A Closer Examination of Capital Structure Convergence and Persistence*

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Abstract

Lemmon et al. (2008) document two features of the data on firm capital structure: convergence and persistence. They sort firms by leverage ratios and find that firms with relatively high (low) leverage tend to move toward more moderate levels of leverage; and despite this convergence, firms with initially high (low) leverage tend to maintain relatively high (low) leverage. We replicate their results in this study and examine more closely the persistence and convergence features. The test results reveal that the observed convergence in our samples is most likely due to a statistical fallacy called the "regression fallacy" and is mechanical rather than real, while the persistence feature remains valid throughout the tests. In fact, the mechanical convergence sources from a permanent component in leverage ratios and the misclassification problem in portfolio construction. To control for the misclassification problem, we propose a method in which firms are sorted in terms of the time-series average of leverage instead of the portfolio formation year leverage. Taking this approach, the convergence feature in our sample is reduced. A decrease in the convergence feature confirms the mechanical nature of the observed convergence further. Finally, we propose two possible driving forces of capital structure persistence.

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1. Introduction

The modern theory of capital structure starts with Modigliani and Miller's (1958, 1963) proof of capital structure irrelevance. Subsequent research relaxes assumptions of the Modigliani-Miller theorem and develops various capital structure theories. Among them, the most noteworthy ones are the trade-off theory and the pecking order theory, which dominated the literature for decades.

The trade-off theory predicts a target leverage ratio that depends on the benefits and costs of debt. Graham and Harvey (2001) provide survey evidence that supports this prediction moderately. Recent studies argue that since the benefits and costs of debt change over time as firm characteristics change, the leverage target should be time-varying. Hovakimian et al. (2001) employ a two-step procedure in which the target leverage ratio is first estimated from firm attributes and then the deviation from the target is used to predict the firm's debt-equity choice. They find supporting evidence of the existence of a time-varying target. However, due to adjustment costs (e.g. Leary and Roberts (2005)), complete adjustment is rare in reality. Firms adjust toward the target partially each year. Fama and French (2002) estimate a speed of adjustment of 7-10% per year for dividend payers and 15-18% per year for non-payers. Subsequent research on the partial adjustment model mainly involves econometric issues and estimate a speed of adjustment ranging from 11% to 34% (e.g. Flannery and Rangan (2006), Lemmon et al. (2008), Huang and Ritter (2007), Flannery and Hankins (2007)). Despite the development of the target adjustment model, there is a line of research that questions its validity. Shyam-Sunder and Myers (1999), Chen and Zhao (2007) and Chang and Dasgupta (2008) provide evidence demonstrating that the leverage ratio tends to revert to the mean mechanically regardless of the firm's financing preference.

The pecking-order theory gains less and less support in recent years. Shyam-Sunder and Myers (1999) point out that if firms follow the pecking-order theory, the financing deficit should be matched dollar-for-dollar by the change in corporate debt. Frank and Goyal (2003) examine Shyam-Sunder and Myers's prediction using a large sample of U.S. firms and find that firms, especially small firms, issue a large amount of equity to finance the deficit, which is contradict to the prediction. Fama and French (2005) find that in contrast to the pecking order prediction that firms rarely issue stock, most firms issue or retire equity each year, and the issues are on average large and not typically done by firms under duress. They thus conclude (p.580-581): "If so, the pecking order, as the stand-alone model of capital structure proposed by Myers (1984), is dead: financing with equity is not a last resort, and asymmetric information problems are not the sole (or perhaps even an important) determinant of capital structures."

Despite the development of existing theories, capital structure research has diverged from these theories in an attempt to explore the evolution and determinants of capital structure in a broader setting. Baker and Wurgler (2002) find that market timing has a significant impact on capital structure and the impact lasts for a long time. They conclude that capital structure is the cumulative outcome of management's past attempts to time the equity market. Welch (2004) documents that a firm's current capital structure varies almost one-to-one with an implied debt ratio variable that assumes no new issuance of debt or equity. He thus argues that firms are indifferent to capital structure so that stock return effects are the real determinants of market-based leverage ratios. Malmendier et al. (2005) observe that overconfident CEOs access external capital markets more conservatively and are more likely to cover financing deficit with debt, as they believe that their firm's securities are undervalued.

Although subsequent studies (e.g. Leary and Roberts (2005), Liu (2005) and Alti (2006)) try to reconcile existing theories with recent findings, it seems that capital structure theory is still far from complete as more and more new evidence emerges.

Lemmon et al. (2008) document two features of the capital structure data that are not identified by previous studies, namely, capital structure convergence and persistence. They sort firms into quartiles each year in terms of their leverage ratios and plot the evolution of portfolio leverages in subsequent years. The graphs reveal that firms with relatively high (low) leverage tend to move toward more moderate levels of leverage; and despite the convergence, firms with initially high (low) leverage tend to maintain relatively high (low) leverage. They include the firm's initial leverage in a leverage regression and find that initial leverage plays an essential role in the firm's future leverage choices. They then turn to analysis of covariance (ANCOVA) and observe that the majority of the total variation in leverage is due to cross-sectional differences, as opposed to time-series variation. The authors argue that the firm's active management of capital structure is the likely explanation for the convergence feature, while leaving the exploration of the source of the persistence feature to future research. However, the authors go one step further showing that the capital structure persistence can cast back to a firm's IPO year or even the private stage of the firm's evolution.

This study follows Lemmon et al. (2008) in an attempt to give a closer examination of the convergence and persistence features of capital structure. We follow their sample selection procedures as closely as possible and replicate their main findings first. In particular, we construct the graphs that present the evolution of leverage and perform the regression that incorporates initial leverage as one of the leverage determinants. Our empirical results are quantitatively similar to those of Lemmon et al.

(2008); both convergence and persistence features are fairly strong and initial leverage is highly significant in the regressions in our samples. Therefore, we do not question their empirical findings.

However, questions arise when we reevaluate their conclusions about the convergence feature. It is likely that the analysis of Lemmon et al. (2008) on capital structure convergence has fallen into a common fallacy in statistical analysis called the "regression fallacy". To address this issue, we first examine the portfolio leverages before rather than after the portfolio formation year. If the convergence feature is real, portfolio leverages must have the same behavior no matter whether we look backward or forward. In sharp contrast, when the pre portfolio formation year leverage is examined, a divergence pattern is observed. Next, we examine one implication of capital structure convergence: if leverage ratios converge to a moderate level over time, their cross-sectional variance will decrease. We find evidence counter to this implication. We observe little decrease in the cross-sectional variance of leverage ratios over time. Taken together, the two tests provide strong evidence of the mechanical nature of the convergence pattern observed in our samples, as well as that documented in Lemmon et al. (2008).

Although capital structure convergence is not supported by our tests, capital structure persistence remains valid in our sample, confirming the argument of Lemmon et al. (2008) that there is a permanent component in leverage ratios. It is probable that the permanent component, together with the misclassification problem in portfolio construction, induces the convergence in capital structure. For example, if firms are sorted into quartiles according to the portfolio formation year leverage, it is highly probable that some firms are classified into the wrong portfolios. When the leverage ratios revert back to the permanent component over time, high and low leverage portfolios are pushed to the centre, inducing the convergence of these portfolios. The middle two remain in the centre and have relatively stable leverage ratios. This misclassification argument explains the behavior of leverage portfolios and illustrates the mechanical nature of capital structure convergence. It has two noteworthy implications. Capital structure convergence will be more severe and initial leverage will be less significant for firms with high leverage ratio variance. We test the two implications through splitting the sample into subsamples with different levels of leverage ratio variance. The results are consistent with the implications, confirming the misclassification argument and cautioning against the regression method adopted in Lemmon et al. (2008) that relies on the role of initial leverage in making inferences on capital structure persistence.

To control for the mechanical convergence, we sort firms in terms of the time-series average of their leverage instead of the portfolio formation year leverage. When the firm's average leverage across the sample period is adopted, we find that the convergence pattern disappears almost completely in the samples. However, caution must be exercised in interpreting the evidence, as the average leverage across the sample period is an ex-post measure. To address this issue, we perform the same operation using the firm's average past leverage, which is an ex-ante measure. Although capital structure convergence does not disappear in this case, it is reduced significantly. In a further test, we incorporate average past leverage into the regression and observe that average past leverage plays a more significant role in the firm's leverage choices than initial leverage. This evidence provides stronger support for capital structure persistence.

The rest of the paper is organized as follows. Section 2 describes the data. Section 3 replicates the main results of Lemmon et al. (2008). Section 4 reinterprets the evolution of leverage. Section 5 depicts the role of the time-series average of leverage. Section 6 proposes future research topics, and Section 7 concludes.

2. Data

This section gives a brief description of the sample selection as well as summary statistics. The primary sample consists of all firms in the merged COMPUSTAT/CRSP database. Following Lemmon et al. (2008), we restrict the sample period to 1965-2003. Financial firms with SIC codes between 6000 and 6999 are excluded. Further, we require that all firm-years have nonmissing data for book assets and that the leverage ratios (both book and market) lie in the closed unit interval. All the other variables in the multivariate analysis are required to have nonmissing data and are winsorized at both the upper and lower one-percentile. Variable definitions are presented in Table 1.

Table 2 presents the summary statistics for the entire sample (All Firms), the subsample of firms with at least 20 years of data (Survivors) and the subsample of the remaining firms (Non-Survivors). The Survivors sample is used to address the potential survivorship bias, since approximately 60% of the observations in the All Firms sample come from the Non-Survivors sample, which include firms with no more than 20 years of data.

Comparison of the three samples reveals that firms in the Survivors sample tend to be large, mature firms. They have larger sales, fewer growth opportunities, greater profitability, more tangible assets, smaller cash flow volatility, and higher probability of paying dividends. These firms also tend to have higher leverage ratios, especially market leverage. Firms in the Non-Survivors sample are just in the opposite. These findings are consistent with previous studies on the determinants of leverage ratios

(Titman and Wessels (1980), Rajan and Zingales (1995), and Frank and Goyal (2007b)).

The summary statistics also reveals the differing distribution of leverage ratios in the three samples. It can be seen from Table 2 that the standard deviation of leverage ratios for the Non-Survivors sample is larger than that of the other two samples, indicating the larger dispersion of leverage ratios in this sample. To explore the source of the dispersion, we plot the histogram of leverage ratios for the three samples separately and present the graphs in Figure 1. The graphs show that the leverage ratios in the Non-Survivors sample are much less concentrated that that of the other two samples and a larger fraction of observations in this sample have zero or extremely high leverage ratios. As most firms in the Non-Survivors sample are small, growth firms, it is not surprising that they tend to have extremely low or even zero leverage. Moreover, since firms in this sample have short lives, it is not surprising as well that a higher fraction of firms in this sample have extremely high leverage ratios as they approach bankruptcy. The summary statistics as well as the histogram caution against subsequent analysis on the All Firms sample with regard to the possible survivorship bias.

3. Replication of Lemmon et al. (2008)

Since the purpose of this study is to explore the source of capital structure convergence and persistence, the empirical tests begin with replicating the key results of Lemmon et al. (2008).

3.1. The Evolution of Leverage

The first remarkable finding of Lemmon et al. (2008) comes from their graphs presenting the evolution of leverage portfolios in event time. The graphs are constructed in the following way: First, each calendar year, firms are sorted into quartiles according to their leverage ratios, denoted as: Very High, High, Medium, and Low. The portfolio formation year is denoted event year 0. Second, the average leverage for each portfolio is calculated in each of the subsequent 20 years, holding the portfolio composition constant unless a firm exits the sample. Third, the two steps of sorting and averaging are repeated for every year in the sample period. This process generates 39 sets of event time averages, one for each calendar year in the sample. Fourth, the average leverage of each portfolio across the 39 sets is computed and plotted in the figure by event year.

We perform the same exercise as Lemmon et al. (2008) and present the evolution of leverage portfolios for the All Firms sample in Panel A of Figure 2. Graph (I) shows that at the portfolio formation year, there is a large dispersion among the book leverage portfolios. The leverage of Very High is 53% while that of Low is only 3%, a difference of as high as 50%. In the following 10 years, the leverage of Very High drops sharply to 37% while that of Low increases to 16%, reducing the difference to only 21%. Afterwards, the speed of convergence declines remarkably and leaves a book leverage of 35% for Very High and 19% for Low, a difference of 17%. As to High and Medium, the leverage ratios remain fairly stable over time and lie between Very High and Low across the event period. The market leverage portfolios display a similar pattern in Graph (II).

Two features of the graphs are worth noting. First, leverage ratios exhibit a significant amount of convergence over time. Both high and low leverage portfolios converge to a moderate level at the end of the event period. Furthermore, most of the convergence occurs in the first few years after the formation year. Afterwards, the speed of convergence declines sharply. Second, despite the convergence, leverage ratios are remarkably persistent over time. All the leverage portfolios maintain their relative position during the whole event period. The order Very High, High, Medium and Low remains even after 20 years.

However, caution must be exercised in interpreting the evidence. As shown in Section 3, the Non-Survivors sample has a large fraction of observations with zero or extremely high leverage, most of which are classified into the Low portfolio or Very High portfolio. As firms in this sample exit the All Firms sample over time, the portfolio leverage of Very High must decrease while that of Low must increase, causing the convergence in leverage ratios. To address the potential survivorship bias depicted above, we repeat the same operations on the Survivors sample and present the graphs in Panel B of Figure 2. These graphs reveal negligible differences between the Survivors sample and the All Firms sample in terms of the evolution of leverage, demonstrating that survivorship bias is not the major driving force of the convergence and persistence features in capital structure.[1]

Lemmon et al. (2008) conclude from Figure 2 that there are two components in firms' leverage ratios: a transitory component corresponding to capital structure convergence, and a permanent component corresponding to capital structure persistence. The authors argue that it is the permanent component only that makes leverage ratios persist in a largely time-invariant and at a firm-specific level. This argument contrasts with recent studies that emphasize the importance of time-varying leverage targets (e.g. Hovakimian et al. (2001), Fama and French (2002), Flannery and Rangan (2006), Lemmon et al. (2008), Huang and Ritter (2007), Flannery and Hankins (2007)).

[1] In unreported results, we also replicate other robustness checks in Lemmon et al. (2008) and obtain similar results.

3.2. The Role of Initial Leverage

The persistence of leverage ratios at a firm specific level implies that the firm' future leverage ratio is closely related to its initial leverage ratio. To verify this implication, Lemmon et al. (2008) estimate the following regression specification:

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

where i indexes firms, t indexes years, X is a set of control variables, $Leverage_{i0}$ is firm i's initial leverage, which is proxied by the first nonmissing value of leverage, v is a year fixed effect, and ε is a random error term assumed to be possibly heteroskedastic and correlated within firms (Peterson (2008)). To avoid an identity at the initial year, the authors drop the first observation for each firm from the regression.

We run the same regression as Lemmon et al. (2008) using pooled OLS[2] and report the results in Table 3. The results for the All Firms sample are presented in Panel A. Column (I) shows that the coefficient of initial book leverage is both statistically and economically significant in a model consisting of solely initial book leverage. A one unit change in initial book leverage corresponds to an average change of 52% in future values of leverage. A more significant effect is found for market leverage. Column (III) shows that a one unit change in a firm's initial market leverage leads to a change of as high as 60.9% in future market leverage. These results are consistent with the finding of Figure 2 with regard to capital structure persistence.

To control for the effect of leverage factors, we estimate the regression specification, including the one-period lagged value of leverage determinants. The results are presented in Columns (II) and (IV). Consistent with prior studies (Rajan

[2] In unreported results, the same regression is performed using a Random Effects Panel method. The results are similar.

and Zingales (1995), Baker and Wurgler (2002), and Frank and Goyal (2003, 2007)), leverage ratios are found to be positively associated with firm size, tangibility and cash flow volatility of assets, and negatively associated with market-to-book ratio, profitability, and dividend payment. Also, industry median leverage plays an important role in the firm's leverage choices, indicating leverage differences among industries. Nevertheless, inclusion of these leverage determinants does not have a large impact on the importance of initial leverage. Column (II) reveals that initial book leverage is highly significant and larger in magnitude than all the other determinants except for industry median leverage. A one unit change in a firm's initial book leverage corresponds to an average change of 35.5% in future book leverage. Again, the effect is more significant for market leverage. A one unit change of initial market leverage corresponds to an average change of 37.2% in future market leverage.

One concern with the interpretation is that initial leverage may simply proxy for leverage lagged only a few periods since some firms in the sample have a small number of time series observations. As a robustness check, the same regression specification is performed on the Survivors sample, which has an average number of time series observations of 28 years. The results are presented in Panel B of Table 3, where the reported findings are qualitatively similar to those of the All Firms sample.

The regression results emphasize that initial leverage is an important determinant of future leverage, even after controlling for traditional sources of variation. These results confirm the finding of Figure 2 with regard to capital structure persistence. Lemmon et al. (2008) go one step further through showing that the persistence of leverage ratios on the firm specific level can be traced to the IPO year or even the firm's private stage.

As to the source of capital structure convergence and persistence, the authors resort to firms' active management of capital structure as the explanation of the convergence feature but do not offer an explanation for this persistence feature. This leaves two open questions for future research: What determines the initial choice of leverage? And what is the driving force behind the persistence on the initial choice?

4. Reinterpreting the Evidence

Section 3.1 has described the two most remarkable findings of Lemmon et al. (2008), namely, capital structure convergence and persistence. However, it seems from the history of statistics that the analysis of Lemmon et al. (2008) fall into a common fallacy in statistical analysis called the "regression fallacy".[3] The fallacy often arises when the sample is first split into high-value and low-value subsamples and the subsamples are then analyzed separately.

4.1. Tests of the Regression Fallacy

A classic example of the fallacy is Secrist (1933). The author begins with analyzing the profitability of 49 department stores. He first divides the stores in the sample into four equal groups based on the initial year profitability and then calculates average profitability of these groups over time – a method almost identical to that of Lemmon et al. (2008). He finds a remarkable tendency of the group profitability to converge toward the overall average. The author repeats the analysis on a large number of other industrial times series and observes the same pattern. He concludes that American business was actually converging toward mediocrity.

However, Hotelling (1933) points out in a review of Secrist's (1933) work that the

[3] Detailed illustration of the fallacy can be found in Friedman (1992), Stigler (1997), and Becker and Greene (2001). We appreciate Stephen Brown for referring us the literature.

apparent convergence of the group averages is a statistical accident, resulting from the method of grouping. Since the groups are formed by possibly extreme values, the average value of each group will converge to a moderate level as the individual values regress to the mean. If the groups are formed by the values in the last year rather than the first year, the graphs will exhibit divergence rather than convergence. Hotelling (1933, p464) concludes that "these diagrams really prove nothing more than that the ratios in question have a tendency to wander about". He points out further that the real evidence of a tendency to convergence is a decreasing cross-sectional variance, not among group averages, but among individual values. Other examples of the regression fallacy in economic literature include Sharpe (1985) and Baumol et al. (1989).

To address the statistical issues of capital structure convergence, we follow the suggestions of Hotelling (1933) and create new graphs with the portfolio formation year being the last year of the event period rather than the first year. The graphs are constructed in the same way as those in Figure 2 except for the second step: we examine the average leverage for each portfolio in each of the previous 20 years, instead of the subsequent 20 years, holding the portfolio composition constant unless a firm has not entered the sample. If the capital structure convergence in Lemmon et al. (2008) is a statistical fallacy, the new graphs will exhibit divergence rather than convergence. The graphs are presented in Figure 3. As expected, although the leverage portfolios still exhibit persistence and are much more volatile, they diverge to more extreme values over the event time rather than converge to a moderate level. The observed divergence casts doubt on the validity of the conclusion of capital structure convergence. It seems from Figures 2 and 3 that the greatest dispersion among leverage portfolios is always observed at the portfolio formation year.[4]

[4] In unreported results, we present the portfolio leverage of both the previous and subsequent 10 years of the portfolio formation year and find evidence consistent with the argument. The greatest dispersion among leverage

Next, we investigate the evolution of the cross-sectional variance of leverage ratios among individual firms. To ensure consistency with Figure 2, we construct the graphs in the following manner: First, a portfolio is formed each calendar year, including all the firms in that year. The portfolio formation year is denoted event year 0. Second, cross-sectional variance of leverage ratios are calculated in each of the subsequent 20 years, holding the portfolio composition constant unless a firm exits the sample. Third, the calculation is repeated for every year in the sample period. This process generates 39 sets of event time variances, one for each calendar year in the sample. Fourth, the average variance of the portfolio across the 39 sets is computed and plotted in the figure by event year. The generated graphs are presented in Figure 4.

Panel A shows that the variance of both book and market leverage of the All Firms sample decline slightly over time. It seems that the documented decline provides some supporting evidence for capital structure convergence. However, caution must be exercised in interpreting the evidence. As shown in Section 3, the Non-Survivors sample, which contains firms with short lives and extreme leverage ratios, constitutes a large fraction of observations to the All Firms sample. When firms in this sample exit the portfolios over event time, the cross-sectional variance of leverage ratios must decrease. Therefore, it is likely that the observed decline in Panel A is induced by the survivorship bias. To address this issue, we perform the same exercise on the Survivors sample, which suffers less from the survivorship bias. The graph is presented in Panel B and reveals that the cross-sectional variance of this sample is fairly stable and does not have any decreasing trend. The graphs provide evidence against the validity of the convergence feature in capital structure, at least in the Survivors sample. From the above tests, it is highly probable that the analysis of

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portfolios appears at the portfolio formation year. No matter we move forward or backward, the dispersion decreases, leading to divergence before the portfolio formation year and convergence after the portfolio formation year.

Lemmon et al. (2008) in Figure 1 falls into the same regression fallacy as does Secrist (1933).

4.2. The Misclassification Argument and Its Implications

The tests in Section 4.1 demonstrate that the convergence feature in Figure 1 is illusory. We will illustrate briefly why this happens in the following. As verified in Lemmon et al. (2008), there is a permanent component in capital structure, and leverage ratios persist on and fluctuate around it over time. However, at each portfolio formation year, the leverage ratio is not necessarily equal to the permanent component. Rather, it may be far larger or smaller. The consequence of sorting firms based on the portfolio formation year values is a misclassification of firms which results in convergence of the portfolio averages. The event year averaging method in Lemmon et al. (2008) magnifies the convergence further as the misclassification problem occurs each calendar year.

Take the Very High portfolio for example, although our intention is to include all the firms with the highest leverage ratio in this portfolio, we may include some firms with high leverage in the portfolio formation year but low permanent component and miss some firms with low leverage in the portfolio formation year but high permanent component. Because the Very High portfolio lies in the higher margin, the misclassification only occurs at its lower boundary. When we move away from the portfolio formation year (no matter forward or backward), the regression of the leverage ratio towards the permanent component generates a single force that pushes the portfolio leverage downward. Since the regression is a short-term phenomenon, most of the convergence or divergence occurs in the first few years around the portfolio formation year. The same principle applies to the Low portfolio but in an opposite direction. As to the High portfolio and the Medium portfolio, since they lie in the center, the misclassification occurs at both their higher and lower boundaries. The regression of the leverage ratio towards the permanent component generates two forces, one pushes the portfolio leverage up and the other pushes it down. The two forces cancel out each other, resulting in the relatively stable portfolio leverage of the High portfolio and the Medium portfolio.

One immediate implication of the misclassification argument is that capital structure convergence will be more significant for firms with a higher leverage ratio variance, since the more volatile the leverage ratio is, the higher probability that the portfolio formation year value is extreme and hence more misclassification problems will occur. In an attempt to test this implication, we split the All Firms sample into two subsamples with equal number of firms in terms of the leverage ratio variance of individual firms. We construct graphs for the subsamples separately in the same manner as that used to construct Figure 2. The graphs are presented in Figure 5 and confirm the implication. It can be seen from Graphs (I) and (II) of Panel A that the convergence among portfolios is remarkably significant whereas little persistence is observed for the subsample of firms with high leverage ratio variance. The High portfolio and Medium portfolio even switch their relative level at the end of the event period. In sharp contrast, Graphs (III) and (IV) of Panel A show that the leverage ratios of the subsample of firms with low leverage ratio variance are fairly persistent. Only slight convergence is observed among the leverage portfolios. The graphs for the Survivors sample are presented in Panel B and exhibit similar patterns.

Another implication of the misclassification argument is related to the regression specification in Lemmon et al. (2008). Not only the portfolio formation year leverage, but also the initial leverage, which is proxied for by the first nonmissing value of leverage, is more likely to be extreme for firms with a higher leverage ratio variance. This results in the negative relationship between the significance of initial leverage and the leverage ratio variance. To verify the implication, we split the samples into four subsamples[5] with equal number of firms in terms of the leverage ratio variance of individual firms and perform the same regression specification as Equation (1) on the subsamples separately. The regression results are presented in Table 4. The results of the All Firms sample in Panel A show that even after controlling for firm characteristics, both the coefficient and the statistical significance of initial leverage (both book and market) decrease sharply as the leverage ratio variance increases. The R-squared of the regression decreases markedly as well, depicting the declining explanatory power of the initial leverage and other determinants for high leverage ratio variance firms. Regression results of the Survivors sample are presented in Panel B and are quantitatively similar.

The evidence documented above suggests caution in adopting the methods in Lemmon et al. (2008) to make inferences regarding capital structure convergence and persistence. In the 2006 version of Chang and Dasgupta (2008), the authors replicate the graphs in Lemmon et al. (2008) with regard to the evolution of leverage ratios[6] for the actual data as well as simulated samples. They find that capital structure persistence disappears only in the simulated sample in which the financing deficit and change in retained earnings are drawn randomly and firms finance the deficit by a coin toss[7]. The leverage portfolios in the random deficit sample converge rapidly and become almost indistinguishable at the end of the event period. They then exercise the same regression specification as Equation (1) on the random deficit sample as a double check and find that the significance of initial leverage is far smaller for this

[5] The sample is split into four subsamples rather than two as in Figure 5 to give more convincing evidence.
[6] Figure 2 in the current study.
[7] The probability of debt to equity financing is 0.5 to 0.5.

sample than for the actual data as well as other simulated samples generated with the actual deficit. The initial leverage becomes even insignificant in the random deficit sample when the first 20 years are excluded from the regression. The authors conclude that the firm-specific component in the financing deficit and change in retained earnings is most likely to be the source of the capital structure persistence. However, it seems from the evidence presented in Figure 6 and Table 4 that the weakening persistence in the random deficit sample is more likely due to the increasing leverage ratio variance, as the authors show subsequently that the variance of the leverage ratios in the random deficit sample is much higher than that in all the other samples.

Tests of the regression fallacy and the misclassification argument demonstrate the mechanical nature of capital structure convergence. This raises serious question regarding the argument of Lemmon et al. (2008) that the convergence in leverage ratios comes from the firm' active management of capital structure. As Friedman (1992, p2131) states "I suspect that the regression fallacy is the most common fallacy in the statistical analysis of economic data", it is likely that this fallacy also occurs in other financial literature. We leave this task to future research.

5. The Role of Average Leverage

Section 4 demonstrates the mechanical nature of capital structure convergence and attribute to the misclassification of firms as its source. In this section, we will introduce a sorting method based on the time-series average of leverage that is able to control for the mechanical convergence.

5.1. The Evolution of Leverage Revisited

Since the leverage ratio has a permanent component and fluctuates around it, one strategy to avoid the misclassification problem is to sort firms in terms of the permanent component instead of the portfolio formation year leverage. Because the permanent component is not directly observable, we employ the firm's average leverage across the sample period as the proxy. This is motivated by early studies that adopt average leverage as leverage targets (Taggart (1977), Marsh (1982), Jalilvand and Harris (1984), and Shyam-Sunder and Myers (1999)). We reconstruct Figure 2 but with a slight difference in the first step: each calendar year, we sort firms into quartiles according to their average leverage across the sample period, rather than the leverage in the portfolio formation year. The graphs of the average leverage portfolios are presented in Figure 6.

Panel A shows that capital structure convergence almost disappears while capital structure persistence is retained in the All Firms sample, as the portfolio leverages are nearly parallel across the sample period. Although slight convergence is still observed, it comes from the survivorship bias illustrated in Sections 2 and 3. Since firms in the Non-Survivors sample tend to have extremely high or low leverage, the portfolio leverages must converge as these firms exit the All Firms sample, even if the mechanical convergence sources from the regression fallacy is controlled for. The graphs in Panel B provide some supporting evidence for this argument. These graphs show that capital structure convergence is even harder to be observed in the Survivors sample, which suffers less from the survivorship bias.[8]

The ability of the new sorting method to control for the mechanical convergence enables us to isolate the persistence pattern so that its real source can be identified. In Figure 6, capital structure persistence nearly vanishes in the subsample of firms with

[8] In unreported results, we also reconstruct the graphs with regard to the history of leverage (Figure 3) using the new sorting method. The divergence feature disappears as well.

high leverage ratio variance. However, it is not clear whether the disappearing persistence in the graphs is real or just comes from the dominance of convergence over persistence; that is, the mechanical convergence is so strong that it covers the persistence feature. To distinguish between the two possibilities, we reconstruct Figure 6 using the new sorting method and present the graphs in Figure 7. In the graphs of both high and low leverage variance subsamples, little convergence is observed while persistence becomes the sole pattern, suggesting that the disappearing persistence in the subsample of firms with high leverage ratio variance depicted in Figure 5 is the result of the dominance of convergence over persistence. In fact, capital structure persistence still exists.

However, one problem of the new sorting method is that the average leverage across the sample period is an ex-post measure; it can only be calculated after the leverage ratios are realized. To address this issue, we employ the firm's average past leverage as the sorting measure and reconstruct Figure 2. The graphs are presented in Figure 8 and reveal some interesting findings. Compared with Figure 2, the new graphs exhibit much less capital structure convergence. Take Graph (I) of Panel A for example, the difference between the Very High portfolio and Low portfolio at event time 0 is around 33%, much smaller than that of the corresponding graph in Figure 2 (50%), while the difference between the two portfolios at event year 20 is about 17%, similar to that of the corresponding graph (15%). The flatter portfolio leverages across the event time indicates the reduced mechanical convergence under this sorting measure.

Although adopting average past leverage does not remove the mechanical convergence completely, it reduces the convergence to some extent. The remaining convergence comes from the poor performance of the average past leverage as the proxy for the permanent component of leverage ratios in the early period, especially the first several years. In unreported results, we repeat the same operations for t ree samples in which the first three, five and ten observations are dropped, respectively. They show that capital structure convergence decreases as the number of observations dropped increases, confirming the above argument.

5.2. Regression with Average Leverage

Despite its ability to remove the mechanical convergence, the role of time-series average of leverage in the firm's leverage choices is still unclear. However, because average leverage across the sample period is an ex-post measure and can not be used for prediction purposes, we quantify the economic importance of average past leverage instead. We perform a regression specification similar to Equation (1):

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

where $Leverage_{iAV}$ is firm *i*'s average past leverage. All the other variables are as defined in Equation (1). The first three observations of each firm are dropped.

The regression is performed using pooled OLS[9] and the results are shown in Table 5. Column (I) of Panel A shows that the average past book leverage for the All Firms sample is highly significant in a model consisting of solely average book leverage. The change in leverage ratios corresponding to the change in average past book leverage is nearly one for one. Inclusion of the leverage ratio determinants does little to the statistical or economical significance of average past book leverage. As shown in Column (II), the average book leverage has absolute dominance over all the other determinants. The same phenomenon is observed in the market leverage of the All Firms sample, as well as for both the book and market leverage of the Survivors

[9] The same regression is performed using a Random Effects Panel method. The results are quantitatively the same.

sample.

Compared with those in Table 3, the results in Table 5 confirm the finding that average past leverage is more relevant to the time series of the leverage ratio than initial leverage, which is more likely to be influenced by extreme values. Take Columns (I) and (II) of Panel A from both tables for example. The coefficient of the average leverage is almost twofold that of the initial leverage in the model consisting of solely these two variables. The R-squared of the average past leverage regression (0.49) is also much larger than that for the initial leverage regression (0.25). Moreover, including other control factors has a far smaller effect on the importance of the average leverage than that of the initial leverage. The inclusion of additional factors reduces the coefficient of the average leverage by only 9% while that of the initial leverage is reduced by 68%. Also, the inclusion of these factors increases the R-squared of the average past leverage regression by 4% while that of the initial leverage regression is increased by 28%.

Motivated by the misclassification argument, we propose a sorting method based on the time-series average of leverage. This sorting method is able to reduce the mechanical convergence. Regression evidence also shows that average past leverage plays an important role in a firm's future leverage choices. This confirms the argument of Lemmon et al. (2008) with regard to capital structure persistence and provides stronger evidence against recent partial adjustment models that adopt time varying targets.

6. Future Research

Capital structure convergence is proven to be mechanical in Section 4, whereas capital structure persistence remains a mystery. In this section, we will propose two possible driving forces of the persistence feature.

The first one is persistence of leverage determinants. As shown in Figure 3 and Table 3, capital structure persistence still remains even after controlling for leverage determinants. However, this does not imply that the leverage determinants contribute little to the persistence of leverage ratios. Our preliminary tests show that leverage determinants such as market-to-book, profitability, tangibility etc. are also persistent and the persistence of leverage determinants is closely related to the persistence of leverage ratios. The contribution of leverage determinants to capital structure persistence will be quantified in future research.

The second one is mechanical mean reversion. Chen and Zhao (2007) and Chang and Dasgupta (2008) document the mechanical mean reversion in leverage ratios, which may also contribute to capital structure persistence. We leave a detailed investigation of this issue to future research.

7. Conclusion

We show in this study that the capital structure convergence documented in Lemmon et al. (2008) is likely due to a common statistical fallacy called the “regression fallacy”. We replicate their results and conduct tests on the observed convergence in our sample. More specifically, if capital structure convergence is real, it will remain whether the pre or post portfolio formation year leverage is examined. Also, the cross-sectional variance of leverage ratios will decrease over time. The test results support none of the above implications, instead supporting the argument that the convergence feature documented in our sample is mechanical in nature. In fact, the mechanical convergence sources from the permanent component in leverage ratios and the misclassification problem in portfolio construction. We test the implications of the misclassification argument and find consistent evidence. Next, we propose a method in which firms are sorted in terms of the time-series average of leverage rather than the portfolio formation year leverage. The reduced convergence under the new method confirms the mechanical nature of capital structure convergence in our samples. Subsequent regressions demonstrate the role of average past leverage in the firm's future leverage choices.

The evidence in this study cautions against studies that adopt similar sorting methods as in Lemmon et al. (2008) in portfolio construction. A detailed investigation on this issue is necessary and will be conducted in future research. The evidence also cautions against the regression method in Lemmon et al. (2008) that relies on initial leverage in making inferences on capital structure persistence. Further research on this topic will be conducted in the future.

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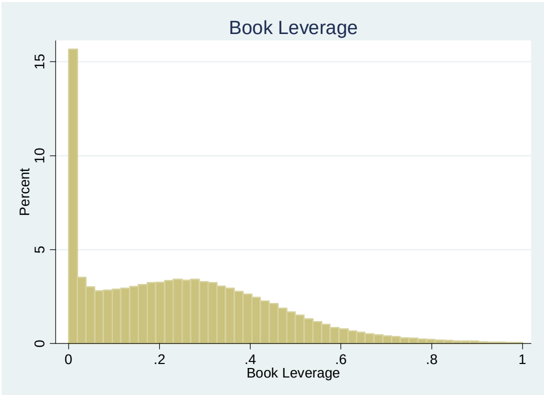
Figure 1
Histogram of Leverage Ratios

The original sample is all firms except financial firms in the merged Compustat/Crsp database during 1965 and 2003. Each graph presents the histogram of leverage ratios for firms in three samples. Panel A presents graphs for the entire sample (All Firms); Panel B presents graphs for firms with at least 20 years of data (Survivors); and Panel C presents graphs for the remaining firms (Non-Survivors).

Panel A: All Firms

(I)



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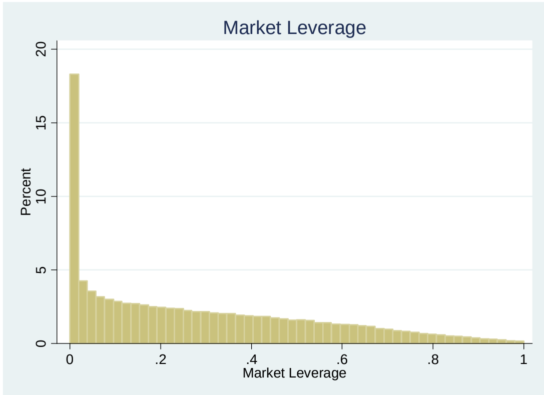
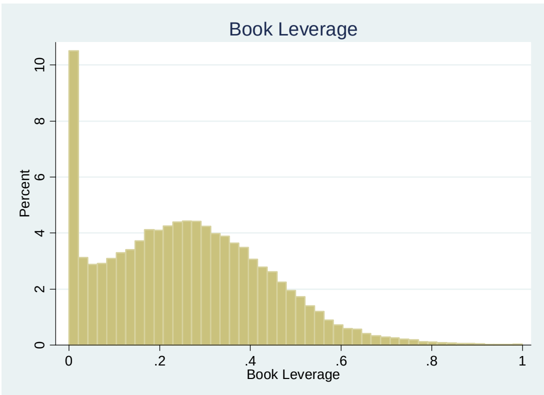


Panel B: Survivors

(I)



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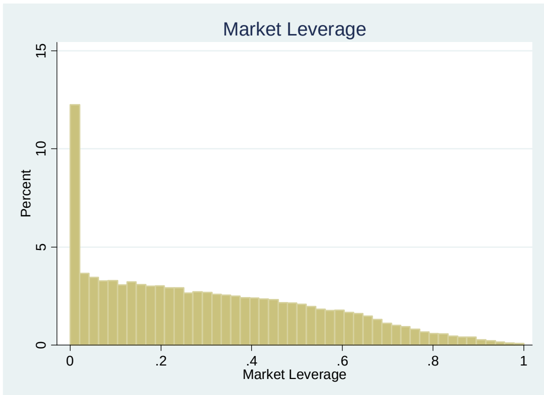
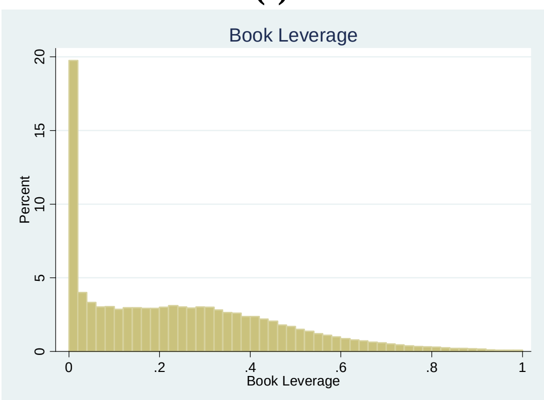


Panel C: Non-Survivors

(I)



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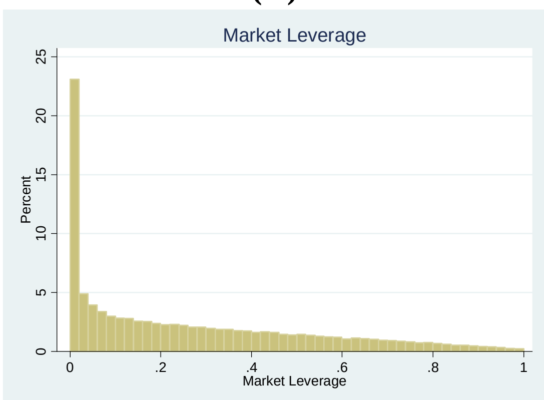
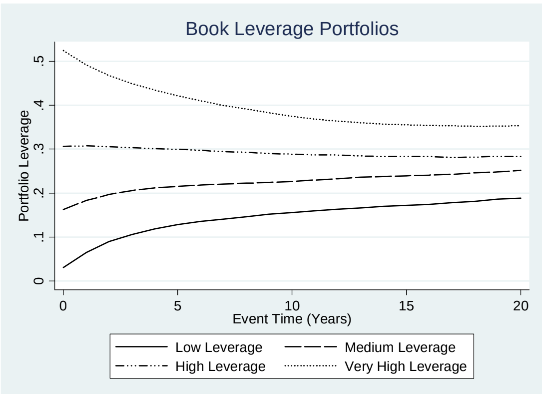


Figure 2
Evolution of Leverage
(Sorted by Portfolio Formation Year Leverage)

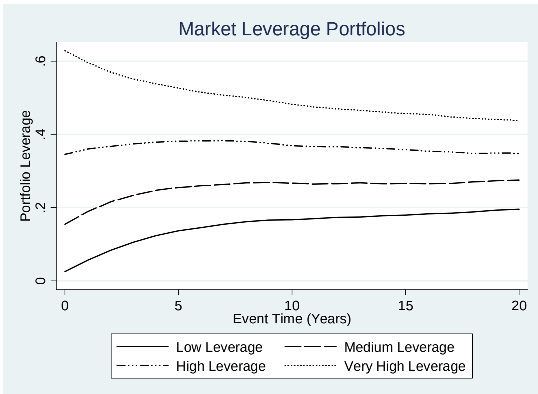
The original sample is all firms except financial firms in the merged Compustat/Crsp database during 1965 and 2003. Each graph presents the average leverage of four portfolios in event time. For each calendar year, we form four portfolios by ranking firms based on their leverage ratios. Holding the portfolios fixed for the next twenty years, we compute the average leverage for each portfolio. Panel A presents graphs for the entire sample (All Firms); Panel B presents graphs for firms with at least 20 years of data (Survivors).

Panel A: All Firms

(I)

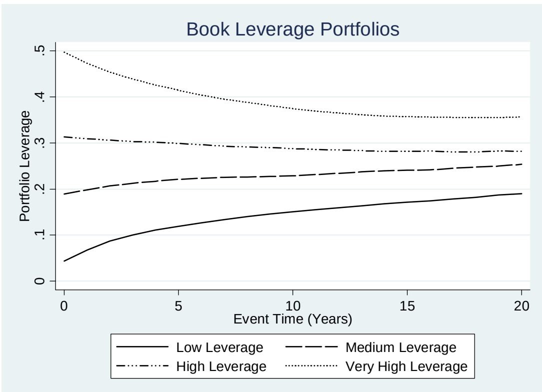


(II)



Panel B: Survivors

(I)



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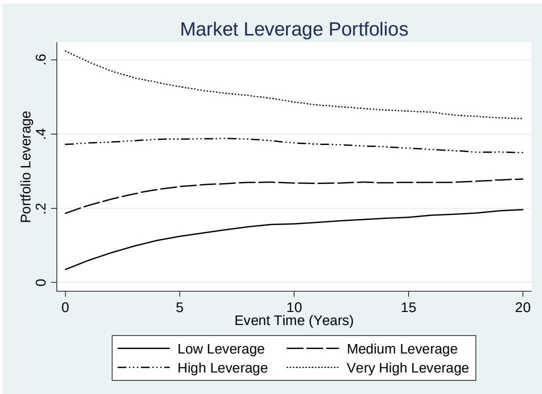
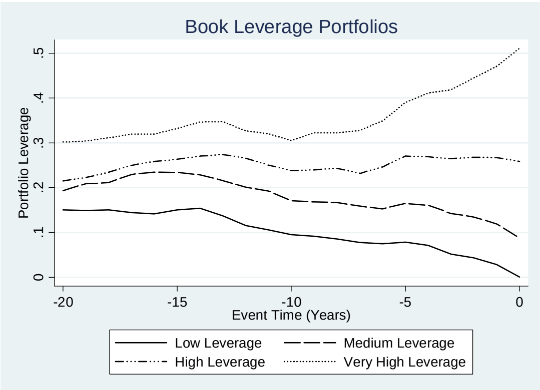


Figure 3
History of Leverage
(Sorted by Portfolio Formation Year Leverage)

The original sample is all firms except financial firms in the merged Compustat/Crsp database during 1965 and 2003. Each graph presents the average leverage of four portfolios in event time. For each calendar year, we form four portfolios by ranking firms based on their leverage. Holding the portfolios fixed for the previous twenty years, we compute the average leverage for each portfolio. Panel A presents graphs for the entire sample (All Firms); Panel B presents graphs for firms with at least 20 years of data (Survivors).

Panel A: All Firms

(I)



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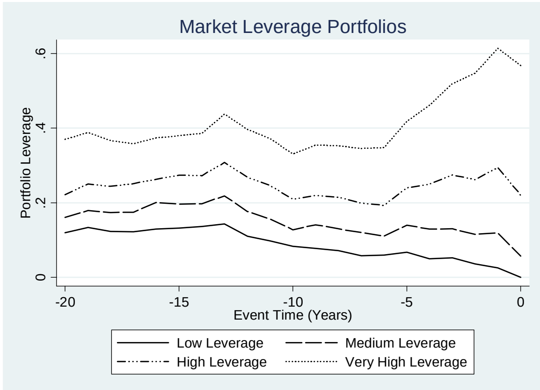
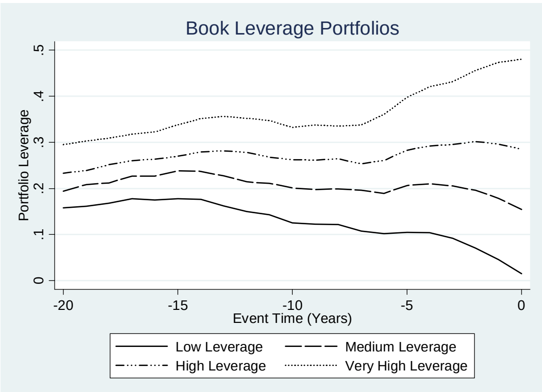


Panel B: Survivors

(I)



(II)

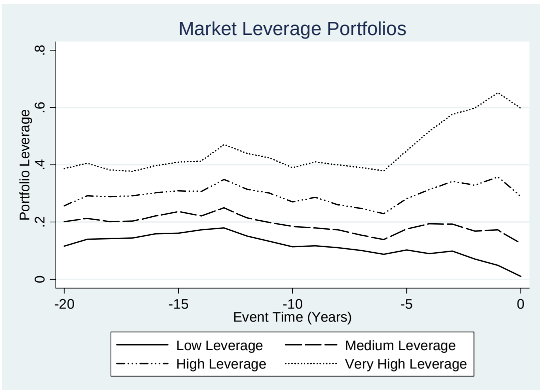
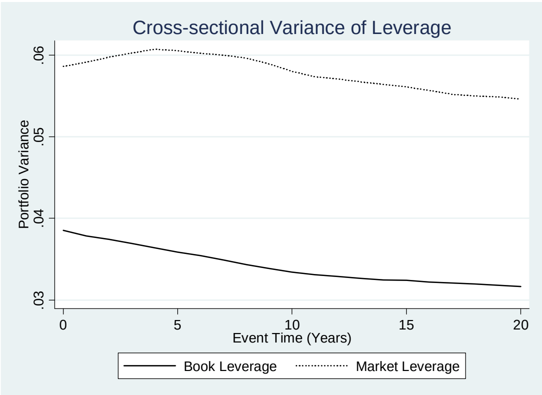


Figure 4
Evolution of Cross-sectional Variance of Leverage

The original sample is all firms except financial firms in the merged Compustat/Crsp database during 1965 and 2003. Each graph presents the cross-sectional variance of leverage portfolios in event time. For each calendar year, we form a portfolio that exists in that year. Holding the portfolio fixed for the next twenty years, we compute the cross-sectional variance of leverage ratios for each portfolio. Panel A presents graphs for the entire sample (All Firms); Panel B presents graphs for firms with at least 20 years of data (Survivors);

Panel A: All Firms



Panel B: Survivors

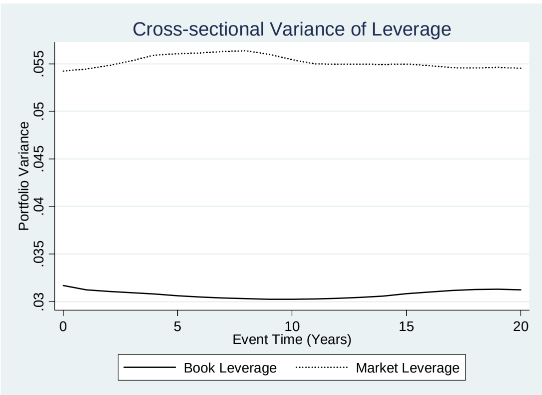
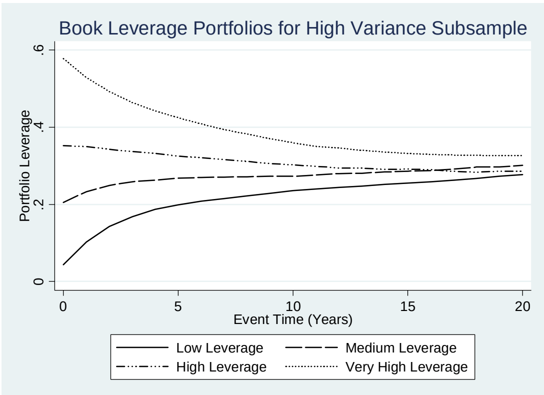


Figure 5
Evolution of Leverage for Leverage Variance Subsamples
(Sorted by Portfolio Formation Year Leverage)

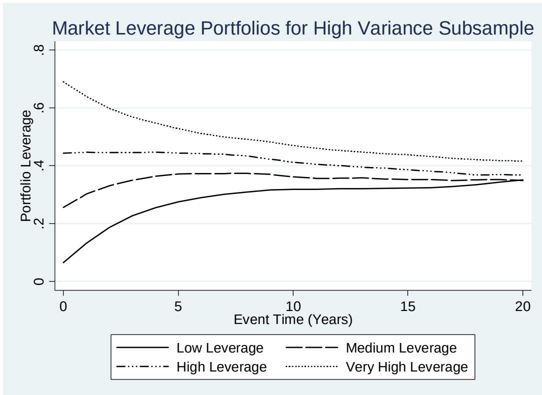
The original sample is all firms except financial firms in the merged Compustat/Crsp database during 1965 and 2003. Each graph presents the average leverage of four portfolios in event time. The samples are split into two subsamples with equal number of firms in terms of the cross-sectional variance of leverage ratios. For each subsample, we form four portfolios by ranking firms based on their leverage ratios in each calendar year. Holding the portfolios fixed for the next twenty years, we compute the average leverage for each portfolio. Panel A presents graphs for the subsamples of the entire sample (All Firms); Panel B presents graphs for the subsamples of firms with at least 20 years of data (Survivors).

Panel A: All Firms

(I)



(II)



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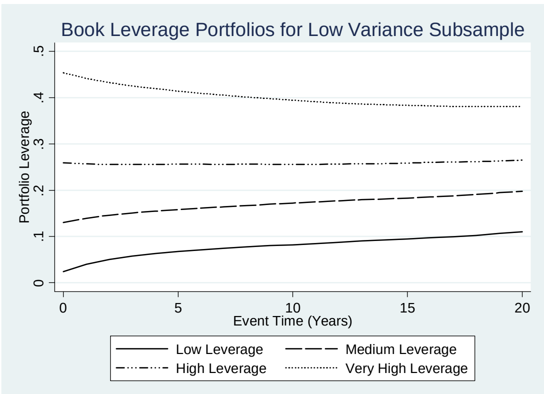
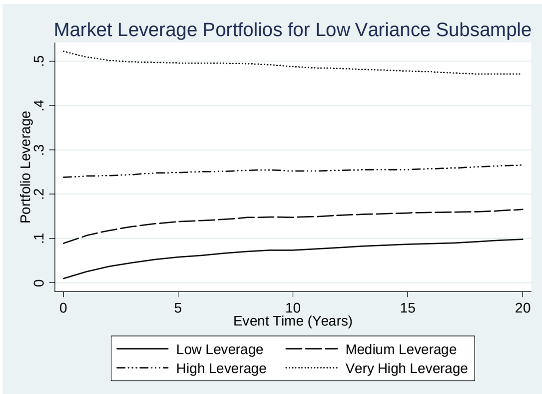
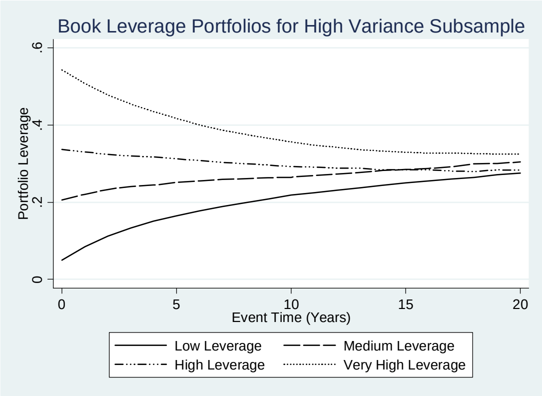


(IV)

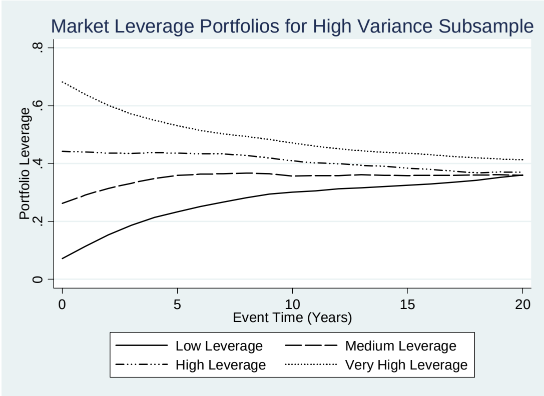


Panel B: Survivors

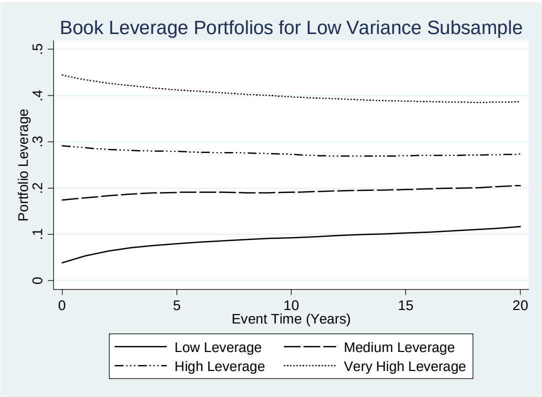
(I)



(II)



(III)



(IV)

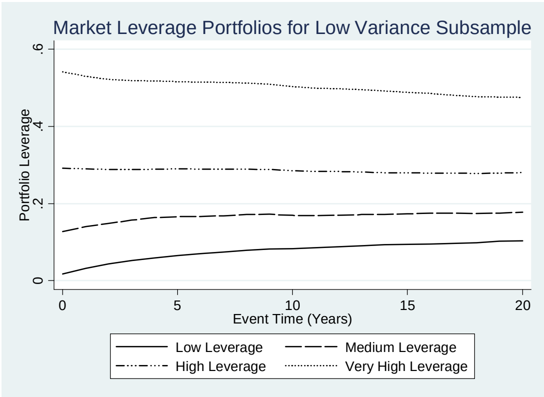
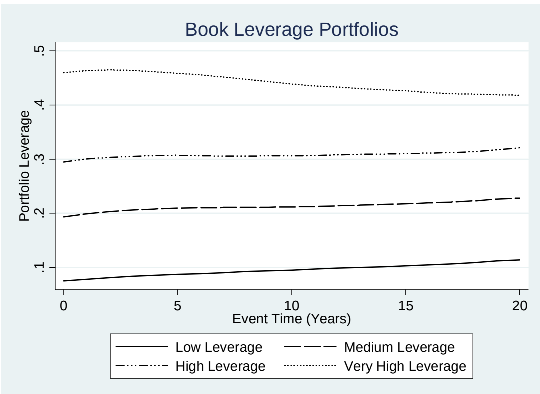


Figure 6
Evolution of Leverage
(Sorted by Average Leverage across the Sample Period)

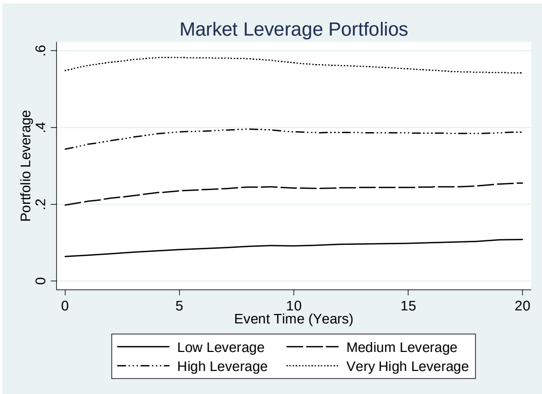
The original sample is all firms except financial firms in the merged Compustat/Crsp database during 1965 and 2003. Each graph presents the average leverage of four portfolios in event time. For each calendar year, we form four portfolios by ranking firms based on their average leverage across the sample period. Holding the portfolios fixed for the next twenty years, we compute the average leverage for each portfolio. Panel A presents graphs for the entire sample (All Firms); Panel B presents graphs for firms with at least 20 years of data (Survivors).

Panel A: All Firms

(I)

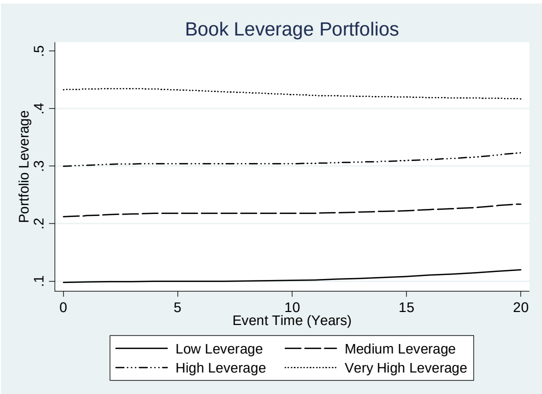


(II)



Panel B: Survivors

(I)



(II)

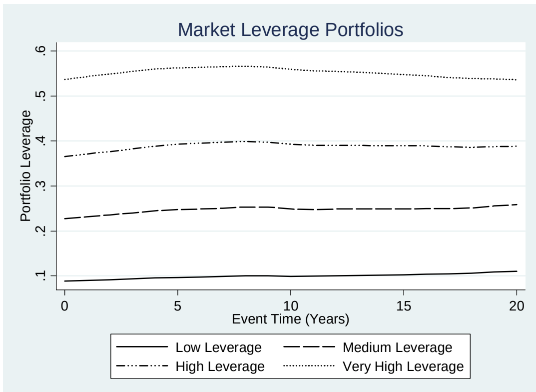
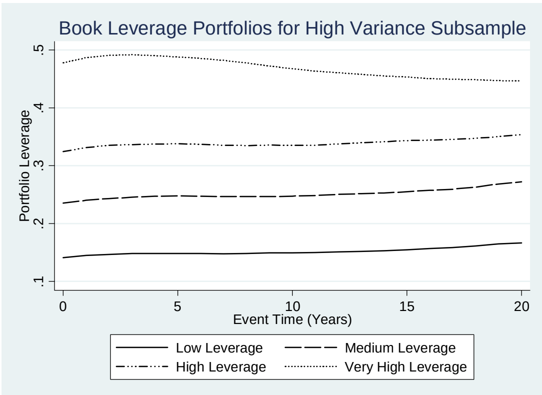


Figure 7
Evolution of Leverage for Leverage Variance Subsamples
(Sorted by Average Leverage across the Sample Period)

The original sample is all firms except financial firms in the merged Compustat/Crsp database during 1965 and 2003. Each graph presents the average leverage of four portfolios in event time. The samples are split into two equal subsamples in terms of the cross-sectional variance of leverage ratios. For each subsample, we form four portfolios by ranking firms based on their average leverage across the sample period in each calendar year. Holding the portfolios fixed for the next twenty years, we compute the average leverage for each portfolio. Panel A presents graphs for the subsamples of the entire sample (All Firms); Panel B presents graphs for the subsamples of firms with at least 20 years of data (Survivors).

Panel A: All Firms

(I)



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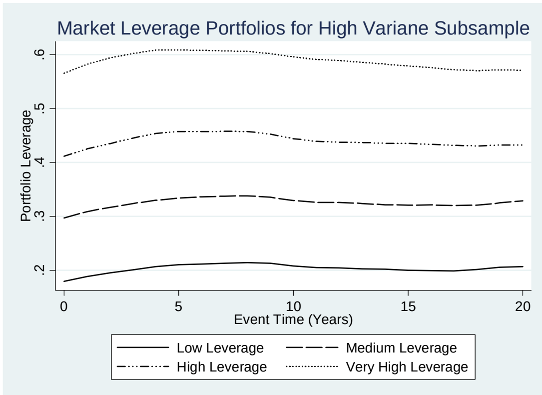
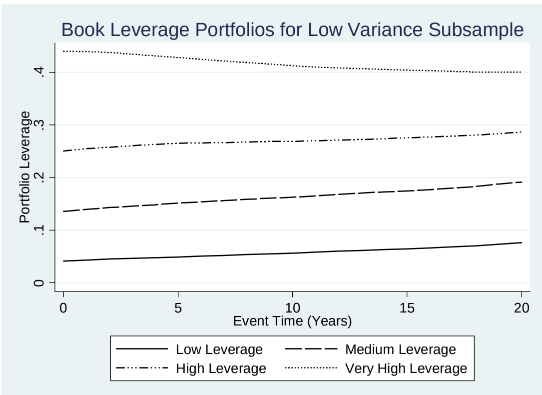
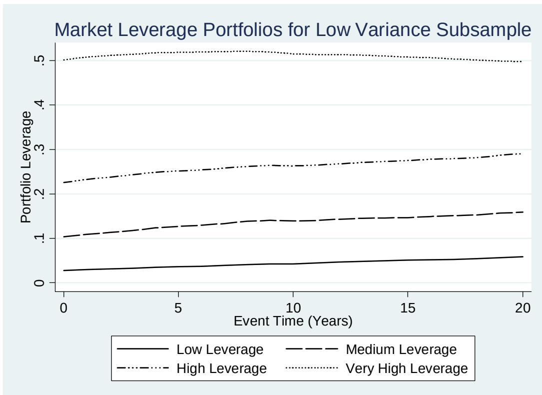


(III)

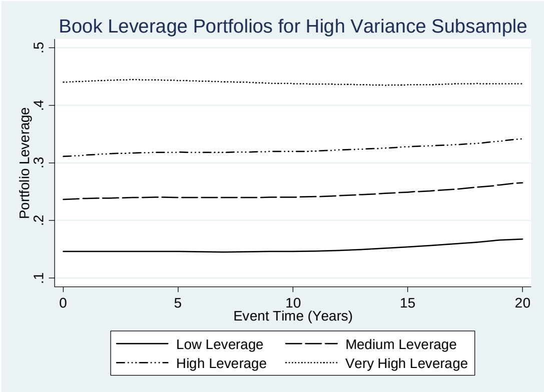


(IV)

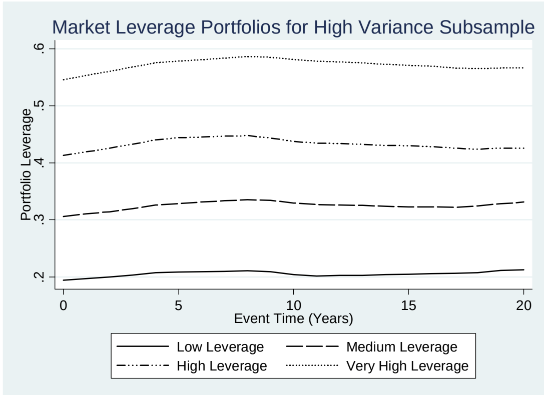


Panel B: Survivors

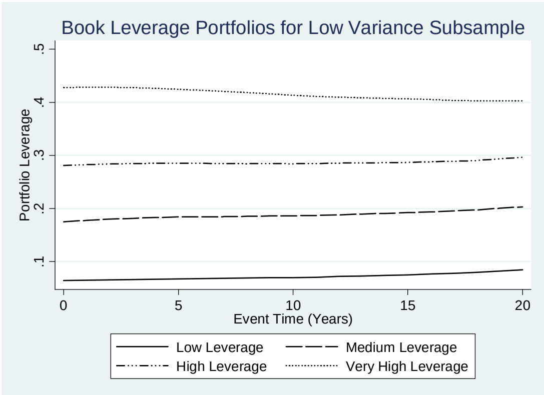
(I)



(II)



(III)



(IV)

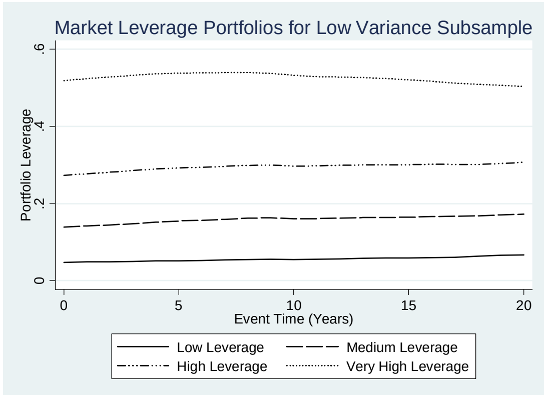
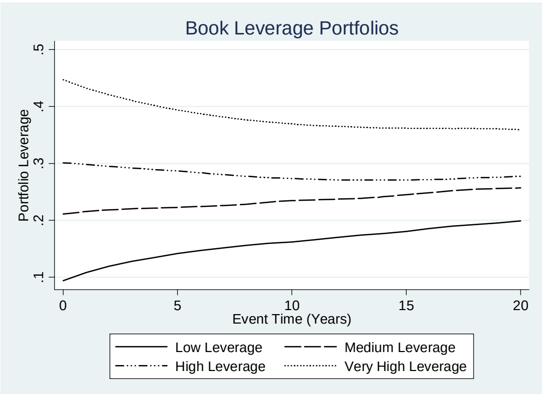


Figure 8
Evolution of Leverage
(Sorted by Average Past Leverage)

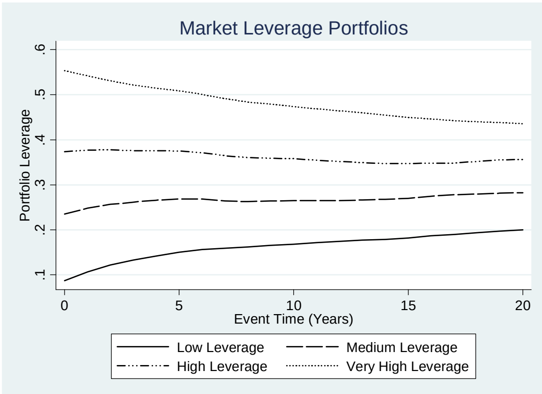
The original sample is all firms except financial firms in the merged Compustat/Crsp database during 1965 and 2003. Each graph presents the average leverage of four portfolios in event time. For each calendar year, we form four portfolios by ranking firms based on their average leverage across all the years before the portfolio formation year. Holding the portfolios fixed for the next twenty years, we compute the average leverage for each portfolio. The first three observations of each firm are dropped. Panel A presents graphs for the entire sample (All Firms); Panel B presents graphs for firms with at least 20 years of data (Survivors).

Panel A: All Firms

(I)

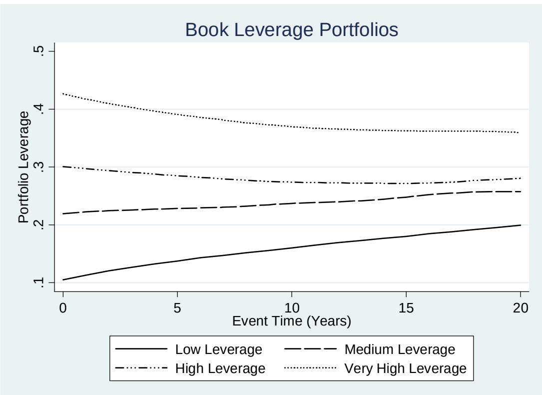


(II)



Panel B: Survivors

(I)



(II)

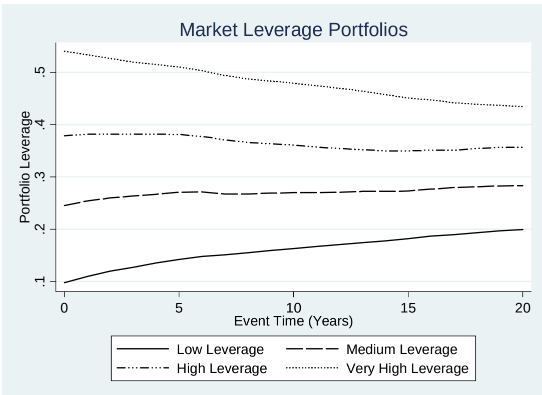


Table 1
Variable Construction

This table details the variable definitions. Italic refers to variable name and numbers in parentheses refer to the annual Compustat item number.

Variable	**Definition**
Total Debt	*Short-term Debt* (data34) + *Long-term Debt* (data9)
Book Lev.	*Total Debt* / *Book Assets* (data6)
Market Equity	*Stock Price* (data199) * *Shares Outstanding* (data54)
Market Lev.	*Total Debt* / (*Total debt* + *Market Equity*)
Size	Log (*Total Sales* (data12)), where *Total Sales* is deflated to 2000 dollars.
Market-to-Book	(*Market Equity* + *Total Debt* + *Preferred Stock* (data10) – *Deferred Tax Credi*t (data35)) / *Book Assets* (data6)
Profitability	*Operating Income before Depreciation* (data13) / *Book Assets* (data6)
Tangibility	*Net PPE* (data8) / *Book Assets* (data6)
Industry Median Lev.	Median leverage of industries defined by three-digit SIC codes.
Cash Flow Volatility	Standard deviation of *Profitability*, requiring at least three years of data.
Dividend	*Common Dividend* (data21) + *Preferred Dividend* (data19)
Dividend Payer	Dummy variable equal to one if *Dividend* is nonmissing and positive, and zero otherwise.

Table 2
Summary Statistics

The original sample is all firms except financial firms in the merged Compustat/Crsp database during 1965 and 2003. The table presents the mean, median and standard deviation (SD) of each variable for the entire sample (All Firms), the subsample of firms with at least 20 years of data (Survivors), and the subsample of remaining firms (Non-Survivors).

Panel A: All Firms

	Mean	Median	SD
Book Lev.	0.25	0.23	0.20
Market Lev.	0.28	0.23	0.25
Log(Sales)	4.79	4.86	2.32
Market-to-Book	1.51	0.98	1.60
Profitability	0.07	0.12	0.22
Tangibility	0.34	0.28	0.24
Cash Flow Vol.	0.11	0.07	0.15
Dividend Payer	0.50	1.00	0.50
No. of Obs.		171,656	

Panel B: Survivors

	Mean	Median	SD
Book Lev.	0.26	0.25	0.18
Market Lev.	0.31	0.27	0.24
Log(Sales)	5.83	5.84	2.03
Market-to-Book	1.21	0.89	1.10
Profitability	0.13	0.14	0.11
Tangibility	0.38	0.32	0.24
Cash Flow Vol.	0.08	0.06	0.07
Dividend Payer	0.72	1.00	0.45
No. of Obs.		71,536	

Panel C: Non-Survivors

	Mean	Median	SD
Book Lev.	0.25	0.21	0.22
Market Lev.	0.26	0.19	0.26
Log(Sales)	4.05	4.19	2.23
Market-to-Book	1.73	1.08	1.86
Profitability	0.03	0.1	0.26
Tangibility	0.31	0.24	0.24
Cash Flow Vol.	0.14	0.08	0.18
Dividend Payer	0.35	0.00	0.48
No. of Obs.		100,120	

Table 3
The Effect of Initial Leverage

The original sample is all firms except financial firms in the merged Compustat/Crsp database during 1965 and 2003. The table presents the coefficients from Pooled OLS regressions of book and market leverage. Panel A present results using the entire sample (All Firms); Panel B present results using a subsample of firms with at least 20 years of data (Survivors). Year Fixed Effects denote whether calendar year fixed effects are included in the specification. The t-statistics are computed using standard errors robust to both clustering at the firm level and heteroskedasticity. Variable definitions are presented in Table 1.

Panel A: All Firms

	Book Leverage		Market Leverage	
	(I)	(II)	(III)	(IV)
Initial Lev.	0.520	0.356	0.609	0.370
	(201.53)**	(116.63)**	(213.42)**	(113.96)**
Size		0.007		0.011
		(23.88)**		(32.59)**
Market-to-Book		-0.009		-0.036
		(-25.11)**		(-95.38)**
Profitability		-0.148		-0.219
		(-40.45)**		(-59.40)**
Tangibility		0.094		0.088
		(39.70)**		(33.18)**
Industry Median Lev.		0.380		0.389
		(70.98)**		(86.00)**
Cash Flow Vol.		-0.028		-0.074
		(-5.03)**		(-12.80)**
Dividend Payer		-0.038		-0.054
		(-33.15)**		(-39.34)**
Year Fixed Effects	No	Yes	No	Yes
No. of Obs.	139,410	139,410	139,410	139,410
R^2	0.25	0.32	0.25	0.41

Panel B: Survivors

	Book Leverage		Market Leverage	
	(I)	(II)	(III)	(IV)
Initial Lev.	0.444	0.277	0.527	0.297
	(125.66)**	(69.32)**	(121.17)**	(66.71)**
Size		0.009		0.014
		(25.54)**		(29.26)**
Market-to-Book		-0.009		-0.044
		(-12.76)**		(-51.53)**
Profitability		-0.274		-0.485
		(-32.47)**		(-46.15)**
Tangibility		0.081		0.079
		(25.31)**		(21.41)**
Industry Median Lev.		0.38		0.381
		(51.25)**		(62.46)**
Cash Flow Vol.		-0.043		-0.093
		(-2.94)**		(-4.85)**
Dividend Payer		-0.04		-0.056
		(-22.39)**		(-26.21)**
Year Fixed Effects	No	Yes	No	Yes
No. of Obs.	66,211	66,211	66,211	66,211
R^2	0.22	0.33	0.20	0.44

* Significant at 95% level
** Significant at 99% level

Table 4
The Effect of Initial Leverage for Leverage Variance Subsamples

The original sample is all firms except financial firms in the merged Compustat/Crsp database during 1965 and 2003. The samples are split into four subsamples with equal number of firms in terms of the cross-sectional variance of leverage ratios. The table presents the coefficients from Pooled OLS regressions of book and market leverage for each subsample. Panel A present results using the entire sample (All Firms); Panel B present results using a subsample of firms with at least 20 years of data (Survivors). Year Fixed Effects denote whether calendar year fixed effects are included in the specification. The t-statistics are computed using standard errors robust to both clustering at the firm level and heteroskedasticity. Variable definitions are presented in Table 1.

Panel A: All Firms

	Book Leverage				Market Leverage			
	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)
	Low Var.	Median Var.	High Var.	Very High Var.	Low Var.	Median Var.	High Var.	Very High Var.
Initial Lev.	0.785	0.492	0.303	0.064	0.826	0.526	0.275	0.057
	(204.82)**	(103.19)**	(63.46)**	(11.10)**	(174.27)**	(102.42)**	(54.15)**	(8.90)**
Size	0.007	0.006	0.007	0.013	0.006	0.011	0.010	0.018
	(30.65)**	(16.20)**	(14.01)**	(16.40)**	(23.89)**	(21.96)**	(16.23)**	(21.23)**
Market-to-Book	-0.002	-0.006	-0.010	-0.012	-0.004	-0.024	-0.047	-0.060
	(-8.94)**	(-11.41)**	(-15.37)**	(-14.39)**	(-24.23)**	(-32.58)**	(-40.00)**	(-39.82)**
Profitability	-0.066	-0.130	-0.148	-0.179	-0.053	-0.213	-0.298	-0.339
	(-27.94)**	(-23.45)**	(-23.01)**	(-25.26)**	(-28.15)**	(-30.62)**	(-33.40)**	(-30.41)**
Tangibility	0.025	0.045	0.083	0.136	0.040	0.078	0.086	0.139
	(10.87)**	(13.48)**	(20.89)**	(24.20)**	(15.10)**	(21.30)**	(18.66)**	(22.82)**
Ind. Med. Lev.	0.131	0.265	0.348	0.389	0.071	0.278	0.327	0.333
	(25.83)**	(34.44)**	(38.05)**	(31.67)**	(14.27)**	(42.78)**	(40.49)**	(33.90)**
Cash Flow Vol.	-0.042	-0.152	-0.119	-0.071	-0.004	-0.080	-0.187	-0.123
	(-11.02)**	(-16.41)**	(-10.81)**	(-7.72)**	(-1.44)	(-5.70)**	(-15.24)**	(-9.50)**
Dividend Payer	-0.010	-0.024	-0.029	-0.039	-0.009	-0.027	-0.045	-0.035
	(-9.36)**	(-15.07)**	(-15.21)**	(-13.79)**	(-7.70)**	(-12.67)**	(-18.83)**	(-11.77)**
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No. of Obs.	32,702	36,548	36,380	33,780	32,093	36,128	36,310	34,879
R^2	0.85	0.53	0.28	0.12	0.79	0.59	0.36	0.24

Panel B: Survivors

	Book Leverage				Market Leverage			
	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)
	Low Var.	Median Var.	High Var.	Very High Var.	Low Var.	Median Var.	High Var.	Very High Var.
Initial Lev.	0.553	0.344	0.224	0.085	0.624	0.373	0.189	0.093
	(86.49)**	(52.08)**	(36.28)**	(10.84)**	(80.39)**	(46.06)**	(25.95)**	(10.83)**
Size	0.008	0.009	0.009	0.013	0.011	0.013	0.009	0.021
	(21.55)**	(16.08)**	(12.22)**	(13.33)**	(23.39)**	(17.08)**	(9.95)**	(18.36)**
Market-to-Book	0.000	0.000	-0.012	-0.013	-0.008	-0.034	-0.060	-0.069
	(-0.23)	(-0.44)	(-10.91)**	(-8.54)**	(-15.90)**	(-18.08)**	(-23.39)**	(-26.35)**
Profitability	-0.228	-0.275	-0.215	-0.295	-0.259	-0.492	-0.529	-0.527
	(-26.04)**	(-21.73)**	(-15.09)**	(-19.05)**	(-31.55)**	(-21.73)**	(-26.02)**	(-23.44)**
Tangibility	0.068	0.045	0.064	0.108	0.125	0.116	0.088	0.094
	(16.65)**	(8.80)**	(11.60)**	(13.74)**	(27.08)**	(19.56)**	(13.35)**	(10.07)**
Ind. Med. Lev.	0.151	0.303	0.467	0.405	0.187	0.313	0.336	0.343
	(16.65)**	(25.98)**	(37.23)**	(23.53)**	(26.31)**	(30.90)**	(28.62)**	(25.14)**
Cash Flow Vol.	-0.404	-0.409	-0.072	-0.087	-0.213	-0.002	-0.342	-0.125
	(-18.55)**	(-14.58)**	(-2.54)*	(-3.96)**	(-12.61)**	(-0.04)	(-11.94)**	(-4.28)**
Dividend Payer	0.005	-0.013	-0.025	-0.048	-0.009	-0.006	-0.043	-0.051
	(2.11)*	(-4.49)**	(-8.95)**	(-13.34)**	(-3.80)**	(-1.39)	(-11.82)**	(-12.26)**
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No. of Obs.	16,631	16,659	16,570	16,351	16,623	16,632	16,556	16,400
R^2	0.78	0.50	0.30	0.15	0.76	0.57	0.38	0.27

* Significant at 95% level
** Significant at 99% level

Table 5
The Effect of Average Past Leverage

The original sample is all firms except financial firms in the merged Compustat/Crsp database during 1965 and 2003. The table presents the coefficients from Pooled OLS regressions of book and market leverage. Panel A present results using the entire sample (All Firms); Panel B present results using a subsample of firms with at least 20 years of data (Survivors). Year Fixed Effects denote whether calendar year fixed effects are included in the specification. The t-statistics are computed using standard errors robust to both clustering at the firm level and heteroskedasticity. Variable definitions are presented in Table 1.

Panel A: All Firms

	Book Leverage		Market Leverage	
	(I)	(II)	(III)	(IV)
Average Past Lev.	0.841	0.765	0.900	0.769
	(342.56)**	(226.63)**	(383.08)**	(232.16)**
Size		0.004		0.006
		(16.22)**		(20.54)**
Market-to-Book		-0.005		-0.023
		(-12.22)**		(-59.64)**
Profitability		-0.124		-0.187
		(-30.13)**		(-45.90)**
Tangibility		0.045		0.047
		(20.19)**		(18.31)**
Industry Median Lev.		0.137		0.15
		(26.64)**		(34.08)**
Cash Flow Vol.		-0.002		-0.005
		(-0.37)		(-0.8)
Dividend Payer		-0.016		-0.038
		(-15.03)**		(28.93)**
Year Fixed Effects	No	Yes	No	Yes
No. of Obs.	112,915	112,915	112,915	112,915
R^2	0.49	0.51	0.51	0.57

Panel B: Survivors

	Book Leverage		Market Leverage	
	(I)	(II)	(III)	(IV)
Average Past Lev.	0.816	0.715	0.877	0.715
	(257.62)**	(155.74)**	(274.60)**	(159.72)**
Size		0.007		0.010
		(20.85)**		(25.47)**
Market-to-Book		-0.002		-0.027
		(-3.18)**		(-36.54)**
Profitability		-0.192		-0.351
		(-24.01)**		(-36.08)**
Tangibility		0.028		0.035
		(9.55)**		(10.39)**
Industry Median Lev.		0.150		0.154
		(21.86)**		(27.39)**
Cash Flow Vol.		-0.023		-0.062
		(-1.94)		(-4.40)**
Dividend Payer		-0.012		-0.03
		(-7.22)**		(-15.37)**
Year Fixed Effects	No	Yes	No	Yes
No. of Obs.	61,302	61,302	61,302	61,302
R^2	0.48	0.51	0.50	0.59

* Significant at 95% level
** Significant at 99% level