 presents panel regressions of leverage on a number of independent variables, each of which is lagged one year relative to leverage. All t-statistics presented are robust with respect to within firm dependence; and, for consistency across specifications, we delete the first three event years for each firm to avoid overlapping observations when initial leverage is considered. However, unlike previous regressions, we do not standardize the right hand side variables in order to more easily benchmark some of our results with other studies. Model 1 uses the original specification found in Rajan and Zingales (Panel A) and the "Tier I" factors of the Frank and Goyal (2004) specification, denoted as such because of their "statistically robust and economically large effect" on capital structure (Panel B). We augment their specifications with both calendar year and industry (Fama and French 38) indicator variables to account for both contemporaneous correlation and unobserved industry effects (Mackay and Phillips (2004)). The signs and magnitudes of the coefficient estimates are largely consistent with these earlier studies. Statistically, all of the coefficients are highly significant even after accounting for within firm dependence. Also, we see that the Frank and Goyal specification offers a significant improvement, in terms of explanatory power, over the Rajan and Zingales specification.

Model 2 replaces all of the characteristics in Model 1, including year and industry fixed effects, with the firm's initial leverage, which is constant for each firm. In Panel A, we see a dramatic *improvement* in both the log likelihood and R-squared in moving from model 1 to model 2. The latter measure increases from 19% to 29%. Unreported non-nested hypothesis tests, in fact, reject model 1 in favor of model 2. In Panel B, while we do not see a similar improvement, the model consisting solely of initial leverage offers nearly comparable explanatory power relative to the augmented Frank and Goyal specification (29% versus 32%).

Using firms' post-IPO leverage (Model 3) instead of the average leverage in the first three years (Model 2) produces qualitatively similar results. Specifically, the Rajan and Zingales specification is still dominated by a model consisting solely of firms' post-IPO leverage, while the Frank and Goyal specification offers a relatively small improvement. Further, the estimated coefficient suggests a large economic effect on future leverage: a one percent change in post-IPO leverage is associated with a 55 basis point change in future leverage. Model 4 presents the results of an AR(1) specification and, again, highlight the persistence of the leverage process.

Finally, Model 5 includes all of the independent variables in Model 1 and adds initial leverage. The addition of initial leverage generally attenuates the effects of the firm specific variables even though the firm characteristics are allowed to vary through time, while initial leverage remains fixed. In addition, the R-squared rises only to 34% for the Rajan and Zingales specification (40% for the Frank and Goyal specification) compared to 29% when initial leverage alone is used to predict future leverage.

While these results may be largely unsurprising in light of the persistence evidence presented above, they are a bit alarming in their appraisal of existing attempts to measure target leverage. Economically, these results suggest that estimating target leverage with predicted values from specifications such as that found in Model 1 of Table 6 is not much different from a strategy that simply utilizes a linear function of the initial or post-IPO leverage.

To be clear, we are not suggesting that past empirical specifications investigating the determinants of capital structure have not been fruitful. Empirical models correlating leverage with firm characteristics have uncovered important evidence illuminating the potential factors behind variation in capital structure. Rather, we are noting that a potentially important shortcoming of empirical specifications attempting to test tradeoff theories is that their existing measures of the optimal leverage may be quite noisy, resulting in an inability to accurately identify adjustment behavior.[11]

4. What Determines Firms' Initial Capital Structures?

The evidence thus far suggests the following. First, leverage is highly persistent. Second, the cross sectional distribution of capital structure is unlikely a reflection of historical timing efforts (Baker and Wurgler (2002)) or past stock returns (Welch (2004)). Third, variation in factors associated with corporate debt policies appear to be more relevant, in terms of having a lasting and significant effect on capital structure, then variation in factors associated with equity policy. Finally, while past attempts to explain cross-sectional heterogeneity in capital structure have been successful to a degree, a significant amount of unexplained heterogeneity remains. As a result, our findings thus

[11] Firm-specific fixed effects avoid this problem by explicitly modeling the unobserved heterogeneity that persists over time. Of course, this specification provides little insight into the economic forces behind this persistence.

far raise an important question, namely: what drives the cross-sectional variation in firms' **initial** capital structures not captured by previously identified determinants?

Initial capital structure can effectively be interpreted as corresponding to an omitted variable(s), although one that is highly persistent, pre-dates the IPO, and is responsible for a significant fraction of the variation in observed capital structures. Only by answering this question can we obtain a better understanding of capital structure, more generally. While a complete investigation of this question is beyond the scope of this study (for both space reasons and a lack of data for firms as private entities), in this section we provide preliminary evidence on this issue.

Our approach to addressing this issue is motivated by more recent explanations not explicitly captured by the existing empirical determinants. Specifically, we investigate the circumstances surrounding firms' IPOs using data from SDC, as well as examining the details of debt contracts that our firms engage in while private companies using data from Loan Pricing Corporation's Dealscan database. Our strategy is to determine whether any systematic differences in IPO conditions or private debt contracts exist across the four unexpected leverage portfolios, which, by construction, control for previously identified determinants of capital structure. Because this approach is somewhat exploratory in nature, our goal with this analysis is not a resolution of the question regarding the factors behind differences in firms' initial capital structures, but rather a first step intended to motivate future research on this issue.

4.1 Segmented Capital Markets

Recent evidence (Faulkender and Petersen (2005) and Leary (2005)) has begun to identify supply-side frictions in the debt markets as important determinants of capital structure. Specifically, segmented capital markets can create cross-sectional dispersion in capital structures simply because of differential access. While these papers examine public firms, their arguments apply equally to private firms, as well. In particular, there is a natural life cycle of financing for private firms, as discussed in Berger and Udell (1998) and Osnabrugge and Robinson (2000). These authors identify the most likely source of financing for each stage of development for entrepreneurial firms beginning with initial insider and angel financing for seed firms, to venture capital and trade credit for early high growth firms, to ultimately intermediate-term credit and private placements for more mature firms just prior to entering the public markets. Importantly, this life cycle indicates differential access to alternative forms of financing.

In Table 7, we present several pieces of evidence consistent with differential access to debt markets. For our sample of IPO firms, we compute the time (in years) until a firm goes public as the difference between the founding date of the firm and its IPO date.[12] We find that firms in the High and Very High unexpected leverage portfolios take longer to go public than those firms in the Low and Medium portfolios. As such, these firms are more likely to have progressed further in the life cycle of private firms discussed above and, consequently, have a greater likelihood of accessing bank capital. We also see that firms in the High and Very High unexpected leverage portfolios are two to three times more likely to have previously undergone a leveraged buyout. Thus, these firms have had significant dealings with the debt markets in the past, thereby easing any frictions in obtaining debt capital in spite of significantly greater leverage relative to

[12] We thank Jay Ritter for kindly providing this data.

firms in the Low and Medium portfolios. Finally, more highly levered firms are significantly less like to tap (or be chosen by) the venture capital markets, possibly suggesting a barrier to private equity, as well. (We revisit this last result below.)

Table 8 provides additional supporting evidence by examining the characteristics of loans received by firms prior to their IPO's. This information is based on a subset of our sample firms that appear in the Dealscan database.[13] An obvious difference appears simply in the number of loans found on the Dealscan database for our sample of firms: firms in the high unexpected leverage portfolio are more likely to take out a loan than their counterparts in the Low portfolio.[14] We also see, for example, that those firms in the Very High and High unexpected leverage portfolios use relatively more "term" loans and fewer revolving lines of credit than those in the Medium and Low unexpected leverage portfolios. This result is consistent with differential access, in part, because of differences in the administration of term and revolving loans. The principal of the former type is typically drawn down in entirety at inception of the loan, whereas the latter is drawn down over the life of the loan. As a result, changes in the borrower's credit risk can at times result in the bank limiting or even denying the withdrawal of funds.[15]

Consistent with this discussion, Panel B of Table 8 also indicates that the maturity of the pre-IPO debt for the Very High and High unexpected leverage portfolio firms is longer, and the size of the loans (relative to assets) is larger. All of these findings are

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[13] Dealscan is marketed by Loan Pricing Corporation and contains detailed contract information for corporate loans culled from SEC filings and contacts within the credit industry. This data is hand matched to Compustat using company names, tickers, and initiation dates in conjunction with the historical header file. See Bradley and Roberts (2003) for a more detailed discussion.

[14] As firms in each unexpected leverage portfolio are homogeneous across many measurable dimensions, it is not clear why sample selection would affect firms differentially across the portfolios.

[15] Technically, recall of the loan can also occur in term loans when covenants are violated. Our point here is only to distinguish between the ability to draw down all of the funds immediately versus a more staggered distribution scheme.

consistent with the idea that the firms in the Very High and High unexpected leverage portfolios are able to better tap long-term credit markets relative to their less levered counterparts.

An attractive feature of this explanation (segmented capital markets) is that it provides a consistent explanation for the evolution of capital structures over longer periods of time. Specifically, bank loans are relatively difficult to obtain given the little collateral, short "track records," and high degree of opacity associated with private firms. As such, private firms have varying degrees of access to private debt, while most rely on internal equity, angel financing, or venture capital. After the IPO, informational asymmetries are greatly reduced (though still clearly present), firms have a greatly expanded access to capital and, as such, the borrowing constraint imposed on some firms is relaxed. Indeed, Figure 1 illustrates that firms in the Low and Medium unexpected leverage portfolios gradually increase their leverage. Though not explicit, this restructuring is accomplished primarily through the private debt market (see Denis and Mihov (2003)). Nonetheless, a constraint still exists for these firms in the form of a restriction on access to public debt markets, as suggested by the evidence in Faulkender and Petersen (2005) and Leary (2005). While clearly, not the whole story, we believe it warrants closer scrutiny.

4.2 Corporate Governance and Optimal Contracting

Another potential source of heterogeneity comes in the form of differences in corporate governance. In particular, if debt is viewed through the lens of the optimal contracting literature (e.g., Aghion and Bolton (1992) and Hart (1995)) and the corresponding control concerns, then the heterogeneity in early corporate capital structures may be reflecting differences in governance requirements. Further, this hypothesis is not without empirical support, in light of the recent evidence presented in Litov (2004) showing a link between capital structure of public firms and the Gompers, Ishii, and Metrick (2003) corporate governance index. To this end, we investigate the ownership structure of our IPO firms just prior to their going public.

Returning to Table 7, a significantly larger fraction of firms in the Low and Medium unexpected leverage portfolios are backed by venture capitalists, relative to firms in the High and Very High portfolios. That is, these firms are willing to concede a significant amount of control by relying more heavily on equity (often convertible preferred (Sahlman (1990)) than debt. Possible motivations for this control decision are diverse. Harris and Raviv (1990) attribute the decision to information asymmetry problems and, thus, the capital structure choice is one that efficiently disseminates information about the quality of management and efficacy of the business strategy. Aghion and Bolton (1992) suggest that unverifiable consumption of private benefits by the entrepreneur results in a capital structure decision insuring investors a fair rate of return. Hart and Moore (1994) suggest that the capital structure decision is predicated on the inalienability of human capital, the inability of the entrepreneur to commit not to withdraw his human capital.[16]

One concern with governance concerns as an explanation for the residual component of leverage is that this component persists after, and is largely unaffected by, the IPO. Yet, the process of going public represents a time of significant information revelation and a dramatic change in the ownership and control structure of the firm. As

[16] See the recent survey by Hart (2001) for further references to this literature.

such, one might expect a more dramatic shift in capital structures after the IPO if governance is a primary concern. Also note that Table 7 indicates there is almost no difference in the insider ownership of equity (pre or post-IPO) across the unexpected leverage portfolios, suggesting that venture capital backing does not appear to substitute for low managerial ownership.

4.3 Managerial Style and Corporate Culture

Bertrand and Schoar (2003) show that manager fixed effects explain a significant amount of variation in corporate capital structures. Their study relies on the relatively frequent turnover of managers to identify this effect. However, given relatively frequent turnover of management, one would expect relatively transient behavior in capital structure, which is clearly not the case. Alternatively, their results may just be symptomatic of an endogeneity problem. Firms may select managers whose style is in accord with their needs or views concerning capital structure at a given point in time, and new managers may typically be installed at a time when the firm requires significant change. Interestingly, their analysis shows that firm fixed effects captures over 90% of the variation in capital structures (consistent with the evidence documented here), while incorporating manager fixed effects leads to a relatively small (3%) increase in this figure. Though significant, it seems unlikely that managerial style is the key determinant behind firms' initial capital structures.

An idea that is related to managerial style but that may be predicted to have a more lasting effect on a firm is corporate culture. This concept is not without economic foundation, as studies by Kreps (1990), Cremer (1993), Hodgson (1996), Lazear (1995), and Hermalin (2000) show. In particular, Hermalin (2000) illustrates how "conventions" can prevent coordination failures and economize on means of ensuring coordination. Additionally, implicit, "culturally given" contracts can often economize relative to more formal explicit contracts. Such cultures exist and persist in firms as mechanism to address more traditional problems (e.g., incomplete contracts, multiple equilibira). Despite the existing theoretical work, empirical studies have primarily been limited to small sample ethnographic observation (e.g., Barley (1983), small sample surveys (Schall (1983)), and experimental economics (e.g., Camerer and Weber (2003)) because of an inherent difficulty in both defining and measuring culture. Perhaps future work can begin to overcome some of these difficulties.

4.4 Measurement Issues

A final explanation is measurement error. If our proxies for the determinants of capital structure are measured with error then the door is open for pre-existing explanations for the differential use of debt across firms. For example, if investment opportunities are not accurately captured by market-to-book ratios or the other covariates, than the residual component of leverage may in fact be reflecting traditional explanations for variation in capital structure. If a firm's ability to "guarantee" the value of its debt is not effectively captured by its profitability, its industry, and the tangibility of its assets then the tensions captured in traditional versions of the static tradeoff theory may lie behind the differences in capital structures that we observe.

There is some recent evidence consistent with this perspective. Shliefer and Vishny (1992) and Morellec (2003) argue that differences in the liquidation values of firms' assets and the resulting variations in debt capacity can generate heterogeneity in capital structures. While we have attempted to control for the fraction of tangible assets within the firm, variation in the liquidation values of these assets can be substantial (Benmelech (2004)). As such, the capital structure decisions may be reflecting the liquidation values or durations (longevity) of the underlying assets of the firm and our measure of asset tangibility is simply too coarse to identify this variation.

Similarly, the results reported in Tables 7 and 8 are not only consistent with a supply side (or market access) argument but also with a demand side (or self selection) argument. Differences across the unexpected leverage portfolios concerning indications of the average number of years from the founding of the firm to the IPO as well as the characteristics (size, maturity, and collateral) and the stated purpose of pre-IPO debt capital may be indicative of differences in fundamental aspects of the business (the longevity or transferability of its assets for example) that help determine the desired amount of leverage.

Given the results presented here, the comment that applies to governance or managerial style explanations applies equally to the frictions of the standard static tradeoff theory. In order for there to be empirical validity, the basic frictions must be such that the balance between the marginal costs and benefits of debt do not change dramatically, either due to the changes inherent in the process of going public or over long periods of time subsequent to the IPO. That is, the underlying frictions should be based on fundamental aspects of the firm's (non-human) assets, business lines, or markets (Kaplan, Sensoy, and Stromberg (2005)).

5. Conclusion

We examined the dynamic behavior of the cross-section of corporate capital structures in order to test recent theories. Our primary result is that leverage is highly persistent, with historical leverage ratios impacting future leverage ratios up to twenty years hence. Moreover, our evidence indicates that the leverage persistence we document extends into the past, prior to the time that a firm goes public. In conjunction with evidence illustrating the relative unimportance of equity market factors (equity returns, equity issuances, etc.) for future leverage, our results cast doubt on the idea that the cross-section of capital structures is largely driven by either market timing (Baker and Wurgler (2002), Chen and Zhao (2004), and Huang and Ritter (2005)) or inertia with respect to changes in equity values (Welch (2004)). Instead, our results point to factors associated with differences in debt policy as the key determinants behind the cross-sectional distribution of leverage.

However, our finding that the cross-section of capital structure is largely determined prior to the IPO suggests that an understanding of firms' initial capital structures is needed in order to better understand capital structure more generally. To this end, we provide preliminary evidence suggesting that capital market segmentation may contribute significantly to cross-sectional heterogeneity in capital structure. Coupled with the recent evidence identifying the importance of such segmentation on public capital structures, our results indicate that supply side frictions may have large and persistent effects on corporate capital structures.

Despite our best efforts, more research is clearly needed on this issue, as well as the other dimensions (e.g., governance, measurement, corporate culture) we discuss.

Importantly, these alternative considerations are neither mutually exclusive nor exhaustive. The conceptual difficulty lies in identifying factors that drive differences in financial policy prior to the time that firms go public and understanding why the differences in financial policy appear to persist for so long after the IPO (even after controlling for differences in traditional observable firm characteristics). We hope to see future research addressing these issues.

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Appendix A: Variable Definitions

This appendix details the variable construction. All numbers in parentheses refer to the 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

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.

Our security issuance variables follow the definitions found in (Hovakimian, Opler, and Titman (2001), Korajczyk and Levy (2003), Hovakimian, (2005), and Leary and Roberts (2004)).

Debt Issuance = a binary variable equal to one if the change in total debt from year *t-1* to year *t* is in excess of 5% of the book value of assets in year *t-1*

Equity Issuance = a binary variable equal to one if dollar amount common and preferred stock sold (108) in year *t* is in excess of 5% of the book value of assets in year *t-1*

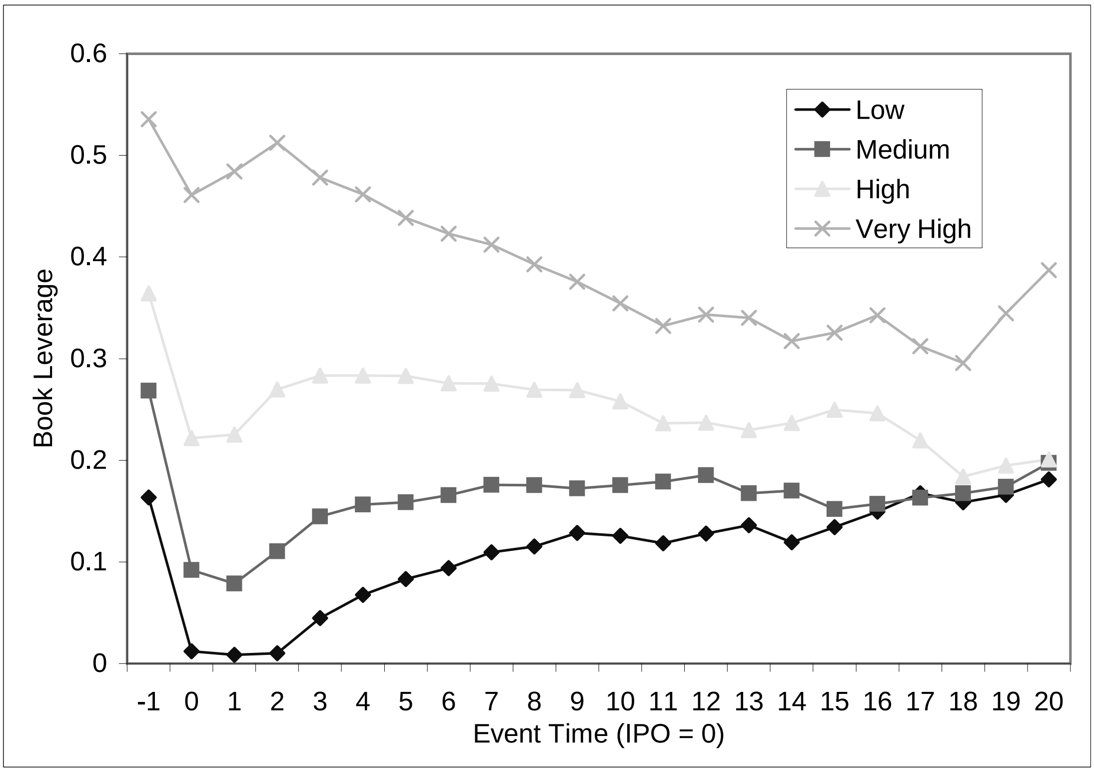
Financially Constrained = binary variable equal to one if long term debt reduction (114) is nonpositive, share repurchases (115) is nonpositive, common dividends is zero (21), and the market-to-book ratio is greater than 1.

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

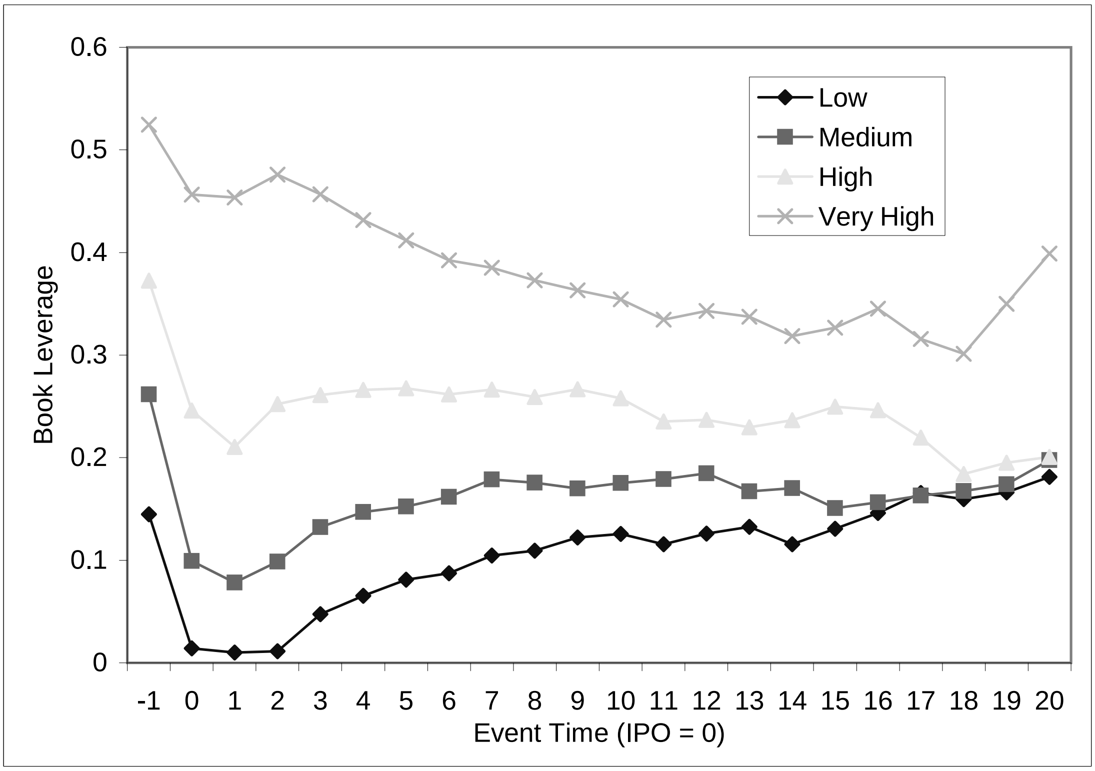
Figure 1
Average Leverage in Event Time for Initial Leverage Portfolios

The sample is all Compustat firms from 1971-2000 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. For panels A and B, portfolios are formed based on quartiles of firms' initial leverage ratios, defined as the average leverage over event year's 0, 1, and 2. For panels C and D, 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 (short-term plus long-term debt divided by assets) on initial values for firm size (log assets), profitability (earnings / assets), market-to-book, and tangibility (tangible assets / assets), year indicator variables, and indicator variables corresponding to the thirty eight Fama/French industries, into quartiles. 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).

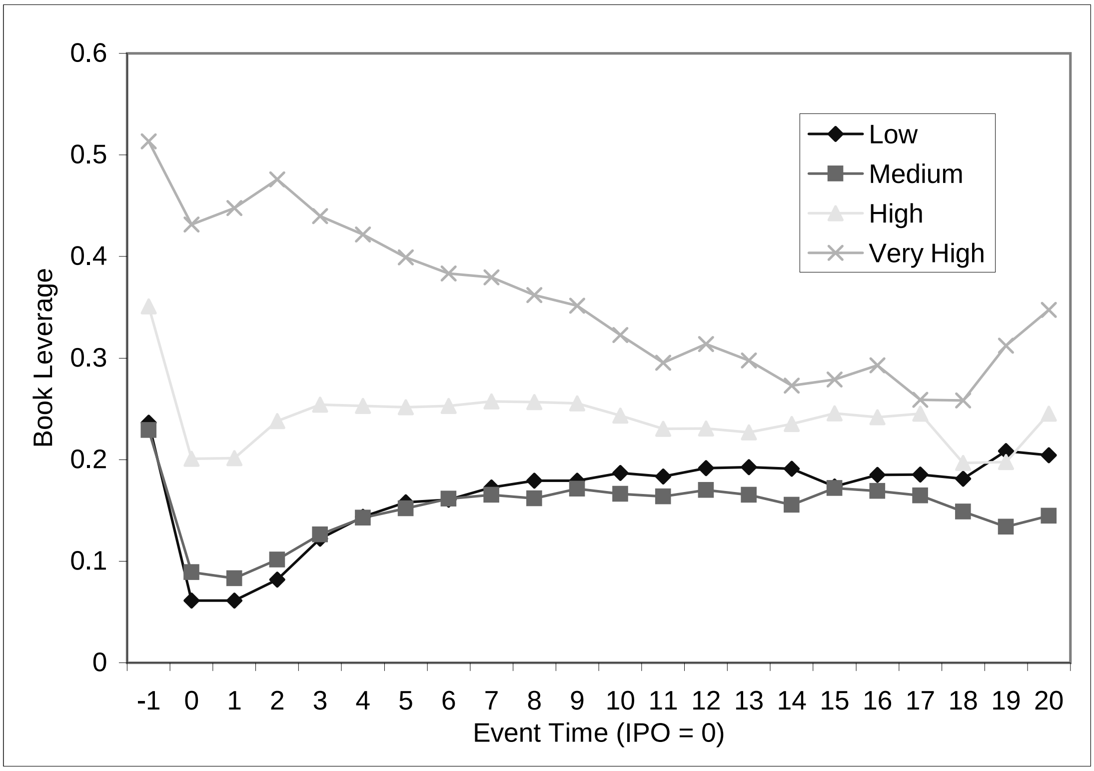
Panel A: Leverage Portfolios (All Firms)



Panel B: Leverage Portfolios (Survivors)



Panel C: Unexpected Leverage Portfolios (All Firms)



Panel D: Unexpected Leverage Portfolios (Survivors)

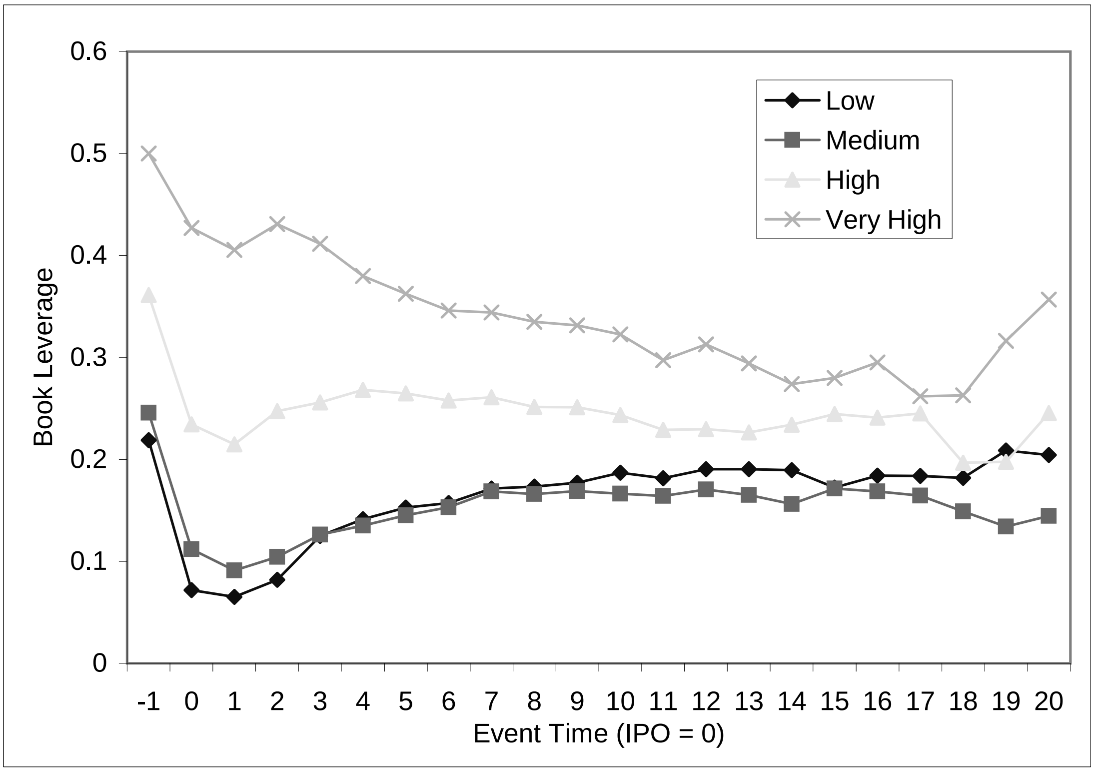
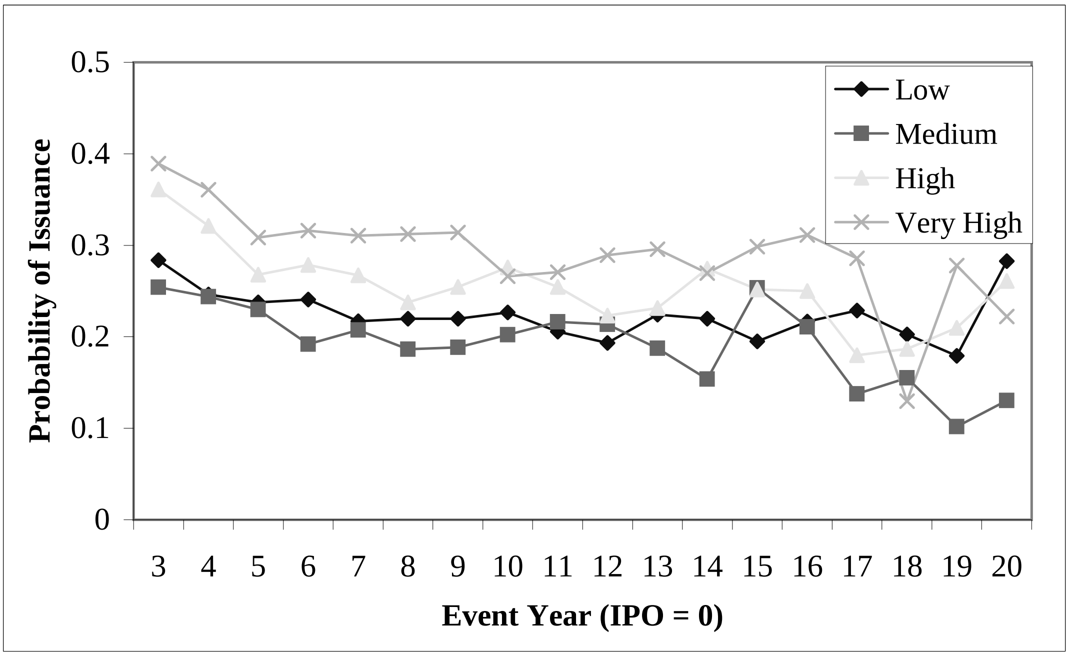


Figure 2

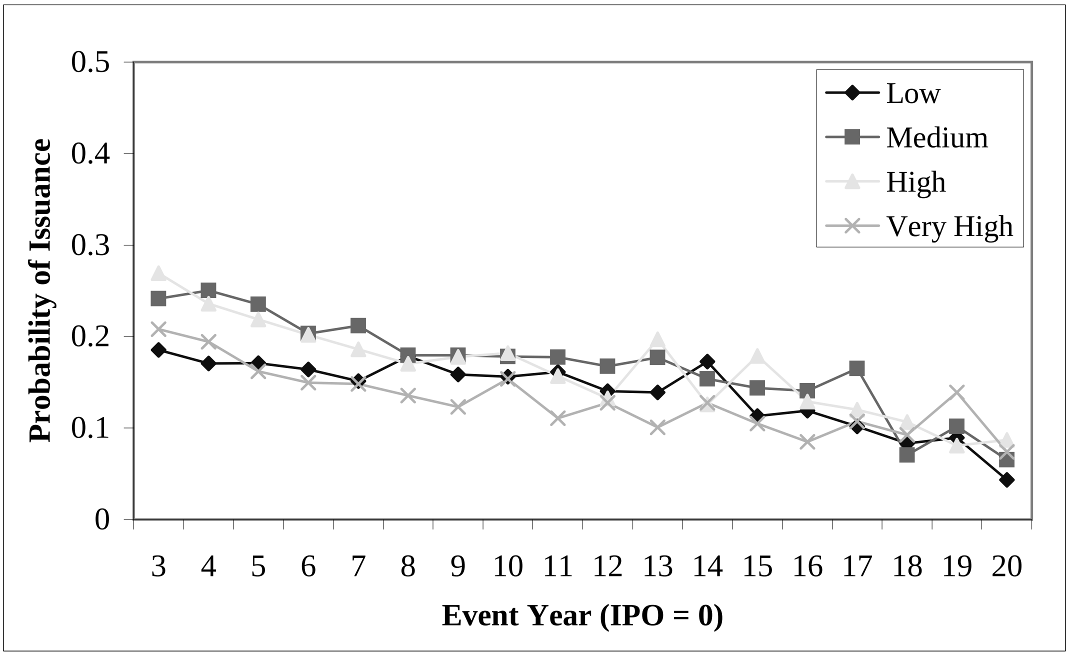
Financing Behavior Across Leverage Portfolios

The sample is all Compustat firms from 1971-2000 for which we have an IPO date. Panel A (B) presents the fraction of firms issuing debt (equity) (equity) for four portfolios constructed by sorting firms on unexpected leverage. Panel C (D) presents the average relative magnitude of debt issuances (equity issuances) for four portfolios constructed by sorting firms on unexpected leverage. The relative magnitude of debt (equity) is defined as the ratio of the change in total debt (sale of common shares) in year t to total assets in year $t-1$. Unexpected leverage is defined as the residual from a cross-sectional regression of initial values for book leverage on initial values for firm size (log assets), profitability (earnings / assets), market-to-book, and tangibility (tangible assets / assets), year dummy variables, and dummy variables corresponding to Fama and French's 38 industries. The initial values are obtained by averaging each variable over the first three years of a firm's public life (event years 0, 1, and 2, where 0 is the year of the IPO). For the dummy variables, we use the values as of the IPO date.

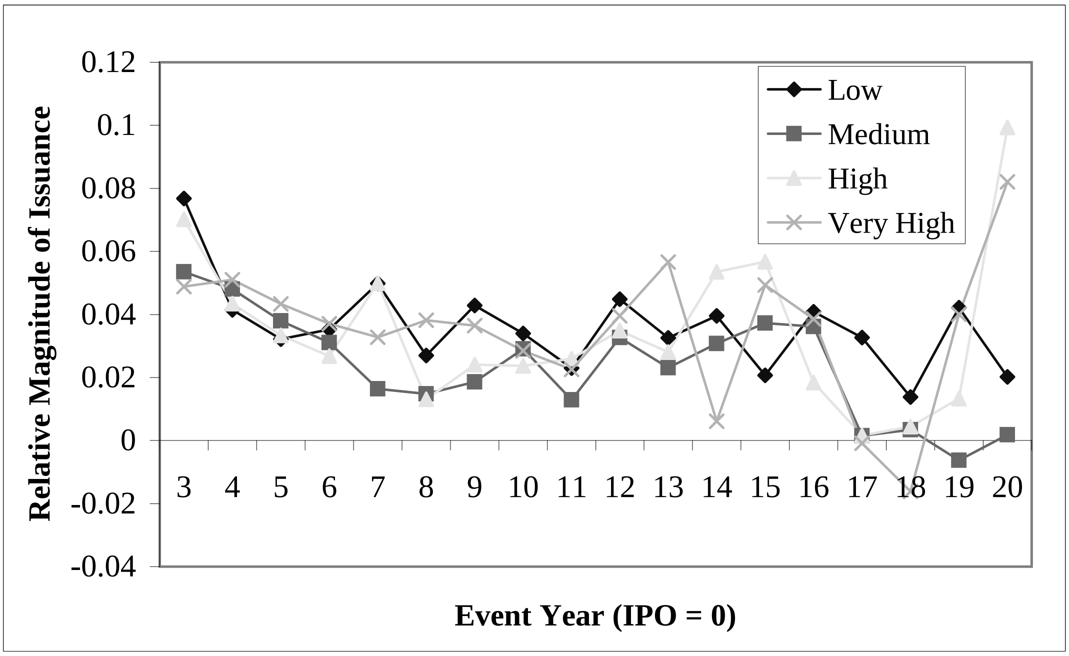
Panel A: Fraction of Firms Issuing Debt (Short- or Long-Term) Each Event Year



Panel B: Fraction of Firms Issuing Equity Each Event Year



Panel C: Average Relative Magnitudes of Debt Issuances Each Event Year



Panel D: Average Relative Magnitudes of Equity Issuances Each Event Year

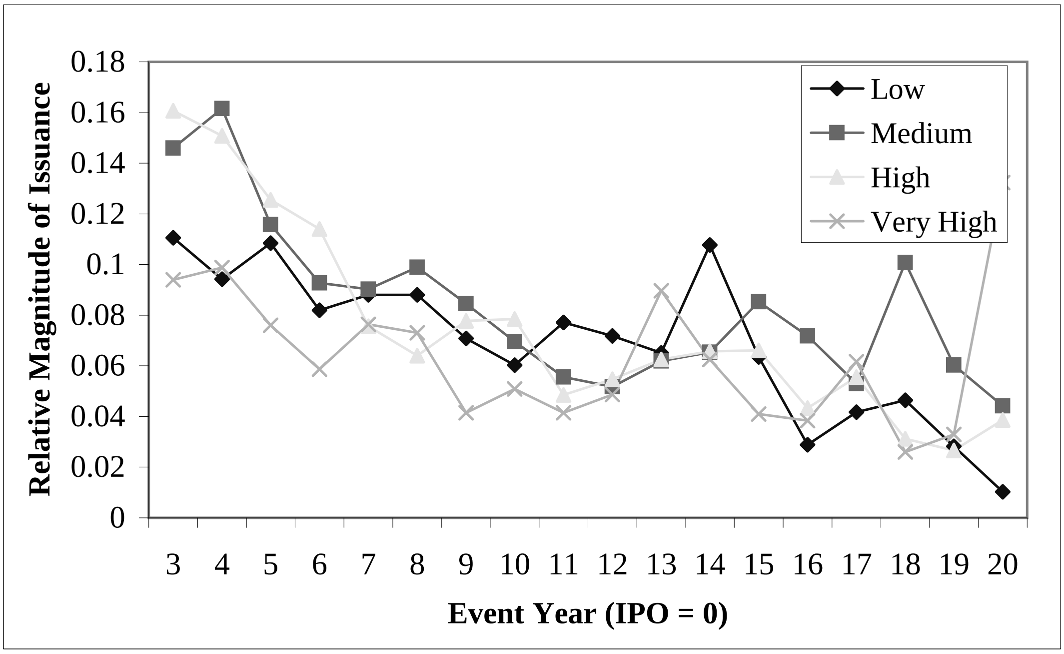


Table 1

Distribution of Firms and Average Firm Characteristics Across Event Years

The sample is all Compustat firms from 1971-2000 for which we have an IPO date. The table presents variable averages in event time relative to the IPO in year zero. Book leverage is the ratio of total debt to total assets. Size is the natural log of total assets deflated by the GDP deflator. Profitability is the ratio of operating income before depreciation to total assets. Market-to-Book is the ratio of the market value of assets to total assets, where the numerator is defined as the sum of market equity, total debt and preferred stock liquidation value less deferred taxes and investment tax credits. Tangibility is the ratio of net physical plant, property and equipment to total assets.

	Full Sample						10-Year Survivors					
Event Year	Firms	Book Leverage	Size	Profitability	Market-to Book	Tangibility	Firms	Book Leverage	Size	Profitability	Market-to Book	Tangibility
-1	4469	0.32	2.74	-0.01	2.10	0.27	1002	0.31	2.67	0.07	3.36	0.29
0	6102	0.19	3.47	0.04	2.39	0.23	1632	0.20	3.29	0.09	2.16	0.25
1	5801	0.20	3.80	-0.01	2.27	0.25	1624	0.18	3.63	0.05	2.23	0.27
2	5297	0.22	3.95	-0.02	2.06	0.27	1623	0.20	3.80	0.04	2.14	0.29
3	4835	0.23	4.05	-0.02	1.95	0.26	1623	0.22	3.95	0.05	1.95	0.29
4	4369	0.23	4.12	-0.01	1.89	0.27	1622	0.22	4.05	0.05	1.89	0.29
5	3814	0.23	4.18	-0.00	1.81	0.26	1622	0.22	4.14	0.05	1.82	0.29
6	3318	0.23	4.22	-0.00	1.81	0.26	1623	0.22	4.21	0.04	1.93	0.29
7	2840	0.24	4.28	0.01	1.77	0.26	1624	0.23	4.30	0.05	1.84	0.28
8	2330	0.23	4.33	0.02	1.76	0.27	1626	0.23	4.36	0.04	1.85	0.28
9	1940	0.23	4.39	0.02	1.75	0.27	1623	0.23	4.40	0.04	1.78	0.28
10	1631	0.22	4.41	0.03	1.84	0.27	1631	0.22	4.41	0.03	1.84	0.27
11	1335	0.21	4.45	0.04	1.80	0.27	1325	0.21	4.45	0.04	1.80	0.27
12	1090	0.22	4.48	0.04	1.78	0.27	1080	0.22	4.49	0.04	1.78	0.27
13	895	0.22	4.45	0.04	1.98	0.27	888	0.22	4.46	0.04	1.98	0.27
14	776	0.21	4.46	0.04	1.99	0.27	768	0.21	4.48	0.05	1.96	0.27
15	657	0.21	4.56	0.03	1.86	0.27	649	0.21	4.58	0.03	1.83	0.27
16	566	0.22	4.54	0.05	1.88	0.26	558	0.22	4.57	0.05	1.83	0.26
17	461	0.21	4.62	0.04	1.78	0.25	456	0.21	4.65	0.04	1.77	0.25
18	315	0.19	4.78	0.05	1.72	0.26	312	0.19	4.80	0.05	1.72	0.26
19	252	0.21	5.01	0.04	1.75	0.24	251	0.21	5.02	0.04	1.75	0.24
20	195	0.22	4.92	-0.01	1.92	0.25	194	0.22	4.93	-0.00	1.91	0.25

Table 2
Leverage Persistence

The sample is all Compustat firms from 1971-2000 for which we have an IPO date. Panel A presents parameter estimates (t-stats) from event time (0 = year of IPO) cross-sectional regressions of book leverage on one-period lagged values *except* for leverage, whose average initial value is used in every regression. Panel B presents parameter estimates (t-stats) from calendar time panel regressions of book leverage on 10-year (20-year) lagged leverage, where all other variables are lagged only one-year. All non-binary variables included in the regressions are standardized to have zero mean and unit variance. Initial leverage is the ratio of total debt to total assets averaged over event years 0, 1, and 2. The natural log of total assets is deflated by the GDP deflator. Market-to-Book is the ratio of the market value of assets to total assets, where the numerator is defined as the sum of market equity, total debt and preferred stock liquidation value less deferred taxes and investment tax credits. Profitability is the ratio of earnings to total assets. Tangibility is the ratio of tangible assets to total assets. Also included in the analysis but not reported are indicator variables calendar years and Fama and French 38 industries. t-stats are in parentheses.

Panel A: Event Time Regressions

Event Year	Intercept	Initial Leverage	Log(Assets)	Market-to Book	Profitability	Tangibility
3	0.23	0.15	0.01	-0.01	-0.02	0.02
	(7.28)	(60.68)	(2.06)	(-5.97)	(-6.36)	(7.05)
4	0.20	0.13	0.02	-0.02	-0.02	0.03
	(5.30)	(45.02)	(5.13)	(-6.00)	(-7.59)	(8.92)
5	0.23	0.12	0.02	-0.02	-0.02	0.04
	(5.57)	(36.51)	(5.05)	(-6.68)	(-6.57)	(10.83)
6	0.23	0.11	0.02	-0.03	-0.03	0.04
	(4.42)	(29.38)	(4.55)	(-7.97)	(-8.12)	(10.28)
7	0.26	0.10	0.01	-0.02	-0.02	0.04
	(4.19)	(24.55)	(3.06)	(-5.46)	(-4.99)	(9.12)
8	0.23	0.09	0.01	-0.03	-0.03	0.05
	(2.79)	(20.58)	(1.72)	(-6.08)	(-6.25)	(10.45)
9	0.27	0.09	0.01	-0.03	-0.02	0.04
	(3.19)	(17.11)	(1.92)	(-5.35)	(-4.02)	(6.62)
10	0.29	0.07	0.02	-0.02	-0.02	0.04
	(3.75)	(13.13)	(2.70)	(-3.26)	(-4.18)	(6.79)
11	0.28	0.06	0.03	-0.03	-0.04	0.04
	(2.75)	(10.34)	(4.48)	(-5.31)	(-6.23)	(6.40)
12	0.31	0.06	0.02	-0.02	-0.02	0.04
	(3.34)	(9.27)	(2.46)	(-3.35)	(-3.67)	(4.74)
13	0.33	0.06	0.01	-0.03	-0.01	0.04
	(1.83)	(7.69)	(1.60)	(-3.79)	(-1.58)	(4.95)
14	0.20	0.05	0.01	-0.02	-0.02	0.05
	(1.09)	(7.14)	(1.30)	(-1.99)	(-2.93)	(5.55)
15	0.16	0.06	0.01	-0.02	-0.02	0.07
	(4.85)	(7.03)	(1.32)	(-3.12)	(-2.52)	(7.51)
16	0.02	0.06	0.00	-0.02	-0.03	0.04
	(0.09)	(6.46)	(0.37)	(-2.22)	(-3.59)	(4.29)
17	0.01	0.05	-0.00	-0.02	-0.03	0.04
	(0.05)	(4.41)	(-0.43)	(-2.03)	(-2.98)	(3.54)
18	0.16	0.04	0.02	-0.03	-0.01	0.02
	(4.59)	(3.93)	(1.39)	(-3.22)	(-0.91)	(1.82)
19	0.22	0.04	0.02	-0.04	-0.01	0.03
	(5.47)	(2.95)	(1.17)	(-2.84)	(-0.79)	(1.55)
20	0.24	0.05	0.00	-0.04	-0.01	0.02
	(5.53)	(3.07)	(0.24)	(-2.91)	(-0.76)	(1.16)
Avg	0.21	0.08	0.01	-0.02	-0.02	0.04
FM t-stat	10.63	9.82	7.29	-12.73	-12.20	13.51

Panel B: Calendar Time Regressions

Variable	Estimate	Estimate
Intercept	0.22	0.22
	(21.52)	(11.42)
10-Year lag Leverage	0.07	.
	(39.15)	(.)
20-Year lag Leverage	.	0.04
	(.)	(13.59)
Log(Assets)	0.02	0.03
	(9.41)	(9.55)
Market-to-Book	-0.02	-0.03
	(-13.79)	(-8.59)
Profitability	-0.05	-0.08
	(-8.22)	(-8.21)
Tangibility	0.04	0.03
	(15.74)	(7.35)
Obs	58,374	18,985

Table 3
Unexpected Leverage State Transition Probabilities

The sample is all Compustat firms from 1971-2000 for which we have an IPO date. The table presents the empirical estimate of the probability transition matrix for the four unexpected leverage portfolios. Unexpected leverage is defined as the residual from a cross-sectional regression of initial values for book leverage on initial values for firm size (log assets), profitability (earnings / assets), market-to-book, and tangibility (tangible assets / assets), year dummy variables, and dummy variables corresponding to Fama and French's 38 industries. The initial values are obtained by averaging each variable over the first three years of a firm's public life (event years 0, 1, and 2, where 0 is the year of the IPO). For the dummy variables, we use the values as of the IPO date. Each element in the table corresponds to the fraction of firms undergoing the transition from state x in period $t-1$ to state y in period t for $x, y \in \{Low, Medium, High, VeryHigh\}$.

	Period t State			
Period $t-1$ State	Low	Medium	High	Very High
Low	0.17	0.06	0.02	0.01
Medium	0.06	0.12	0.06	0.01
High	0.02	0.06	0.13	0.05
Very High	0.01	0.01	0.04	0.18

Table 4

Persistence of Capital Structure Determinants

The sample is all Compustat firms from 1971-2000. Panel A presents parameter estimates (t-stats in parentheses) from event time (0 = year of IPO) cross-sectional regressions of book leverage on average initial values, taken over event years (0,1,2,), for all of the right hand side variables. Panel B presents parameter estimates (t-stats) from calendar time panel regressions of book leverage on 10-year and 20-year lagged variables. All non-binary variables included in the regressions are standardized to have zero mean and unit variance. Initial leverage is the ratio of total debt to total assets averaged over event years 0, 1, and 2. Leverage is the ratio of total debt to total assets. Size is the natural log of total assets deflated by the GDP deflator. Market-to-Book is the ratio of the market value of assets to total assets, where the numerator is defined as the sum of market equity, total debt and preferred stock liquidation value less deferred taxes and investment tax credits. Altman's Z-Score is the ratio of 3.3 times pre-tax income + sales + 1.4 times retained earnings plus 1.22 times working capital all divided by total assets. Dividend Payer is an indicator for whether a firm paid a dividend. Intangible assets is the ratio of intangible assets to total assets. Collateral is the ratio of inventory plus net physical plant property and equipment to total assets. Equity return is the annual equity return computed from compounded monthly returns. Equity Iss (#) is the number of equity issuances. Equity Size ($) is the dollar magnitude of equity issuances. Debt Iss (#) is the number of debt issuances. Debt Size ($) is the dollar magnitude of debt issuances. Also included in the analysis are indicator variables calendar years and Fama and French 38 industries. Also included in the analysis are indicator variables calendar years and Fama and French 38 industries. t-stats are in parentheses and computed using standard errors adjusted for dependence at the firm level.

Panel A: Coefficient Estimates by Event Year: Static Regressors (All Firms)

Event Year	Initial Leverage	Market-to Book	Equity Return	Equity Iss (#)	Equity Iss ($)	Dividend Payer	Intangible Assets	Size	Altman's Z-Score	Collateral	Debt Iss (#)	Debt Iss ($)	Obs
3	0.12	-0.00	-0.01	-0.00	-0.00	0.00	0.01	-0.00	-0.01	0.01	0.03	0.02	3,954
	(37.44)	(-0.45)	(-4.06)	(-0.78)	(-0.21)	(0.29)	(4.71)	(-1.47)	(-2.58)	(4.03)	(9.33)	(8.44)	
4	0.10	-0.01	-0.00	0.00	0.00	-0.00	0.01	-0.00	-0.01	0.02	0.02	0.02	3,537
	(25.77)	(-2.07)	(-0.80)	(0.13)	(0.12)	(-0.14)	(3.61)	(-0.36)	(-2.85)	(5.06)	(5.82)	(5.85)	
5	0.09	-0.00	-0.00	-0.00	0.01	0.00	0.01	0.00	-0.01	0.03	0.02	0.01	3,041
	(19.72)	(-1.29)	(-1.27)	(-0.50)	(1.50)	(0.97)	(3.25)	(0.82)	(-2.24)	(6.46)	(4.99)	(2.48)	
6	0.08	-0.00	-0.00	-0.00	0.00	0.01	0.01	-0.01	-0.01	0.04	0.02	0.01	2,626
	(15.98)	(-0.33)	(-0.52)	(-0.22)	(0.41)	(1.44)	(3.05)	(-1.38)	(-1.63)	(6.74)	(3.52)	(2.31)	
7	0.07	-0.01	-0.00	0.00	0.01	0.01	0.01	-0.00	-0.00	0.03	0.02	0.01	2,219
	(12.52)	(-2.41)	(-0.24)	(0.47)	(1.32)	(1.61)	(1.98)	(-0.89)	(-0.60)	(5.07)	(4.16)	(1.76)	
8	0.06	-0.01	-0.00	0.00	-0.00	0.00	0.01	-0.01	-0.01	0.04	0.02	0.01	1,820
	(9.91)	(-2.49)	(-0.03)	(0.34)	(-0.17)	(0.92)	(1.70)	(-1.28)	(-0.87)	(5.45)	(3.36)	(1.62)	
9	0.07	-0.01	-0.00	-0.00	-0.00	0.01	0.01	-0.01	0.00	0.02	0.02	0.00	1,508
	(10.05)	(-1.38)	(-0.01)	(-0.40)	(-0.04)	(2.28)	(1.64)	(-1.58)	(0.58)	(2.36)	(2.34)	(0.64)	
10	0.06	-0.01	-0.01	0.00	0.00	0.02	0.00	0.00	-0.00	0.02	0.01	0.01	1,254
	(7.20)	(-2.35)	(-1.30)	(0.03)	(0.53)	(2.51)	(0.64)	(0.65)	(-0.49)	(1.85)	(1.77)	(1.09)	
11	0.05	-0.01	-0.01	0.00	0.00	0.02	0.00	0.01	0.00	0.01	0.01	0.01	1,011
	(5.58)	(-1.62)	(-1.20)	(0.56)	(0.30)	(2.45)	(0.26)	(1.07)	(0.17)	(1.09)	(1.02)	(1.63)	
12	0.04	-0.02	-0.01	-0.00	0.00	0.02	-0.01	0.01	-0.00	0.01	0.02	0.01	805
	(4.31)	(-2.13)	(-1.13)	(-0.06)	(0.48)	(2.05)	(-1.09)	(1.19)	(-0.48)	(1.21)	(1.66)	(1.64)	
13	0.05	-0.02	-0.00	0.00	0.01	0.02	-0.01	0.01	0.00	-0.00	0.01	0.01	657
	(4.85)	(-1.90)	(-0.52)	(0.38)	(0.72)	(2.12)	(-1.31)	(0.91)	(0.32)	(-0.26)	(0.76)	(0.79)	
14	0.04	-0.01	-0.01	0.00	0.01	0.02	-0.00	0.00	0.01	0.03	0.01	0.01	564
	(3.33)	(-1.51)	(-1.39)	(0.30)	(1.39)	(2.28)	(-0.14)	(0.14)	(0.99)	(2.27)	(1.15)	(0.89)	
15	0.06	-0.02	-0.00	-0.01	0.01	0.03	-0.00	-0.02	0.02	0.01	0.02	-0.01	470
	(4.81)	(-1.62)	(-0.53)	(-0.76)	(1.46)	(2.63)	(-0.33)	(-1.47)	(1.87)	(1.20)	(2.01)	(-0.90)	
16	0.05	-0.03	-0.01	-0.01	0.02	0.03	-0.02	-0.00	0.01	0.00	0.03	-0.00	396
	(4.10)	(-3.09)	(-0.64)	(-0.88)	(2.15)	(3.03)	(-1.70)	(-0.31)	(0.52)	(0.25)	(2.16)	(-0.16)	
17	0.03	-0.03	-0.00	0.00	0.01	0.01	-0.01	-0.02	-0.00	0.00	0.02	-0.00	313
	(2.03)	(-3.06)	(-0.38)	(0.29)	(0.51)	(1.25)	(-1.03)	(-1.24)	(-0.09)	(0.23)	(1.58)	(-0.13)	
18	0.04	-0.02	-0.01	-0.01	-0.00	0.02	-0.00	-0.01	-0.00	-0.01	0.03	-0.00	203
	(2.20)	(-1.17)	(-0.61)	(-0.54)	(-0.38)	(1.35)	(-0.11)	(-0.67)	(-0.22)	(-0.56)	(1.77)	(-0.30)	
19	0.03	-0.00	-0.02	-0.01	-0.01	0.02	0.00	-0.03	-0.02	0.00	0.01	0.03	159
	(1.45)	(-0.19)	(-1.57)	(-0.36)	(-0.65)	(1.18)	(0.22)	(-1.88)	(-1.03)	(0.19)	(0.57)	(1.44)	
20	0.02	-0.02	-0.04	0.03	-0.03	-0.00	0.03	-0.06	0.01	-0.02	0.00	0.06	113
	(0.79)	(-1.11)	(-2.18)	(1.63)	(-1.60)	(-0.06)	(1.78)	(-2.66)	(0.39)	(-0.71)	(0.12)	(2.36)	
Avg	0.06	-0.01	-0.01	0.00	0.00	0.01	0.00	-0.01	-0.00	0.01	0.02	0.01	.
FM t-stat	9.35	-6.34	-3.53	0.35	0.82	5.88	1.32	-1.89	-0.60	3.72	10.24	3.25	.

Panel A: 10 & 20 Year Lagged Independent Variables

Variable	10-Year Lags	20-Year Lags
Intercept	0.25	0.23
	(10.28)	(5.74)
Leverage	0.07	0.05
	(23.82)	(8.89)
Market-to-Book	-0.01	-0.00
	(-6.28)	(-1.37)
Equity Return	0.01	0.00
	(5.74)	(1.73)
Equity Issue	0.01	0.01
	(2.91)	(1.03)
($) Equity Issued	0.00	0.00
	(0.86)	(0.12)
Dividend Issuer	-0.00	0.01
	(-0.78)	(1.56)
Intangible Assets	0.01	0.01
	(3.35)	(1.33)
Log(Assets)	0.01	0.02
	(4.19)	(4.22)
Z-Score	-0.01	-0.01
	(-2.22)	(-0.89)
Collateral	0.02	0.02
	(5.74)	(3.72)
Debt Issue	0.01	-0.00
	(4.68)	(-0.07)
($) Debt Issued	-0.01	-0.01
	(-3.52)	(-2.15)
Obs	35,241	11,748

Table 5
Debt and Equity Issuance Propensities and Magnitudes

The sample is all Compustat firms from 1971-2000 for which we have an IPO date. The table presents empirical estimates of the likelihood of a debt or equity issuance for each of the four initial unexpected leverage portfolios. Unexpected leverage is defined as the residual from a cross-sectional regression of initial values for book leverage on initial values for firm size (log assets), profitability (earnings / assets), market-to-book, and tangibility (tangible assets / assets), year dummy variables, and dummy variables corresponding to Fama and French's 38 industries. The initial values are obtained by averaging each variable over the first three years of a firm's public life (event years 0, 1, and 2, where 0 is the year of the IPO). For the dummy variables, we use the values as of the IPO date. In Panel A, each event year the fraction of firms in each portfolio issuing debt (equity) is computed. Pr(Issuing) is the event time series average of those probabilities and SE is the corresponding standard error. The t-Statistics of Differences matrix presents t-statistics, computed assuming independence, for the mean difference across various portfolios. For example, the t-statistic for the difference in the probabilities of issuing equity for the Very High and Medium portfolios is -2.6009, which corresponds to the mean difference of 0.1302 - 0.1690 = -0.0388 (not reported). Panel B presents a similar analysis of the average magnitudes of issuances relative to total assets defined as the ratio of sale of common equity (change in total debt) during year t to total assets at the end of year $t-1$.

Panel A: Propensity to Issue Debt and Equity

Unexpected Leverage			t-Statistics of Differences			
Leverage Portfolio	Pr(Issuing)	SE	Low	Medium	High	Very High
			Equity Issuance			
Low	0.1388	0.0092				
Medium	0.1690	0.0123	1.9615			
High	0.1642	0.0121	1.6659	-0.2792		
Very High	0.1302	0.0084	-0.6919	-2.6009	-2.3040	
			Debt Issuance			
Low	0.2244	0.0064				
Medium	0.1925	0.0101	-2.6613			
High	0.2548	0.0102	2.5256	4.3469		
Very High	0.2904	0.0128	4.6217	6.0187	2.1884	

Panel B: Average Relative Magnitudes of Debt and Equity Issuances

Unexpected Leverage			t-Statistics of Differences			
Leverage Portfolio	Magnitude	SE	Low	Medium	High	Very High
			Equity Issuance			
Low	0.0691	0.0069				
Medium	0.0838	0.0076	1.4433			
High	0.0744	0.0092	0.4693	-0.7909		
Very High	0.0635	0.0065	-0.5834	-2.0340	-0.9706	
			Debt Issuance			
Low	0.0361	0.0033				
Medium	0.0235	0.0040	-2.4423			
High	0.0345	0.0058	-0.2400	1.5710		
Very High	0.0352	0.0052	-0.1386	1.7860	0.0945	

Table 6
Target Leverage Models

The sample is all Compustat firms from 1971-2000 for which we have an IPO date. The table presents parameter estimates from panel regressions of book leverage on several different specifications. Leverage is the ratio of total debt to total assets. Initial leverage is the average book leverage over the first three years of being a public firm. Post-IPO leverage is the leverage in the year after the IPO. Lagged leverage is one-year lagged leverage. Median Industry Leverage is the median leverage of the firm's 4-digit industry, excluding the firm from the computation. Z-Score is the ratio of 3.3 times pre-tax income + sales + 1.4 times retained earnings plus 1.22 times working capital all divided by total assets. Size is the natural log of total assets deflated by the GDP deflator. Dividend Payer is an indicator for whether a firm paid a dividend. Intangible assets is the ratio of intangible assets to total assets. Market-to-Book is the ratio of the market value of assets to total assets, where the numerator is defined as the sum of market equity, total debt and preferred stock liquidation value less deferred taxes and investment tax credits. Collateral is the ratio of inventory plus net physical plant property and equipment to total assets. Tangibility is the ratio of net physical plant property and equipment to total assets. Profitability is the ratio of operating income before depreciation to total assets. Industry (year) Fixed Effects denote whether or Fama and French 38 industries (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: Rajan and Zingales Specification

Variable	Estimates (t-stats)				
Intercept	0.19	0.10	0.12	0.04	0.07
	(4.77)	(29.05)	(36.58)	(31.55)	(2.37)
Initial Leverage	.	0.66	.	.	0.55
	(.)	(40.92)	(.)	(.)	(31.18)
Post-IPO Leverage	.	.	0.56	.	.
	(.)	(.)	(33.73)	(.)	(.)
Lagged Leverage	.	.	.	0.86	.
	(.)	(.)	(.)	(157.56)	(.)
Size	0.01	.	.	.	0.01
	(6.52)	(.)	(.)	(.)	(4.57)
Market-to-Book	-0.02	.	.	.	-0.01
	(-14.98)	(.)	(.)	(.)	(-11.20)
Profitability	-0.07	.	.	.	-0.08
	(-8.55)	(.)	(.)	(.)	(-9.34)
Tangibility	0.30	.	.	.	0.18
	(18.23)	(.)	(.)	(.)	(13.18)
Industry Fixed Effects	Yes	No	No	No	Yes
Year Fixed Effects	Yes	No	No	No	Yes
Log Likelihood	5,449.00	6,839.73	6,108.97	15902.99	7,802.37
Adj. R^2	(0.19)	(0.29)	(0.24)	(0.68)	(0.34)
Obs	22593.00	22593.00	22593.00	22593.00	22593.00

Panel B: Frank and Goyal "Tier I" Specification

Variable	Estimates (t-stats)				
Intercept	-0.03	0.10	0.12	0.04	-0.06
	(-0.68)	(29.05)	(36.58)	(31.55)	(-1.90)
Initial Leverage	.	0.66	.	.	0.43
	(.)	(40.92)	(.)	(.)	(24.59)
Post-IPO Leverage	.	.	0.56	.	.
	(.)	(.)	(33.73)	(.)	(.)
Lagged Leverage	.	.	.	0.86	.
	(.)	(.)	(.)	(157.56)	(.)
Median Industry Leverage	0.38	.	.	.	0.26
	(21.22)	(.)	(.)	(.)	(15.46)
Z-Score	-0.01	.	.	.	-0.00
	(-6.22)	(.)	(.)	(.)	(-5.53)
Size	0.01	.	.	.	0.01
	(7.61)	(.)	(.)	(.)	(5.56)
Dividend Payer	-0.06	.	.	.	-0.04
	(-9.62)	(.)	(.)	(.)	(-7.05)
Intangibles	0.35	.	.	.	0.26
	(20.47)	(.)	(.)	(.)	(15.52)
Market-to-Book	-0.01	.	.	.	-0.01
	(-6.81)	(.)	(.)	(.)	(-5.80)
Collateral	0.30	.	.	.	0.21
	(23.06)	(.)	(.)	(.)	(16.86)
Profitability	-0.04	.	.	.	-0.04
	(-3.37)	(.)	(.)	(.)	(-4.40)
Industry Fixed Effects	Yes	No	No	No	Yes
Year Fixed Effects	Yes	No	No	No	Yes
Log Likelihood	7,378.63	6,839.73	6,108.97	15902.99	8,844.86
Adj. R^2	(0.32)	(0.29)	(0.24)	(0.68)	(0.40)
Obs	22593.00	22593.00	22593.00	22593.00	22593.00

Table 7

Average IPO Characteristics Across Unexpected Leverage Portfolios

The sample is all Compustat firms from 1971-2000 for which we have an IPO date. The table presents averages of various firm and offering characteristics at the time of the IPO for four unexpected leverage portfolios. The portfolios are formed by sorting the residuals (i.e., unexpected leverage) from a cross-sectional regression of initial values for book (market) leverage on initial values for firm size (log assets), profitability (earnings / assets), market-to-book, and tangibility (tangible assets / assets), year indicator variables, and indicator variables corresponding to the twelve Fama/French industries, into quartiles. 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. *Venture Capital Backed* is the fraction of firms that were backed by venture capital. *Previous LBO* is the fraction of firms that had previously undergone an LBO. *Unit Offering* is the fraction of firms whose IPO consisted of a unit offering. *Inside Own Before* is the average fraction of the firm owned by insiders before the IPO. *Inside Own After* is the average fraction of the firm owned by insiders after the IPO. *Debt Rating* is the fraction of firms with rated debt. *Years to IPO* is the average number of years between the founding of the firm and the IPO. The first five measures are culled from SDC, debt ratings come from Compustat, and the founding date of the firms is kindly provided by Jay Ritter. Standard errors are in parentheses.

Unexpected Leverage Portfolio	Obs	Venture Capital Backed	Previous LBO	Unit Offering	Inside Own Before	Inside Own After	Debt Rating	Years to IPO
Low	1,498	0.39	0.02	0.08	0.64	0.44	0.01	12.51
		(0.01)	(0.00)	(0.01)	(0.01)	(0.01)	(0.00)	(0.47)
Medium	1,518	0.45	0.02	0.09	0.64	0.43	0.01	11.90
		(0.01)	(0.00)	(0.01)	(0.02)	(0.01)	(0.00)	(0.42)
High	1,499	0.33	0.05	0.11	0.67	0.46	0.02	13.11
		(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.00)	(0.52)
Very High	1,472	0.25	0.06	0.11	0.69	0.45	0.07	14.29
		(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.58)

Table 8

Debt Contract Features for Unexpected Leverage Portfolios

The sample consists of all Compustat firms from 1987-2000 for which we have an IPO date and that also took out a loan recorded in Dealscan prior to the IPO. *Term Loan* is a loan whose face value is typically drawn down at the start of the loan. *Revolving Loan* is a loan whose face value can be drawn down over the life of the loan. *Maturity* is the loan maturity in months. *Loan Size* is the ratio of the face value of the loan to the asset value of the firm in the quarter prior to the inception of the loan. *Syndicate Size* is the number of lenders in the lending syndicate. *Dividend Restriction* is the fraction of loans containing a covenant restricting the payment of dividends. *Secured* is the fraction of loans that are secured by collateral. *Loan Sponsor* is the fraction of loans in which the borrower is sponsored by another firm.

Panel A: Loan Type and Purpose

		Loan Type		Deal Purpose			
Unexpected Leverage Portfolio	Obs	Term Loan	Revolving Loan	Corporate Purposes	Debt Repayment	Takeovers & Asset Acquisitions	Working Capital
Low	379	0.26	0.61	0.39	0.20	0.07	0.20
		(0.02)	(0.03)	(0.03)	(0.02)	(0.01)	(0.02)
Medium	360	0.24	0.57	0.37	0.18	0.05	0.24
		(0.02)	(0.03)	(0.03)	(0.02)	(0.01)	(0.02)
High	487	0.31	0.53	0.32	0.21	0.13	0.21
		(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Very High	707	0.34	0.51	0.25	0.25	0.15	0.14
		(0.02)	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)

Panel B: Loan Characteristics

Unexpected Leverage Portfolio	Obs	Maturity (Months)	Loan Size	Syndicate Size	Dividend Restriction	Secured	Sponsored
Low	379	35.62	50.67	1.72	0.98	0.89	0.03
		(1.40)	(14.00)	(0.11)	(0.01)	(0.02)	(0.01)
Medium	360	35.85	51.00	1.91	0.99	0.90	0.03
		(1.66)	(20.47)	(0.20)	(0.01)	(0.02)	(0.01)
High	487	42.88	34.19	2.37	1.00	0.92	0.06
		(1.48)	(3.98)	(0.19)	(0.00)	(0.01)	(0.01)
Very High	707	55.04	60.56	3.41	0.95	0.94	0.18
		(1.29)	(3.68)	(0.18)	(0.01)	(0.01)	(0.01)

Panel C: Loan Collateral

Unexpected Leverage Portfolio	Obs	A/R Inventory	All Assets	Intangible Assets	Real Estate	PPE
Low	379	0.63	0.13	0.00	0.00	0.25
		(0.13)	(0.13)	(0.00)	(0.00)	(0.09)
Medium	360	0.75	0.00	0.25	0.00	0.00
		(0.14)	(0.00)	(0.14)	(0.00)	(0.00)
High	487	0.31	0.42	0.14	0.00	0.14
		(0.10)	(0.15)	(0.05)	(0.00)	(0.05)
Very High	707	0.20	0.30	0.05	0.15	0.30
		(0.13)	(0.13)	(0.05)	(0.08)	(0.15)

Table 9
Determinants of Initial Unexpected Leverage

The sample is all Compustat firms from 1971-2000 for which we have an IPO date. The table presents coefficient esimmates (t-stats in parentheses) of a regression of initial unexpected leverage on various determinants known at the time of or prior to the IPO. Initial unexpected leverage is defined as the residual from a cross-sectional regession of initial leverage on initial values for firm size (log assets), profitability (earnings / assets), market-to-book, and tangibility (tangible assets / assets), calendar year indicator variables, and indicator variables corresponding to the thirty eight Fama/French industries. Initial values are computed as the average over the first three event years of a firm's life (IPO = event year 0). *Venture Capital Backed* is an indicator variable equal to one if the firm was backed by venture capital. *Previous LBO* is an indicator variable equal to one if fraction of firms that had previously undergone an LBO. *Unit Offering* is an indicator variable equal to one if fraction of firms whose IPO consisted of a unit offering. *Term Loan* is the average number of pre-IPO loans that are term loans. *Revolver* is the average number of pre-IPO loans that are revolving loans. *Maturity* is the average loan maturity in months of pre-IPO loans. *Syndicate Size* is the average number of lenders in the lending syndicates of pre-IPO loans. *Secured* is the fraction of pre-IPO loans that are secured. *Loan Sponsor* is the fraction of pre-IPO loans in which the borrower is sponsored by another company.

Variable	Estimate
Intercept	-0.09
	(3.00)
Venture Capital Backed	-0.02
	(1.63)
Previous LBO	0.01
	(0.23)
Unit Offering	0.08
	(2.26)
Term Loan	-0.01
	(0.43)
Revolver	-0.02
	(0.97)
Corp. Purposes	-0.01
	(0.69)
Takeover / Acquisition	0.04
	(1.56)
Loan Maturity	0.00
	(3.06)
Secured	0.08
	(3.86)
Syndicate Size	0.01
	(3.85)
Loan Sponsor	0.10
	(3.11)
Adj. R^2	0.11
Observations	754