Testing Dynamic Tradeoff Theory: Profitability and Leverage

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Abstract

In an influential study, Ilya Strebulaev (2007) shows that classical tests of dynamic tradeoff theory of capital structure can be misleading. Instead of regressing leverage on profitability and other explanatory variables using end-of-year data, one should identify capital structure adjustments and examine cross- sectional variation in leverage at those points in time. Using simulated data, he finds that the regression coefficient of profitability in standard leverage regressions changes from negative to positive. We confirm this prediction of dynamic tradeoff theory using US-listed firms in Compustat. The evidence from international data is weaker. Further, recognizing the limitations of target adjustment models, we analyze the dynamics of capital structure prior to adjustments. We find that before an upward adjustment in leverage, profitability and equity payouts of rebalancing firms increase, market leverage decreases, while book leverage is relatively stable. Our results are consistent with time series patterns predicted by dynamic tradeoff theory.

JEL classification: G30, G32.

1 Introduction

The capital structure of a company, its determination and time variation continues to be a major object of interest for finance researchers. In recent years, a series of recognized papers has fundamentally challenged well established empirical findings on how firms choose their debt levels by pointing to major weaknesses in the design of traditional tests. Focusing on dynamic tradeoff theory, Strebulaev (2007) argues that a test closely related to theoretical comparative statics requires considering optimally levered firms only. For these, and assuming that tradeoff theory holds, the relationship between profitability and leverage should be positive. However, most leverage regressions fail to detect such a positive relationship as they are typically based on year-end observations - points in time at which a firm may be well off a potential target capital structure. Strebulaev (2007) circumvents the problem of empirically identifying refinancing points by providing evidence based on simulated data. In this environment, firms are known to behave according to dynamic tradeoff theory, i.e. they choose optimal leverage by balancing tax benefits of debt and bankruptcy costs in the presence of adjustment costs. An interesting, yet unaddressed next step then consists of analyzing whether the positive relationship between profitability and leverage exists in reality. In this paper, we use a simple procedure to empirically identify a certain type of capital structure adjustment, increases in leverage, leading to a sample of firms whose capital structure may be assumed to be close to their targets. In the simulated data of Strebulaev (2007), it is clear that firms behave according to dynamic tradeoff theory. In reality, however, it is not clear ex ante whether this is true. One of our major contributions therefore is to show that observed firm behavior is consistent with dynamic tradeoff theory.

Using all listed US firms between 2000 and 2008, we document a negative relationship between profitability and leverage for the cross section of firms on the one hand, and a positive relationship between these two measures for firms with optimal capital structures on the other hand. We classify firms as being optimally levered in a given year by considering their simultaneous issuing behavior with respect to debt and equity. In close relation to the framework of dynamic tradeoff theory, our sample of firms close to or at refinancing points consists of firms that significantly increase their leverage. They do so by issuing long term debt, while at the same time repurchasing shares or paying out cash in form of dividends. It is important to note that our results do not contradict previous findings of Bradley, Jarrell, and Kim (1984), Rajan and Zingales (1995), or Fama and French (2002), who report a negative coefficient of profitability in a leverage regression. But they have direct implications for the interpretation of previous regression results and they highlight the importance of tailoring empirical tests to the related theoretical models and their predictions.

In a second step, we repeat most of the analysis for a number of different samples of publicly listed firms in the UK, Japan, Canada, and Australia. With the exception of Japan, these economies are chosen due the proximity of their legal origins and thus more comparable accounting standards. The evidence on the relationship between profitability and leverage is somewhat weaker, but points into the same direction. One of the major reasons for lower levels of statistical significance stems from problems of sample size and is related to how we identify capital structure adjustment.

A paper related to our analysis is Dudley (2007), who analyzes and estimates the influence of widely used capital structure determinants on the lower and upper boundaries that define a firm's optimal leverage range, i.e. the range where firms do not adjust their debt ratios. He finds that more profitable firms are associated with higher target leverage ratios, a finding in favour of tradeoff theory. Moreover, another important set of related papers includes Hovakimian, Opler, and Titman (2001), Hovakimian, Hovakimian, and Tehranian (2004), Hovakimian (2004), Leary and Roberts (2006), and Frank and Goyal (2009). These papers address determinants of a firm's securities issuing policy and relate them to classical theories of capital structure choice. They document that profitability has a significant and positive impact on the probability that firms issue debt and repurchase equity, a finding consistent with the idea of firms adjusting their capital structure according to dynamic tradeoff theory. We differ from these papers by means of our test design, focusing on leverage regressions as opposed to issuing probabilities. Both approaches can be used to test tradeoff theory, and are based on issuing activities.[1] For our purpose, by considering leverage regressions, we avoid the need to simultaneously estimate correlations of profitability with issuing probabilities and issuing sizes in order to evaluate the relationship between profitability and leverage.

Similar to Strebulaev (2007) being concerned about the interpretation of classical leverage regressions, a second series of papers criticizes the so-called target adjustment models of leverage. These models assume that after leverage is hit by an exogenous shock, it continuously converges back to a target, and estimate the speed at which the convergence takes place. Chen and Zhao (2007) are among the first to argue that mechanical mean reversion in leverage ratios makes it difficult to identify how important active capital structure changes are in explaining the time series pattern of leverage. Based on this insight and using simulated data, Chang and Dasgupta (2009) estimate adjustment models for firms which are known to follow a purely random financing strategy. They obtain parameter estimates which are very similar to empirical results that have been interpreted as supporting tradeoff theory. Hence, as target adjustment models have low

[1] While classical leverage regressions are not concerned with firm issuing behavior, we rely on firm financing decisions to identify optimally levered firms.

power to reject alternative hypotheses, there is room for new approaches of how to discriminate between different capital structure theories. We take a view closely related to the original framework of tradeoff theory of capital structure choice, whose static version was formulated by Kraus and Litzenberger (1973) and later extended to include dynamics by Fischer, Heinkel, and Zechner (1989). In particular, the second main contribution of this paper consists of analyzing the dynamics of leverage and other firm characteristics prior to refinancing events. This approach stems from the insight that if firms act as predicted by tradeoff theory, they do not slowly return to target leverage after sudden changes in their capital structure. Instead, due to transaction costs, firms ignore shocks to their leverage ratio for some time, until they find it optimal to return to their target. The rebalancing of capital structure is a single large transaction. In other words, if tradeoff theory holds, we should observe divergence from target debt ratios followed by large adjustments as opposed to large shocks followed by slow convergence towards target ratios. We therefore differentiate ourselves from target adjustment models by staying close to the predictions of dynamic tradeoff theory.

Our analysis of the dynamics of leverage is closely related to Hovakimian (2004) and Lemmon, Roberts, and Zender (2008). The first author looks at the evolution of book leverage around leverage increasing transactions, i.e. where firms issue debt and increase payouts to equityholders. Our event studies are similar, but we look at longer time horizons, we define leverage increasing transactions differently, and we include other variables such as market leverage, profitability, and equity payouts. Lemmon, Roberts, and Zender (2008) form portfolios of firms based on leverage and follow the evolution of their leverage in the subsequent years. Instead, we define a leverage increasing event, split the sample based on the event, and look at the evolution of leverage for refinancing firms and non-refinancing firms prior to it. Focusing on US firms and matching by size, market-to-book and profitability, we find that market leverage dynamics for refinancing firms are consistent with patterns predicted by dynamic tradeoff theory. Leverage of the average firm in the two samples is roughly the same in the 10 to 6 years before refinancing. Starting 5 years before the adjustment, leverage of refinancing firms significantly drops below the leverage ratio of non-adjusting firms on average. In the year of the adjustment, the divergence is completely corrected. Interestingly but not in conflict with dynamic tradeoff theory, we do not observe a similar pattern for book leverage. Hovakimian (2004) reports a similar result for simultaneous debt issuers and equity repurchasers, interpreting his finding as evidence against firms offsetting debt ratio changes. A closer look at the dynamics of firm profitability and payouts to equityholders helps resolve the discrepancy between book and market leverage. Further, we document that the profitability of refinancing firms increases for several years prior to restructuring, both relative to non-refinancing firms and in absolute terms. Notably, payouts to equityholders increase over the same period. Hence, as increases in profits are paid out, there is no effect on the book value of equity, and consequently, on book leverage.

The remainder of the paper is organized as follows. The next part describes our dataset and how we construct the refinancing sample. The third part introduces our test specification and empirical results. The fourth part provides various tests of robustness. The evolution of leverage and other firm characteristics prior to refinancing events is analyzed in Section 5. Finally, Section 6 contains concluding remarks.

2 Data and Sample Selection

Our primary sample consists of all firms with listed equity in the United States, Japan, the United Kingdom, Canada, and Australia in the time period from 2000 to 2008. Aside from data availability constraints (which led us to exclude countries such as China), two additional considerations influence our sample selection. First, focusing on countries with well developed equity markets, firms in the sample account for 53 percent of world market capitalization as of 2008.[2] Second, we look mostly at Anglo-Saxon countries (plus Japan), with the intention that accounting measures are comparable. A more detailed cross-country comparison of leverage and other firms characteristics can be found in Rajan and Zingales (1995). Individual country samples differ with respect to the source of data and the availability of accounting items. Therefore, we proceed by pointing to some differences between the samples before reporting summary statistics.

The US sample consists of all firms available in Compustat between 2000 and 2008. All financial firms (SIC code 6000 to 6999) and regulated firms (SIC code 4900 to 4999) are excluded from the sample. Leverage - both book and market - is computed as in Baker and Wurgler (2002). Profitability is defined as operating profit over total assets. A detailed description of other covariates that are included in the empirical model is provided in Appendix A. Each year, two conditions determine whether a firm is included into the final sample. First, we require non-missing data on our measure of leverage and all covariates. Second, as we use the variation in annual operating profit as a proxy for asset risk similar to Titman and Wessels (1988), earnings data needs to be available for a minimum of 5 out of 10 years prior to the year for which the firm is to be added to the sample. Finally, all variables are winzorized at the upper and lower 1 percent level unless more economic meaningful mechanisms for the exclusion of outliers are available. An example of the latter is that leverage or the fraction of tangible assets is required to

[2] Source: U.S. Census Bureau, International Statistics, Section: Finance, Item 1360: *United States and Foreign Stock Markets - Market Capitalization and Value of Shares Traded.*

be between 0 and 1.

A key challenge in testing dynamic tradeoff theory as proposed by Strebulaev (2007) is the identification of firm years where a firm's capital structure is close to or at its optimum. In the framework of this theory, depending on the evolution of leverage, firms either increase or decrease their debt ratios when they find it profitable to do so. In the present paper, we exclusively focus on leverage increasing adjustments, i.e. where firms issue long term debt and reduce equity through cash dividends or share repurchases. We do so for several reasons. First, as noted by Chen and Zhao (2005), previous results in favor of tradeoff theory are much weaker once overlevered firms that reduce their debt ratios are excluded from the sample. Hence, we attempt to address this critique by focusing on leverage increasing transactions. Second, when firms actively enhance their use of debt, we conjecture that they are not threatened by immediate insolvency. In this case, book values of debt serve as reasonable proxies for corresponding market values, which are needed to determine market leverage. Finally, as we attempt to formulate a test that is closely linked to the unterlying theory, considering downward adjustments in leverage ratios would require determining the outcome of asset sales and bankruptcy procedures. Especially given the international nature of our sample, this is a far from straight forward task and we thus concentrate on upwards adjustments in this paper, i.e. leverage increases through debt financed equity reductions.

In accordance with the arguments described in the previous paragraph, for each firm in the final US sample, in each year, a firm is classified to belong either to the cross sectional sub-sample (non-refinancing sample) or the refinancing sub-sample. We follow the literature on securities issues and use the following three criteria, which are set up to ensure that firms are close to a capital structure adjustment, to define when a firm year observation is included in the refinancing sample. First, within the last year, the difference in long term debt relative to total assets has to exceed a percentage threshold, TH1. Second, to qualify for a financially motivated adjustment in our context, firms have to pay out cash dividends or report spendings on stock repurchases that, again relative to total assets, add up to at least TH2 percent. A third condition, positive net income, helps to ensures that we focus on profitable and healthy firms which find it optimal to increase their debt ratios. In principle, while being classified as refinancing in a given year, most firms are likely to occur in the cross sectional sample for all remaining years. To ensure independence between the two sub-samples, we require that firms that refinance according to our criteria at least once between 2000 and 2008 cannot be included in the cross sectional sample in any other period.

The remaining data (i.e. the sample of UK firms, Japanese firms, Canadian firms, and Australian firms) is obtained from Datastream's Worldscope. Again, firms of the financial sector and the regulated sector are excluded from the sample. The non-US samples differ from the US sample with respect to two key characteristics. First, leverage is computed as book debt divided by market value of assets, where book debt is obtained as total assets less total shareholders equity. This is slightly different from Baker and Wurgler (2002), whose procedure we use in the sample of US firms. The market value of assets is computed as book debt plus shares outstanding times the fiscal year end share price. Second, as an item similar to spendings on stock repurchases is not readily available, we approximate share repurchases by reductions in total shareholders equity that are reported together with positive net income. Thus, book equity reductions are not simply a consequence of incurred losses. The identification of refinancing firms and computation of covariates then works analogously to the US case and is provided in Appendix A.

Table 1 presents summary statistics for both the cross section of US firms and the sub-sample of US firms adjusting their capital structure, using a symmetric threshold (TH1=TH2) of 5 percent and 10 percent, respectively. A comparison between the samples reveals a few interesting differences. Firms that are found to adjust their capital structure tend to be larger, have slightly higher valuations expressed in higher market-to-book ratios and are more capital intensive, i.e. have relatively more tangible assets. Moreover, while refinancing firms show higher profitability on average, we note that unprofitable firms are excluded from the refinancing sample by means of the third requirement, positive net income. Thus, the reported difference on profitability is due to self selection. Overall, our summary statistics are mostly consistent with those found in previous studies such as Rajan and Zingales (1995), Baker and Wurgler (2002), and Lemmon, Roberts, and Zender (2008). Table 2 shows summary statistics for the cross section of firms in the UK, Japan, Canada, and Australia. All variables, except for size, are scaled by total assets and are therefore independent of the respective currency. In order to facilitate comparison, the variable size, defined as the natural logarithm of a firm's sales, is based on sales converted to US-Dollar using year end exchange rates from Datastream. Overall, Japanese firms tend to be larger and use more leverage, while Canadian and Australian firms exhibit higher average valuations and face more volatile profits.

The number of firms we classify as revealing their optimal capital structure in a given year is small and shows considerable variation over time. For each country sub-sample and each year from 2000 to 2008, Table 3 reports the total number of firms, the size of the refinancing sample defined by a symmetric 10 percent threshold for debt issues and equity reduction (TH1=TH2=0.10), and the refinancing sample with an equity reduction threshold (TH2) of 10 percent not considering debt issues. More than 3500 firms are part of the US sample in each year. However, especially the second column reveals that leverage-increasing transactions are infrequent events leading to a small refinancing sample size. With a strict symmetric 10 percent threshold, only 327 firms are classified as refinancing firms over the 9 year sample horizon. Dropping the condition on long term debt issuances increases the refinancing sample size to 2325 firm year observations.

A comparison across countries reveals that overall, sample sizes differ significantly from as few as 2699 and 3180 firm year observations in Australia and Canada, to 23412 and 36355 observations in Japan and the US. While the overall relation between refinancing subsample sizes and the total sample size within each country is comparable to the US, it is interesting to note that Japan, with the second largest overall sample size reports the smallest refinancing sub-samples. Hence, the proposed procedure used to identify refinancing firms may not be appropriate for Japanese firms as market conditions or corporate practices may lead corporations to adjust their capital structure through means other than long term debt financing and equity repurchases. With this caveat in mind, we analyze the relationship between leverage and profitability in the next section.

3 Relating Leverage and Profitability

With a dynamic tradeoff model in mind and in an ideal world, the empirical model we would like to test at refinancing dates can be written as

$$Lev_i = \beta_0 + \beta_1\pi_i + \beta_2\sigma_i + \gamma_i'C_i + \epsilon_i \tag{1}$$

which corresponds to Equation (20) in Strebulaev (2007). Leverage (Lev_i) of firm i is the dependent variable, π_i and σ_i denote profitability and cash flow volatility, respectively. Since more profitable firms and firms with less earnings volatility tend to default less frequently, leading to lower expected bankruptcy cost, these firms should pursue higher leverage ratios. C_i is a vector of costs that determine capital structure, including bankruptcy costs, adjustment costs incurred during the issuing and retirement of debt and equity, as well as costs related to the sale of assets. As those cost components are not directly observable, we have to deviate from the specification of Equation (1) and instead attempt to estimate the following modified regression:

$$Lev_{it} = \alpha_0 + \beta_1\pi_{it} + \beta_2\sigma_{it} + \gamma' Z_{it} + \alpha_1 D_{it} + \beta_3 D_{it}\pi_{it} + \epsilon_{it}. \tag{2}$$

Here, the vector Z_{it} replaces C_i and includes measures of a firm's size, market to book ratio, tangible assets, non-debt tax shields, and industry concentration according to Herfindahl.

Table 1:
Summary Statistics for US Firms

The sample consists of all nonfinancial and unregulated firms that are available in Compustat between 2000 and 2008. The table presents means, medians and standard deviations for the total sample (cross section) and the sub-sample of firms that refinance their capital structure based on a 5% threshold (TH=0.05) or a 10% threshold (TH=0.10). A threshold of 5% means that the increase in long-term debt relative to assets and the payouts to equityholders relative to assets in a given firm-year are both larger than 5%. The variables are Market Leverage (MarketLev), Book Leverage (BookLev), Profitability (Profit), Risk, Size, Market-to-Book ratio (MTB), Tangible Assets (TA), Non-Debt Tax Shields (NDT), and the Herfindahl industry concentration measure (HHI). Variable definitions are provided in Appendix A.

	Cross Section			TH = 0.05			TH = 0.10		
Variable	Mean	Median	SD	Mean	Median	SD	Mean	Median	SD
MarketLev	0.371	0.317	0.261	0.310	0.289	0.160	0.291	0.264	0.156
BookLev	0.445	0.435	0.227	0.527	0.533	0.195	0.537	0.544	0.214
Profit	0.053	0.101	0.208	0.190	0.173	0.092	0.214	0.193	0.108
Risk	0.473	0.449	0.249	0.303	0.238	0.213	0.309	0.251	0.210
Size	5.392	5.507	2.551	7.312	7.334	1.712	7.090	7.158	1.669
MTB	1.872	1.430	1.357	2.089	1.828	1.048	2.382	2.012	1.253
TA	0.264	0.188	0.233	0.332	0.251	0.255	0.308	0.222	0.253
NDT	0.049	0.040	0.039	0.045	0.040	0.026	0.045	0.039	0.027
HHI	0.071	0.045	0.080	0.082	0.051	0.091	0.086	0.053	0.094
Obs	36355			910			327		

Table 2:
Summary Statistics for Non-US Firms

We collect data from Thomson Reuters Datastream for United Kingdom (UK), Japan (J), Canada (CAN), and Australia (AU), the sample period is 2000 to 2008. The variables are Market Leverage (MarketLev), Book Leverage (BookLev), Profitability (Profit), Risk, Size, Market-to-Book ratio (MTB), Tangible Assets (TA), Non-Debt Tax Shields (NDT), and the Herfindahl industry concentration measure (HHI). Variable definitions are provided in Appendix A.

	UK			Japan			Canada			Australia		
Variable	Mean	Median	SD	Mean	Median	SD	Mean	Median	SD	Mean	Median	SD
MarketLev	0.412	0.392	0.234	0.540	0.564	0.234	0.372	0.339	0.239	0.325	0.293	0.221
BookLev	0.511	0.516	0.215	0.537	0.547	0.215	0.455	0.461	0.214	0.434	0.459	0.213
Profit	0.046	0.070	0.164	0.048	0.042	0.058	0.020	0.068	0.197	-0.013	0.048	0.230
Risk	0.454	0.419	0.246	0.454	0.418	0.230	0.516	0.498	0.248	0.533	0.516	0.254
Size	5.080	5.096	2.320	6.628	6.477	1.501	5.681	5.916	2.540	4.770	5.282	3.025
MTB	1.667	1.315	1.114	1.131	0.991	0.636	1.693	1.358	1.129	1.913	1.484	1.297
TA	0.281	0.211	0.247	0.314	0.299	0.173	0.399	0.377	0.274	0.319	0.268	0.260
NDT	0.051	0.044	0.038	0.031	0.027	0.021	0.057	0.047	0.042	0.047	0.036	0.048
HHI	0.225	0.181	0.180	0.090	0.064	0.083	0.330	0.236	0.238	0.355	0.300	0.212
Obs	6913			23412			3180			2699		

Table 3:
Number of Refinancing Firms by Year

We collect data from Compustat for US firms, and from Thomson Reuters Datastream for United Kingdom (UK), Japan (J), Canada (CAN), and Australia (AU). The sample period is 2000 to 2008. For each country the first column shows the total number of observations for which all regression variables are available. The second and third columns show the number of firm-years classified as refinancing observations. We use two alternative definitions of refinancing. For the first definition, a firm-year is classified as a refinancing observation if the increase in long-term debt relative to assets exceeds $TH1 = 10\%$, the payouts to equityholders relative to assets are larger than $TH2 = 10\%$, and net income is positive. The second definition drops the condition on long-term debt. For US firms, payouts to equityholders consist of dividends and purchases of common and preferred stock. For non-US firms this measure is approximated by the sum of cash dividends and the absolute value of changes in shareholders equity.

Criterion	US			UK			J			CAN			AU		
TH1		0.10			0.10			0.10			0.10			0.10	
TH2		0.10	0.10		0.10	0.10		0.10	0.10		0.10	0.10		0.10	0.10
NI		0	0		0	0		0	0		0	0		0	0
2000	4211	26	183	674	5	19	1963	2	4	188	1	6	120	4	10
2001	4088	15	142	748	4	19	2038	0	3	195	2	4	137	1	5
2002	4202	17	132	782	5	34	2471	0	17	251	1	4	156	1	6
2003	4239	23	148	773	3	30	2516	1	8	328	2	12	187	0	8
2004	4237	23	234	767	3	25	2615	0	5	384	2	16	254	0	10
2005	4100	35	324	765	8	59	2829	1	12	404	1	20	381	6	32
2006	3950	62	382	795	7	56	2900	1	10	452	4	28	454	6	42
2007	3796	91	454	803	6	38	3009	2	17	480	6	37	498	5	31
2008	3532	35	326	806	11	35	3071	1	42	498	4	29	512	6	28
Total	36355	327	2325	6913	52	315	23412	8	118	3180	23	156	2699	29	172

These covariates are standard in the empirical corporate finance literature and intend to capture alternative determinants of capital structure choice. In what follows, we shortly describe each underlying tradeoff and expected sign of the coefficient. Smaller firms are likely to be less diversified and thus face higher expected bankruptcy costs. Hence, we expect to find a positive relationship between firm size and leverage. Growth opportunities, approximated by market-to-book ratios, introduce risk to the firm's prospects and thus increase the expected cost of financial distress. The corresponding coefficient in our leverage regression is therefore expected to be negative. A positive relationship should be found between tangible assets and leverage, since tangible assets may serve as collateral and thus reduce expected cost of financial distress. Non-debt tax shields such as R&D expenses or depreciation reduce total taxable income. In consequence, interest related tax shields are less valuable making debt financing less attractive. Following Maksimovic (1988), we expect higher leverage ratios for concentrated industries. In his model, the usage of debt is connected to output restrictions, and the maximum leverage consistent with an optimal policy declines in the number of firms. Returning to Equation (2), D_{it} refers to a dummy variable that equals 1 if firm i adjusts its capital structure in year t and 0 otherwise.

In principle, conditioning the analysis on refinancing points makes the inclusion of dummy variables obsolete. However, increasing the likelihood of correctly identifying firms that consciously use equity-for-debt swaps for adjusting their capital structure comes at a price. Higher thresholds for debt issuing and stock repurchasing (and dividend) activity simultaneously leads to a reduction in sample size. In order to avoid this tradeoff, we use the full sample and include dummy variables that identify firms at refinancing points. Moreover, using this specification directly facilitates a comparison between the cross section of firms and the refinancing sub-sample. In particular, while a negative coefficient for π_{it} would be consistent with prior empirical evidence, we expect a positive sign on the interaction term $D_{it}\pi_{it}$ for firms which are at or close to their optimal capital structure. Furthermore, a test of dynamic tradeoff theory can be constructed by testing whether the sum of the coefficients on π_{it} and $D_{it}\pi_{it}$ is positive.

3.1 Analysis based on the US Sample

Changes in capital structure that result from issuances or repurchases of debt or equity securities are typically identified by considering changes in quarterly accounting items, an approach used by Hovakimian, Opler, and Titman (2001), Korajczyk and Levy (2003), and Leary and Roberts (2006). The standard procedure is to classify changes in debt or equity, which exceed a 5 percent threshold when measured relative to total assets, as capital structure adjustments. As our analysis is based on yearly instead of quarterly observations, Table 4 provides estimation results of the basic model given by Equation 2 for different adjustment thresholds ranging from 5 percent to 10 percent. The header of each column specifies threshold values for the three criteria used to define refinancing firms, changes in long term debt (TH1), stock repurchases and dividend payments (TH2), and net income. Whenever a criterion is missing in the column header, it is ignored when determining the refinancing sub-sample.

The first two columns provide estimation results of the basic model when selecting refinancing firms with a symmetric threshold of 5 percent and 10 percent for both the debt issuance and equity repurchase criterion while also requiring that firms have positive net income. In both columns (1) and (2), profitability shows the expected negative and significant coefficient (-0.29). Moreover the signs on Size (+), market-to-book (MTB) (-), tangible assets (TA) (+), and the Herfindahl index (+) are also found to display their respective expected signs. Risk, which we conjectured to be negatively related to leverage, turns out to carry a positive coefficient. This may in part be due to the way the risk measure is constructed and we therefore refer the section on robustness, where we introduce an alternative measure for risk that results in a negative coefficient estimate. Moreover, the sign of the coefficient on non debt tax shields (NDT) (+) is also in conflict with theoretical predictions. However, while higher tax shields that are not associated with interest payments should render debt less attractive, approximating non-debt tax shields using depreciation over total assets clearly also captures the positive effect of tangible assets serving as collateral for debt issues. Here, this second effect seems to dominate and produces the not anticipated positive coefficient. The dummy identifying refinancing firms turns out to be negative, suggesting that even though these firms adjust their leverage ratios upwards, they tend to not adjust them sufficiently to return to the average leverage ratio of the cross section. Finally, and most interestingly, the coefficient on the interaction term of the dummy variable with profitability (DumxProfit) is positive and significant in both specifications. Moreover, the magnitude of the coefficients is large enough to counterbalance the negative coefficients on profitability. In both cases, we also test whether the sum of the coefficients on profitability and its interaction with the refinancing dummy is different from zero. As reported by the second last row, labeled "Wald", this is only the case when choosing refinancing firms based on a 10 percent threshold (p-value of 0.005).[3] Unreported results reveal that this test provides significant results when defining refinancing firms based on a symmetric threshold value of 7 percent or higher.

Model (3) assesses the importance of the third selection criterion, positive net income,

[3]We use a standard Wald test with heteroscedasticity robust standard errors as suggested in Wooldridge (2002), p.57. Relating to equation 2, the null hypothesis is that $\beta_1 + \beta_3 = 0$.

for the procedure's ability to determine a sample of firms that adjust leverage ratios after hitting the lower leverage barrier. Interestingly, the estimation reveals that the third criterion is of some importance for the selection process. Starting from the previous specification with the same two other thresholds of 10 percent in place, when we omit the positivity constraint on net income, the interaction term of profitability and the refinancing dummy, while still significant, decreases in magnitude from 0.549 to 0.315, a level that is comparable with the coefficient in specification (1). Consequently, the sum of the two coefficients on profitability and its interaction with the refinancing dummy looses its significance. While the fact that there are firms which increase their debt ratios by issuing new debt and paying extensive dividends, repurchasing shares or engaging in a combination of both while reporting negative net income is interesting in itself, our results indicate that these firms' behavior is less consistent with dynamic tradeoff theory. Firms which where recently created through spin-offs or divestitures may be one potential explanation for these results. As a stand alone company, firms may take on debt to pay off claims of the former parent company, resulting in payments which are then recorded as stock repurchases or special dividend payments. In these cases, it is questionable whether these firms actually qualify as reporting an optimal capital structure or whether the capital structure of these firms is driven by preferences of the parent company.

The two remaining model specifications attempt to determine the individual importance of adding criterion 1 (debt issues) and criterion 2 (equity payouts), to the selection process. The estimation results of model (4), omitting the second criterion, reveals that when focusing on firms that issue long term debt, more profitable firms are found to have even lower leverage ratios. Clearly, comparing this specification with specification (2), the results are driven by firms that report payouts for stock repurchases or dividends that do not exceed the 10 percent threshold. As these firms retain a larger fraction of their profits, resulting in lower leverage ratios, it is not surprising that we find a negative coefficient on the interaction term.

Focusing on stock repurchases and dividend payments while maintaining the requirement of positive net income in column (5), produces estimation results that are again consistent with dynamic tradeoff theory predictions. As can be seen in the last column of Table 4, while the coefficient of the interaction term slightly decreases in magnitude from 0.549 to 0.369, adding the coefficient of the interaction term results in a positive and statistically significant overall coefficient of profitability for refinancing firms (as reported by the Wald test p-value of 0.014). In summary, it seems that profitable firms that repurchase stocks or pay out large dividends are closest to managing their capital structure in a way which is consistent with dynamic tradeoff theory predictions. This finding is consistent with Hovakimian, Opler, and Titman (2001), who show that the amount of repurchased equity is close to the size of the deviation of leverage from its target. Moreover, the importance of stock repurchases as a selection criterion for refinancing firms is also in line with Brav, Graham, Harvey, and Michaely (2005) who provide survey evidence of firms claiming that they use stock repurchases to adjust their capital structure toward a target ratio.

3.2 Analysis based on the NON-US Samples

In this section, we intent to confirm our previous findings by separately considering firms listed in the UK, Japan, Canada, and Australia. Before we start to discuss some of the results, it is important to remember the main differences between these samples and the US sample. First, book debt, which is used as a proxy for market debt in the calculation of market leverage, is obtained as total assets less total shareholders equity. Second, share repurchases are approximated by reductions in total shareholders equity in combination with positive net income. Positive net income is important, because otherwise a reduction in shareholders equity can be triggered by a loss. All remaining variables are computed analogously to the US sample, though potential differences with respect to accounting standards may still result in additional deviations across countries. Thus, less emphasis is put on across-country comparisons than on whether behavior that is consistent with tradeoff theory predictions can be found for each country separately.

Table 5 shows results for the standard model based on the four different country samples, where the refinancing sample is defined as in model specification (2) of Table 4, i.e. positive net income and a symmetric threshold of 10 percent for debt issues and equity payouts. In the cases of UK and Australia, both coefficients on the interaction of the refinancing dummy with profitability are positive and greater in magnitude than the corresponding negative coefficient of profitability. However, the Wald test shows that the difference is not significantly different from zero. The regression based on the Japanese sample produces a positive and significant coefficient on the interaction term. However, its magnitude is not sufficient to counterbalance the negative coefficient of profitability. In the Canadian regression, the coefficient on the interaction term turns out to be slightly negative and insignificant. Most of the remaining explanatory variables, when significant, show similar coefficient signs to the respective coefficients in the US regression. The only notable difference is the highly significant impact of non-debt tax shields in the case of Japan, which are negatively correlated with leverage and are therefore consistent with the theoretical prediction. In conclusion, the major reason for the insignificance of our interaction coefficients is probably the very small sample size of the respective refinancing sub-samples, as indicated by the discussion of Table 3. Therefore, to overcome this problem, Table 6 provides estimation results for model specification (5), which uses only the second criterion and positive net income to identify refinancing firms, naturally resulting in larger sub-samples. With the exception of UK, the interaction coefficient in all other countries is large enough to ensure that the overall coefficient on profitability is not negative for refinancing firms. In the Australian regression, the positive coefficient on the interaction term is large enough in magnitude compared to the coefficient on profitability so that the sum of the two coefficients is positive and significant, which can be seen from the Wald test. To conclude, while evidence in favor of dynamic tradeoff theory provided using a selection of non-US markets is not as strong as the evidence based on US data, we should bear in mind that the selection process for the refinancing samples are somehow weaker due to non-availability of data on share repurchases in Datastream.

4 Robustness

A major concern is that the decision to become a refinancing firm may not be exogenous in the specification, i.e. it may be at least in part determined by leverage. Assuming that the remaining variables are exogenous, the model we have specified in Equation (2) is similar to a class of models first considered by Heckman (1978), which are called dummy endogenous variable models. To address the problem of endogeneity, we follow a 3 step procedure proposed by Wooldridge (2002).[4] The main objective of the method is to replace the endogenous dummy variable with an exogenous proxy using an instrumental variables approach. When suitable instruments for the dummy variable are not readily available, fitted probabilities of a binary response model may be used instead. Therefore, the first step requires a model of selection into the refinancing sub-sample. This can be written as

$$P\left(D_{it} = 1 | \overline{Z_{it}}, X_{it}\right) = G\left(X_{it}, \overline{Z_{it}}; \eta\right). \tag{3}$$

In this specification, $\overline{Z_{it}}$ contains all exogenous variables of Equation (2) and X_{it} is a vector that may contain cash holdings of firm i, several differences in lagged cash holdings, as well as various interaction terms. The parameters of the model are denoted by η. Initially, both probit and logit models are considered as a choice for G. An advantage of this procedure, besides its robustness, is that we do not require Equation (3) to be correctly specified. As Wooldridge notes, fitted probabilities $\hat{G}_{it}$ have to be significant in the upcoming second stage regression (a linear projection of D_{it} onto exogenous variables of Equation (2) and $\hat{G}_{it}$) for the approach to be meaningful. Generally, partial correlation between D_{it} and X_{it} should be enough to provide applicability of the procedure, making it relatively robust against first stage misspecification.

[4]The method we apply closely follows procedure 18.2 in Wooldridge (2002), p.626.

The second step then comprises regressing D_{it} on the right hand side variables of Equation (2), where the endogenous dummy variable is replaced by $\hat{G}_{it}$ from the first stage estimation. The second stage thus corresponds to the reduced form equation of the typical IV estimation where fitted probabilities are used as instruments. Formally, we have

$$D_{it} = \delta_0 + \lambda'\overline{Z_{it}} + \delta_1 \hat{G}_{it} + \delta_2 \hat{G}_{it}\pi_{it} + r_{it}. \tag{4}$$

In the above equation, $\overline{Z_{it}}$ is the same as in Equation (3) and the error term is given by r_{it}. When fitted values obtained from the second stage are exogenous to leverage, the third stage regression can be estimated using ordinary least squares. In particular, the model is closely related to Equation (2) in which the two endogenous covariates are replaced by their fitted values $\hat{D}_{it}$ and $\hat{D}_{it}\pi_i$ from the reduced form regression, resulting in

$$Lev_{it} = \alpha_0 + \beta_1 \pi_{it} + \beta_2 \sigma_{it} + \gamma'_{it} Z_{it} + \alpha_1 \hat{D}_{it} + \beta_3 \hat{D}_{it}\pi_{it} + \epsilon_{it}. \tag{5}$$

With this basic procedure in place, we are equipped to correct for a potential endogenous dummy variable problem. The following paragraphs explain its implementation and provide estimation results. Moreover, the results are based on model specification (2) from Table 4, requiring firms to report positive net income, and debt issues as well as stock repurchases (plus dividend payments) relative to total assets in excess of 10 percent to count as a refinancing firm. The following analysis also pertains for symmetric thresholds other than 10 percent.

The first stage binary response model is estimated using a probit specification. There is no obvious benefit of choosing a probit over a logit in this context as our results remain largely unaffected by the choice of the specification. Table 7 summarizes the estimation results. The first 7 variables, contained in $\overline{Z_{it}}$ in Equation (3), resemble our standard set of covariates excluding the endogenous dummy variable and its interaction with profitability. Aside from tangible assets and the Herfindahl index, all variables in $\overline{Z_{it}}$ are of some relevance in explaining the decision to refinance. Additional variables, intended to help construct a suitable instrument for the endogenous dummy and denoted by X_{it} in Equation (3), include average industry leverage, contemporaneous cash holdings, the difference between current and three (two) year lagged market leverage (profitability), lagged book leverage, as well as a quadratic term in market-to-book. The latter quadratic term is meant to account for non-linearities in the firm's decision to adjust its capital structure. The inclusion of cash into our regression model is motivated by the idea that firms might view reductions in cash as a cheap way to increase their debt ratios before they proceed to use costly debt markets for refinancing. The inclusion of lagged covariates, in particular market leverage and profitability (i.e. their differences with respect to current levels), and book leverage are meant to capture the potential impact these deviations might have on the decision to refinance. In fact, both leverage related lagged variables turn out to carry a significant coefficient. Moreover, average industry leverage and cash also contribute to the prediction in a statistically significant manner. The two remaining variables we included in X_{it} prove to be unrelated to the decision to adjust capital structure. However, unreported results show that these variables turn out to be of some importance as we consider lower threshold levels, which is why we keep them in the basic model. Finally, note that the first stage model is estimated over all cross sections pooled, and year dummies are included to capture any omitted year fixed effects.

Using the fitted probability of being included in the refinancing sub-sample from the first stage regression as an instrument, Table 8 provides estimation results of the second stage reduced form regression. A necessary requirement for the reduced form model to provide appropriate instrumented variables is that the left hand side variable of interest, the refinancing dummy, is actually related to the instrument. Here, this is the case through both the fitted probability (Dumfit) alone as well as through its interaction with profitability (Interact). At the same time, neither of the remaining covariates included in Z_{it} carries a coefficient significantly different from zero.

Replacing the endogenous refinancing dummy with its fitted counterpart from the second stage regression enables us to apply standard ordinary least squares estimation to Equation (5). However, while all covariates can now be assumed exogenous in the model, the procedure naturally comes at a cost. Initially, we were able to distinguish between the two sub-samples merely on the basis of the binary refinancing dummy. Thus, in the original model specification of Equation (2), β_3 can be interpreted as the addition to the profitability coefficient β_1 for firms at their optimal capital structure. Now, since the instrumented dummy of the second stage regression is the result of a linearization of a binary variable, its domain is no longer restricted to the set $\{0, 1\}$. Fortunately, we can interpret the instrumented dummy (Dum) in a similar manner, namely as a measure of distance to refinancing. A higher value of Dum simply indicates that the firm under consideration is closer to a refinancing event, and hence closer to its optimal capital structure. Thus, we interpret the coefficient of the interaction term of Dum and profitability as the addition to the stand alone coefficient of profitability for firms that we consider to be fairly close to a leverage ratio adjustment. Table 9 summarizes estimation results of the third stage regression where market leverage is the dependent variable. First and most important, while we find that leverage in the cross section of firms is negatively related to profitability, this relationship is counteracted when firms find themselves at their optimal capital structure, as indicated by the positive and significant coefficient on the interaction term of profitability and Dum. The remaining variables mostly show signs which are consistent with previous studies and are in accordance with our expectations outlined in the preceding subsection. Risk and the market-to-book ratio (MTB) carry a negative coefficient, while the coefficients on size, tangible assets (TA), non-debt tax shields (NDT) and industry concentration (HHI) are positive.

Finally, a meaningful joint test of the coefficients on profitability (β_1) and its interaction with the constructed dummy (β_3) is no longer straight forward. As the constructed dummy prevents us from directly considering the sum of the two coefficients, we provide two alternative test specifications. First, the fitted dummy obtained through Equation (4) is used to divide the sample into refinancing firms and non-refinancing firms. Instead of choosing an ad hoc cutoff value, we require the number of firms that are classified as refinancing to match the refinancing sample size of the base case (327). Using a Wald test, we then determine whether the sum of the coefficient on profitability and its interaction with the constructed dummy is significantly different from zero. The interaction term is weighted by the refinancing firms' mean value of the fitted dummy.[5] With a mean value of the fitted dummy for refinancing firms of 0.102, the sum of the two coefficients of interest is 1.442, which is positive and statistically significant (with a p value below 1 percent).

Second, we repeat the previous test without reclassifying our refinancing sample, i.e. we use our original procedure to determine refinancing firms. Applying the above procedure then requires replacing the weighting factor for the interaction term with the mean value of the fitted dummy of the original refinancing sample, which is 0.035. This roughly corresponds to a lower cutoff value in the previous procedure, which would consequently lead to an increased sample size of refinancing firms (by a factor of 15). Thus, it is a more conservative test as it would allow more firms to be defined as refinancing in a hypothetical reclassification. In this case, the sum of the two coefficients is still positive at 0.391 and significant (with a p value below 1 percent).

To conclude, the basic results presented in Table 4 remain unaffected by the correction for potential endogeneity in the refinancing dummy. Most of the time, the mechanic negative relationship between profits and leverage ratios dominates. However, when firms reveal their optimal capital structure after refinancing though equity-for-debt swaps, appetite for leverage indeed increases as firms are more profitable.

[5] Instead of testing $\beta_1 + D\beta_3$, where $D = 1$, we modify the linear restriction, which now is $\beta_1 + \hat{D}\beta_3$, where $\hat{D}$ is the average fitted dummy for the new sample of refinancing firms.

Table 4: Regression Results for US Firms

We use all nonfinancial and unregulated firms that are available in Compustat between 2000 and 2008 in a pooled OLS regression. The dependent variable is market leverage, the independent variables are Profitability (Profit), Risk, Size, Market-to-Book ratio (MTB), Tangible Assets (TA), Non-Debt Tax Shields (NDT), and the Herfindahl industry concentration measure (HHI), a dummy which indicates refinancing firms (Dum), the refinancing dummy interacted with Profitability (DumxProfit), and year dummies. Variable definitions are provided in Appendix A. Columns (1) to (5) show how the sample of refinancing firms is created. In column (1) we include firm-years in the refinancing sample if long-term debt relative to assets increases by $TH1 = 5\%$, payouts to equityholders relative to assets are larger than $TH2 = 5\%$, and net income (NI) is positive. Columns (2) to (5) are defined analogously, i.e. $TH1$ and $TH2$ always refer to the thresholds for debt changes and equity payouts, respectively. Wald contains heteroskedasticity-consistent p-values for the test whether the sum of the coefficients of Profit and DumxProfit is zero. The symbols *, **, and *** refer to estimates significantly different from zero at the 10%, 5%, and 1% confidence level, respectively. Standard errors are based on White's heteroskedasticity-consistent estimator.

Variable	(1)	(2)	(3)	(4)	(5)
	TH1=0.05	TH1=0.10	TH1=0.10	TH1=0.10	
	TH2=0.05	TH2=0.10	TH2=0.10		TH2=0.10
	$NI > 0$	$NI > 0$		$NI > 0$	$NI > 0$
Intercept	0.399***	0.399***	0.399***	0.387***	0.404***
Profit	−0.288***	−0.289***	−0.289***	−0.256***	−0.278***
Risk	0.021***	0.022***	0.022***	0.022***	0.018***
Size	0.016***	0.016***	0.016***	0.016***	0.016***
MTB	−0.078***	−0.078***	−0.078***	−0.077***	−0.077***
TA	0.124***	0.123***	0.122***	0.119***	0.119***
NDT	0.518***	0.523***	0.526***	0.590***	0.512***
HHI	0.266***	0.265***	0.264***	0.277***	0.265***
Dum	−0.100***	−0.130***	−0.055***	0.051***	−0.159***
DumxProfit	0.334***	0.549***	0.315***	−0.210***	0.369***
Year FE	*yes*	*yes*	*yes*	*yes*	*yes*
Adj. R^2	0.283	0.283	0.282	0.285	0.290
Wald	0.525	0.005	0.778	0.000	0.014
Obs	32821	32821	32825	36281	32887

Table 5:
Regression Results for Non-US Firms: Base Case

We evaluate data from Thomson Reuters Datastream in a pooled OLS regression. The countries included are United Kingdom (UK), Japan (J), Canada (CAN), and Australia (AU), the sample period is 2000 to 2008. The dependent variable is Market Leverage, the independent variables are Profitability (Profit), Risk, Size, Market-to-Book ratio (MTB), Tangible Assets (TA), Non-Debt Tax Shields (NDT), and the Herfindahl industry concentration measure (HHI), a dummy which indicates refinancing firms (Dum), the refinancing dummy interacted with Profitability (DumxProfit), and year dummies. Variable definitions are provided in Appendix A. Firm-years belong to the refinancing sample (i.e. Dum=1) if the increase in long-term debt relative to assets in larger than 10%, the sum of cash dividends and the absolute value of changes in shareholders equity relative to assets exceed 10%, and if net income is positive. Wald contains heteroskedasticity-consistent p-values for the test whether the sum of the coefficients of Profit and DumxProfit is zero. The symbols *, **, and *** refer to estimates significantly different from zero at the 10%, 5%, and 1% confidence level, respectively. Standard errors are based on White's heteroskedasticity-consistent estimator.

Variable	UK	J	CAN	AU
Intercept	0.479***	0.281***	0.352***	0.368***
Profit	−0.393***	−1.252***	−0.307***	−0.177***
Risk	0.076***	0.156***	0.038**	0.045***
Size	0.024***	0.033***	0.035***	0.027***
MTB	−0.103***	−0.105***	−0.095***	−0.079***
TA	−0.029**	0.287***	0.023*	−0.038**
NDT	−0.005	−2.068***	0.053	0.067
HHI	0.042**	−0.005	0.060***	0.021
Dum	−0.058	0.028	0.051	−0.085*
DumxProfit	0.708**	0.803***	−0.130	0.605*
Year Fixed Effects	*yes*	*yes*	*yes*	*yes*
Adj. R^2	0.381	0.433	0.407	0.394
Wald	0.187	0.024	0.110	0.098
Obs	6887	23162	3129	2681

Table 6:
Regression Results for Non-US Firms: Alternative Case

We evaluate data from Thomson Reuters Datastream in a pooled OLS regression. The countries included are United Kingdom (UK), Japan (J), Canada (CAN), and Australia (AU), the sample period is 2000 to 2008. The dependent variable is market leverage, the independent variables are Profitability (Profit), Risk, Size, market-to-book ratio (MTB), tangible assets (TA), non-debt tax shields (NDT), and the Herfindahl industry concentration measure (HHI), a dummy which indicates refinancing firms (Dum), the refinancing dummy interacted with Profitability (DumxProfit), and year dummies. Variable definitions are provided in Appendix A. Firm-years belong to the refinancing sample (i.e. Dum=1) if the sum of cash dividends and the absolute value of changes in shareholders equity relative to assets exceed 10% and if net income is positive. Wald contains heteroskedasticity-consistent p-values for the test whether the sum of the coefficients of Profit and DumxProfit is zero. The symbols *, **, and *** refer to estimates significantly different from zero at the 10%, 5%, and 1% confidence level, respectively. Standard errors are based on White's heteroskedasticity-consistent estimator.

Variable	UK	J	CAN	AU
Intercept	0.478***	0.284***	0.351***	0.369***
Profit	−0.403***	−1.260***	−0.321***	−0.194***
Risk	0.078***	0.156***	0.040**	0.047***
Size	0.025***	0.033***	0.035***	0.028***
MTB	−0.105***	−0.106***	−0.097***	−0.082***
TA	−0.029**	0.287***	0.026*	−0.036**
NDT	0.003	−2.065***	0.056	0.048
HHI	0.042**	−0.004	0.057***	0.023
Dum	0.009	−0.180*	−0.048*	−0.082***
DumxProfit	0.359***	1.310**	0.328***	0.421***
Year Fixed Effects	*yes*	*yes*	*yes*	*yes*
Adj. R^2	0.384	0.435	0.408	0.399
Wald	0.635	0.789	0.934	0.003
Obs	6887	23170	3141	2683

Table 7:
1st Stage: Binary Response Model (Probit)

The table provides results for the first stage binary response model (probit) in Equation (3). The dependent variable is the dummy denoting that firms belong to the refinancing sub-sample. Covariates are profitability (Profit), cash flow volatility (Risk), size, the market to book ratio (MTB), tangible assets (TA), non-debt tax shield (NDT), the Herfindahl industry concentration measure (HHI), average industry leverage (ILev), the firm's cash position including marketable securities at time t, MTB squared, the difference between current market leverage (profitability) and market leverage (profitability) lagged by three (two) periods ($Mlev_{-3}$ ($Profit_{-2}$)), as well as book leverage lagged by one period (LBlev). Variable definitions are provided in Appendix A.

Variable	
Intercept	-2.589^{***}
Profit	2.798^{***}
Risk	-0.427^{***}
Size	0.072^{***}
MTB	0.104^{***}
TA	0.083
NDT	-3.220^{***}
HHI	0.325
ILev	-0.628^{**}
Cash	-0.686^{***}
MTB^2	-0.004
$Mlev_{-3}$	-0.341^{**}
$Profit_{-2}$	0.273
$LBlev$	-0.530^{***}
Obs	26758

Table 8:
2nd Stage: Reduced Form Model

The table provides results for the second stage reduced form model in Equation (4). The dependent variable is the dummy denoting that firms belong to the refinancing subsample. Covariates are profitability (Profit), cash flow volatility (Risk), size, the market to book ratio (MTB), tangible assets (TA), non-debt tax shield (NDT), the Herfindahl industry concentration measure (HHI), as well as the fitted probability (Dumfit) and the fitted probability interacted with profitability (Interact) that are obtained from the first stage regression.

Variable	
Intercept	0.000
Profit	0.004
Risk	−0.001
Size	−0.000
MTB	0.000
TA	−0.000
NDT	0.008
HHI	0.001
Dumfit	1.150***
Interact	−0.693***
$Adj.R^2$	0.025
Obs	26758

Table 9:
3rd Stage: IV Regression for Leverage

The table provides results for the third stage regression in Equation (5). The dependent variable is book leverage. Covariates are profitability (Profit), cash flow volatility (Risk), size, the market to book ratio (MTB), tangible assets (TA), non-debt tax shield (NDT), the Herfindahl industry concentration measure (HHI), as well as the instrumented exogenous dummy (Dum) and the instrumented probability interacted with profitability (DumxProfit) that are obtained from the first stage regression. The symbols *, **, and *** refer to estimates significantly different from zero at the 10%, 5%, and 1% confidence level, respectively. Standard errors are based on White's heteroskedasticity-consistent estimator.

Variable	
Intercept	0.359***
Profit	−0.164***
Risk	−0.033***
Size	0.028***
MTB	−0.073***
TA	0.127***
NDT	0.153***
HHI	0.250***
Dum	−8.876***
DumxProfit	15.679***
Year Fixed Effects	*yes*
$Adj.R^2$	0.405
Obs	26758

After having addressed the endogeneity issue we now present further robustness checks. With a sample horizon of nine years ranging from 2000 to 2008, and covering about one economic cycle, we are concerned that the results presented in the previous section are a characteristic of the last decade. However, the construction of our risk measure requires a long time series of operating profits, which necessarily leads to a short sample horizon. Instead of relying on a time series of past profitability to compute a risk measure, we alternatively estimate a firm's asset volatility assuming a structural model of credit risk. Following the standard iterative estimation approach which is, among others, used by Moody's KMV, we match monthly equity values obtained from CRSP to all firms in our sample and compute asset volatilities under the assumption of a constant risk free rate of 5 percent. Further details on the computation of the alternative risk measure are provided in Appendix A. A major advantage of this measure is that we can obtain acceptable estimates for asset volatilities relying on only two years of monthly data (we assume that firm debt is constant between two consecutive annual accounting reports), which leaves us with an extended US sample of 17 years spanning the time period from 1992 to 2008. Building on this extended sample period, specifications (2) to (5) in Table 10 show estimation results for the case with symmetric thresholds ($TH1 = TH2$) of 10 percent and the positive net income requirement. For comparison purposes and already including the new risk measure, specification (1) provides estimation results that are conditional on the smaller initial sample ranging from 2000 to 2008. Two aspects require special attention. First, and in contrast to the base specifications in Table 4, the new risk measure is significant and carries the expected negative sign. Second, the coefficient on the interaction term of profitability with the refinancing dummy is still highly significant, and adding it to the coefficient of profitability results in a positive and significant overall coefficient for refinancing firms. Considering model (2), which is essentially model (1) estimated on the extended sample, we note that the only difference to column (1) is that the coefficient on the interaction term, while not loosing its significance, slightly decreases from 0.611 to 0.482.

For the third specification, following Flannery and Rangan (2006), we include mean industry debt ratios in the model to control for industry characteristics which are not yet captured by other explanatory variables. Industry groups are based on 2 digit SIC codes to guarantee a sufficient number of firms per category. Consistent with previous studies, we find a positive and highly significant coefficient for the mean industry leverage. At the same time, the only other effect of including mean industry debt ratios worth mentioning is that the coefficient on HHI, while still significant, drops from 0.249 to 0.062.

The last extension considers a model in which one year lagged market leverage is included as a further control variable. The main motivation for including lagged leverage is that within one refinancing cycle, leverage should be rather persistent. As we observe only very few refinancing events, it seems that the sample captures at most one or two refinancing cycles for the majority of firms. In a model without mean industry leverage, lagged leverage is highly significant and positive. Moreover, the interaction term remains both positive and significant, and its (reduced) magnitude relative to the (also reduced) magnitude of the coefficient of profitability is relatively stable. Finally, in the full model (5) with average industry leverage and lagged leverage, both of which are positive and significant, the results on profitability remain unchanged relative to specification (4). In both cases, the sum of the coefficients on profitability and its interaction with the refinancing dummy remains positive and significant at the 5 percent level.

The next robustness check addresses our concern that previous findings are driven by firms that recently entered the database after a spin-off. The capital structure of these firms may still be highly influenced by the characteristics of the deal that separated the firm from its previous parent company. [6]

Thus, we exclude all firms from our base case regression for which the IPO date in Compustat, if available, is within the 3 years prior to being classified as refinancing firm. The regression results are not affected by this small decrease in the number of refinancing firms and we thus abstain from reporting detailed regression results.

As a further robustness check we replicate our base case regression (2) in Table 4 using a Tobit model. We do this to account for potential censoring in our dependent variable, market leverage, which lies between 0 and 1. Our main findings remain unchanged and are thus not reported here. Even though our underlying theoretical model is not directly related to book leverage, we repeat all regressions using book leverage as a dependent variable. All main findings are not affected so we do not report them. The same is true for the inclusion of industry dummies in our base case regression. These are constructed from 2 digit SIC codes and do not affect our main results.

Concluding this section, correcting for endogeneity in the dummy variable does not affect our main finding. Profitability is negatively related to leverage, but less so for refinancing firms, and the relationship even reverts for some definitions of refinancing events. Returning to the initial evidence based on pooled OLS regressions, extending the sample size and including average industry market leverage or one year lagged market leverage in the model, still results in significant and positive add-ons to the negative profitability coefficient, which are large enough to offset the negative coefficient on profitability, resulting in positive overall coefficients of profitability for refinancing firms.

[6] A textual analysis of annual reports of a random selection of 50 refinancing firms shows that while about 75 percent of the subsample seems to fund open-market share repurchases with increases in debt, we find a few cases in which a firm makes debt financed cash distributions to an old parent company after a spin-off.

Table 10:
Robustness Checks for US Firms

We use all nonfinancial and unregulated firms that are available in Compustat between 1992 and 2008 and perform pooled OLS regressions. The dependent variable is Market Leverage, the independent variables are Profitability (Profit), Risk_SM, Size, Market-to-Book ratio (MTB), Tangible Assets (TA), Non-Debt Tax Shields (NDT), the Herfindahl industry concentration measure (HHI), a dummy which indicates refinancing firms (Dum), the refinancing dummy interacted with Profitability (DumxProfit), and year dummies. For some regressions we include, as indicated, the mean industry leverage and market leverage lagged by one year. Variable definitions are provided in Appendix A. The definition of Risk is different in this Table, as explained in Appendix A. The thresholds used to define refinancing firm-years are 10% for the increase in long-term debt, 10% for equity payouts, and net income must be positive. Column (1) presents results for the basic sample period from 2000 to 2008 with the new risk measure. Columns (2) to (5) are based on an extended sample period from 1992 to 2008. Wald contains heteroskedasticity-consistent p-values for the test whether the sum of the coefficients of Profit and DumxProfit is zero. The symbols *, **, and *** refer to estimates significantly different from zero at the 10%, 5%, and 1% confidence level, respectively. Standard errors are based on White's heteroskedasticity-consistent estimator.

Variable	(1)	(2)	(3)	(4)	(5)
	2000 - 2008	1992 - 2008	1992 - 2008	1992 - 2008	1992 - 2008
Intercept	0.405***	0.401***	0.205***	0.191***	0.144***
Profit	−0.259***	−0.268***	−0.268***	−0.166***	−0.168***
Risk	−0.089***	−0.072***	−0.057***	0.003	0.006*
Size	0.021***	0.022***	0.018***	0.008***	0.007***
MTB	−0.08***	−0.081***	−0.074***	−0.030***	−0.029***
TA	0.103***	0.091***	0.054***	0.032***	0.023***
NDT	0.288***	0.246***	0.304***	0.043**	0.061***
HHI	0.258***	0.249***	0.062***	0.049***	0.003
Dum	−0.124***	−0.087***	−0.085***	0.017	0.015
DumxProfit	0.611***	0.482***	0.475***	0.262***	0.264***
ILev			0.499***		0.131***
LMlev				0.778***	0.764***
Year FE	*yes*	*yes*	*yes*	*yes*	*yes*
Adj. R^2	0.395	0.395	0.432	0.799	0.801
Wald	0.000	0.009	0.007	0.048	0.041
Obs	23249	37896	37896	37736	37736

5 Capital Structure Dynamics

5.1 The Evolution of Leverage

So far we have focused on the prediction of dynamic tradeoff theory that at the optimum, the relationship between leverage and profitability is positive. But the theory also predicts how leverage and profitability, among other variables, evolve prior to a capital structure rebalancing. In this section, we extend our analysis of capital structure adjustments and their determinants along the time dimension and consider the evolution of leverage and other firm characteristics prior to refinancing points. The following analysis has two purposes. First, we want to make sure that our selection criteria indeed result in a refinancing sample that is consistent with dynamic tradeoff theory. The second purpose is to better understand the dynamics of capital structure rebalancing. What happens in the years around the rebalancing? What differentiates rebalancing firms from non-rebalancing firms? These are the questions we aim to answer using the event study methodology.

Moreover, emphasizing the ex-ante dynamics of leverage, our approach differs from the classical view of the target adjustment literature.[7] These studies, including Hovakimian, Opler, and Titman (2001), Leary and Roberts (2006), and Frank and Goyal (2009), address how firms respond to major shocks to their capital structure and interpret their findings as supporting dynamic tradeoff theory. As pointed out by Chen and Zhao (2007) and Chang and Dasgupta (2009), however, due to mechanical mean reversion, many existing tests of target behavior have low power to reject alternatives such as random financing. Our approach is not addressed by this criticism as we are trying to identify a time series pattern of leverage that works in the opposite direction of what is implied by mechanical mean reversion.[8]

If firm management makes capital structure decisions based on dynamic tradeoff theory, their leverage should decrease relative to the cross-sectional mean leverage prior to refinancing. On one side, firms find it optimal to increase their debt ratio once it falls below certain long-term targets in the absence of transaction costs. On the other hand, the existence of frictions causes firms to postpone adjustments until foregone benefits of optimizing capital structure exceed adjustment costs. Thus, for firms that eventually end up exchanging equity for new debt, leverage ratios should decline in the periods before capital structure adjustments.

[7] Common to both approaches is that dynamics are analyzed relative to major capital structure adjustments.

[8] Note that a variable called financing deficit, the sum of net debt issues and net equity issues, is central to the analysis in Chang and Dasgupta (2009). Our selection criteria imply that rebalancing firms issue debt and reduce equity in similar amounts, which means that the financing deficit is close to zero and cannot be used to find the same refinancing firms that we identify.

The dynamic model of Strebulaev (2007) provides a suitable framework that we can use to illustrate the evolution of leverage conditional on hitting the lower refinancing barrier of leverage ratios. Using his Matlab Code (see Appendix B for details), we simulate a time series of leverage spanning a total of 300 quarters for an economy with 3000 different firms, from which we consequently drop the first 150 quarters for each firm. Moreover, in each quarter, we know exactly which firms pursue a capital structure adjustment after their leverage ratios have hit the lower refinancing barrier. Note that all firms in the simulated economy act according to dynamic tradeoff theory, which enables us to compare the behavior of real firms to the theoretical behavior of firms.

The following methodology is in the spirit of Hovakimian (2004) and Lemmon, Roberts, and Zender (2008). In a first step, for each quarter, we divide the total sample into two portfolios: firms at refinancing, and the remaining firms in the cross section that are inactive. From our 150 quarters of simulated data we do this for the quarters 41 to 150. Each rebalancing quarter is subsequently assigned event time 0, so that in sum, 110 different quarters have event time 0. In the next step, we combine all firm-quarter observations of the refinancing portfolios and the non-refinancing portfolios to two big portfolios, respectively. This implies that for any given event period, the same firm may be included in the non-refinancing sample more than once. However, observations from the same firm that are included in the non-refinancing sample at a particular event quarter are always from different calendar quarters.

The final step consists of computing the mean leverage for both portfolios in the event period and in each of the 40 quarters (10 years) prior to the event. Here, as in Strebulaev (2007), the notion of quasi market leverage (QML) is used taking into account that market values of debt are not readily available when using real data. QML is defined as book value of all outstanding debt divided by the sum of book value of debt and market value of equity.

Even though market values of debt can be obtained for firms of the simulated economy, restricting the analysis to the use of book values of debt seems more plausible when relating the results to the next analysis that uses the sample of US firms introduced in Section 2.

This procedure provides the evolution of mean leverage for regular firms and firms that eventually adjust their capital structure through an equity- for-debt swap. Figure 1 presents the two series of mean leverages, together with bootstrapped 90 percent confidence intervals.

A first observation is that mean leverage of non-refinancing firms (dashed line) is relatively stable over time. Moreover, mean leverage of the refinancing sub-sample (solid line) does not differ significantly from the cross sectional average in event years -10 to -6. In the -5 to -1 years, however, the mean leverage of refinancing firms declines

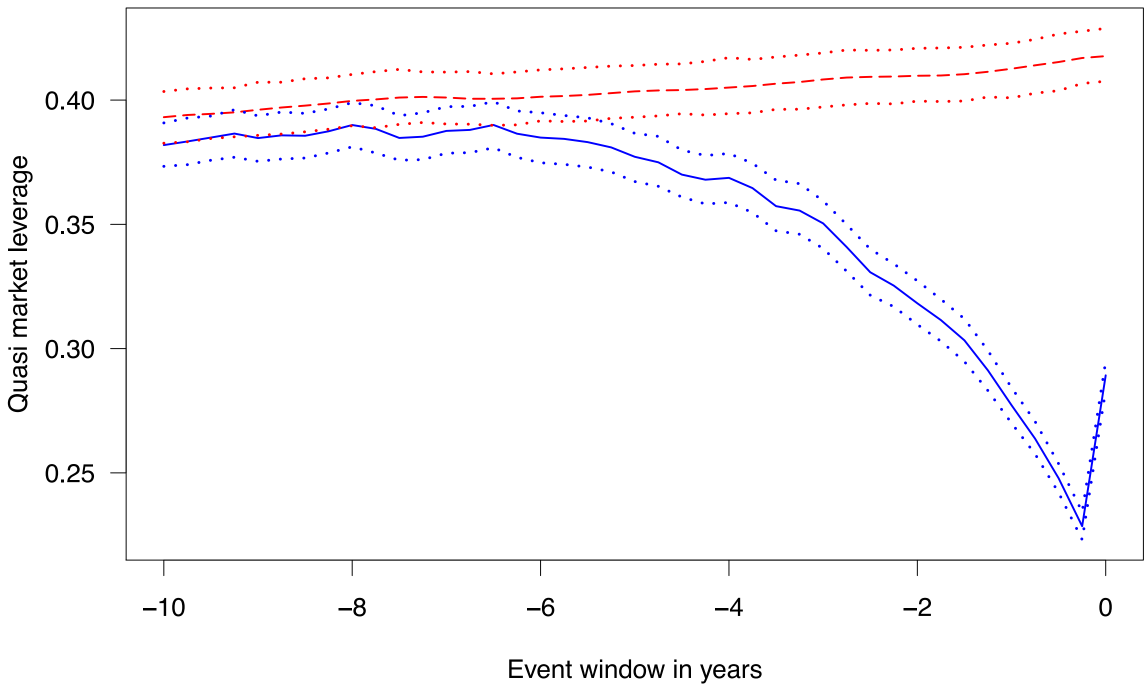

Figure 1: The Evolution of Quasi Market Leverage (QML) for the Simulated Economy Prior to Refinancing. QML is defined as book debt divided by book debt plus market equity. The solid line shows mean QML for the refinancing subsample, whereas the dashed line depicts mean QML for non-refinancing firms. The dotted lines show bootstrapped 90% confidence intervals for the means.

significantly, which is exactly what we would expect to observe if firms apply dynamic tradeoff theory as a basis for their decision making.[9]

Now that we have confirmed our intuition of how leverage should evolve for refinancing firms as opposed to non-refinancing firms, we can proceed and challenge dynamic tradeoff theory by implementing the same analysis for our sample of US-listed firms. If tradeoff theory is capturing major determinants of capital structure choice, we should be able to observe at least similar time series patterns for the two sub-samples, with divergence of leverage ratios prior to refinancing. Closely following the methodology introduced above, our sample consists of all firms available in Compustat between 2000 and 2008. For each

[9]It is interesting that after the capital structure rebalancing, the mean leverage of refinancing firms does not jump to the same level as the mean leverage of non-refinancing firms. This is because the mean optimal leverage ratio is different from the mean leverage ratio in the sample. Strebulaev (2007) simulates 1000 economies with 3000 firms each and shows that the mean reference point for leverage is 0.26, whereas the mean leverage ratio in the whole sample is 0.36. Hence, most of the time firms have a leverage ratio which is above the optimum.

year, we define refinancing firms as described in Section 2. Moreover, for each firm in a given year, which we denote again as event year 0, we construct a leverage path for 10 years prior to the event. Thus, in total we use Compustat data from 1990 to 2008. As opposed to the previous illustration that was based on quarterly data, we use yearly observations for this analysis. However, as we use the same 10 year window in both studies, the only mechanic difference in the two approaches is that for the simulated economy, leverage of the refinancing firms increases only in the last quarter. For the Compustat sample, the increase will occur in the last year. Finally, to account for the possibly large heterogeneity in the non-refinancing sample, we match non-refinancing firms to the refinancing sample based on market-to-book, size, and profitability.[10] The details of our matching procedure can be found in Appendix C.

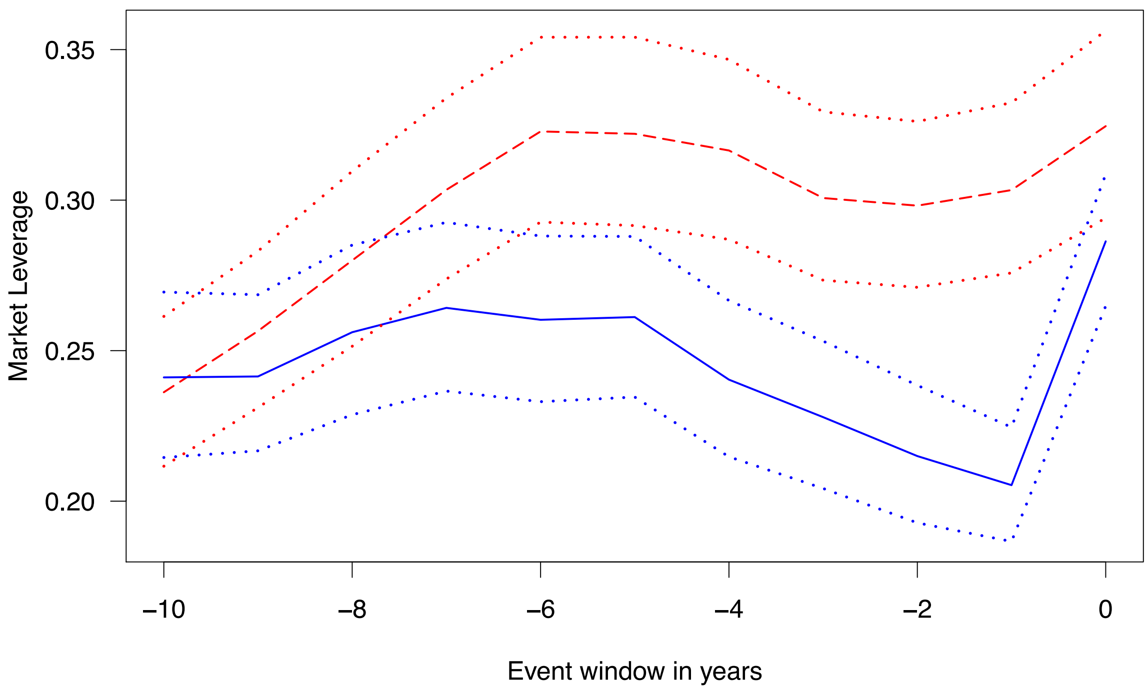

Figure 2: The Evolution of Market Leverage Prior to Refinancing. The solid line shows mean market leverage for the refinancing subsample, whereas the dashed line depicts mean market leverage for non-refinancing firms. The dotted lines show bootstrapped 95% confidence intervals for the means. Non-refinancing firms are matched to refinancing firms based on market-to-book, size and profitability.

Figure 2 shows the evolution of the mean market leverage for firms in the non-refinancing sub-sample (dashed line) and firms in the refinancing sample (solid line).

[10]We would like to thank Michael Halling for suggesting matched samples.

The dotted lines show bootstrapped 95% confidence intervals. The qualitative results are very similarly to Figure 1. Refinancing firms, on average, report stable market leverage in the 10 to 5 years before they pursue adjustments. As in the simulated economy, refinancing firms are found to report declining leverage ratios in the four years prior to adjusting capital structure. On the other hand, passive firms do not experience the decline in leverage prior to the event year. Hence, the overall pattern is similar between the simulated economy and the sample of Compustat firms. Firms seem to experience reductions in leverage ratios before they decide to actively raise their debt ratios. As we have argued before, the observable firm behavior is consistent with firms that optimize their capital structure according to dynamic tradeoff theory.

We perform the same analysis for other firm characteristics as book leverage, profitability, and payouts to equityholders. The aim is to better understand the dynamics of firm characteristics around capital structure adjustments, and to check whether observed behavior is consistent with theoretical behavior in a simulated economy.

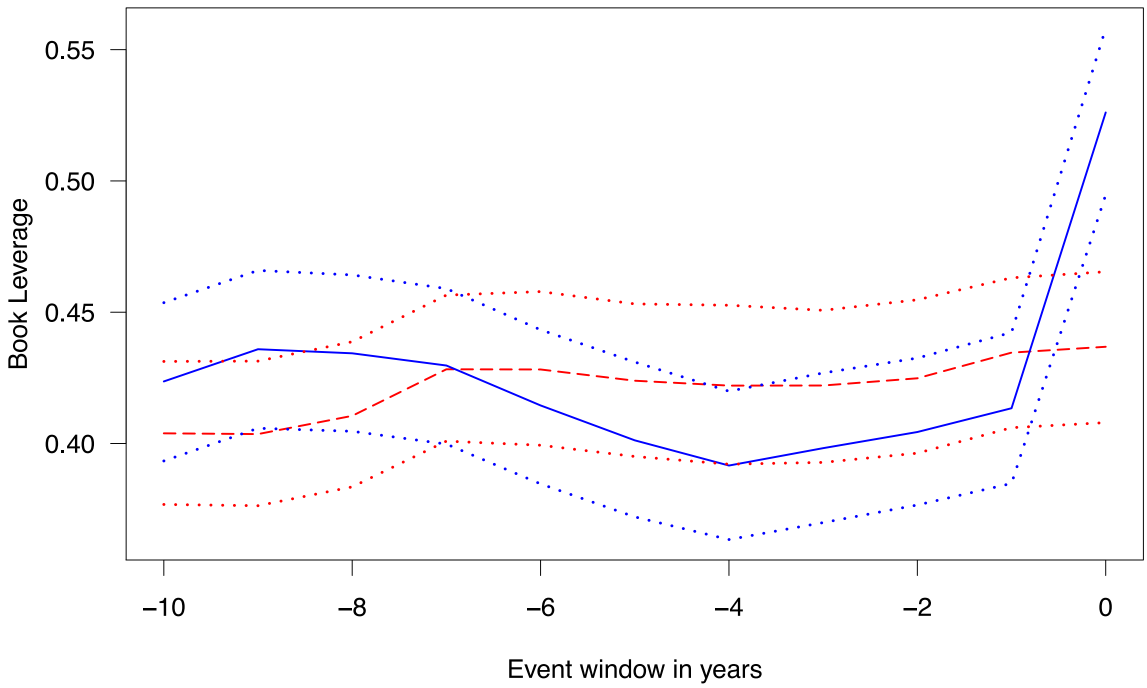

Figure 3: The Evolution of Book Leverage Prior to Refinancing. The solid line shows mean book leverage for the refinancing subsample, whereas the dashed line depicts mean book leverage for non-refinancing firms. The dotted lines show bootstrapped 95% confidence intervals for the means. Non-refinancing firms are matched to refinancing firms based on market-to-book, size and profitability.

The evolution of book leverage is shown in Figure 3. Book leverage of the two subsamples does not significantly differ in event years −10 to −1, but in the event year the refinancing firms experience a large increase in leverage. Refinancing firms seem to choose an average indebtedness which lies above the average for passive firms. However, dynamic tradeoff theory suggests that market values should be used instead of book values. We postpone further examination of book leverage to Section 5.3, after having discussed the dynamics of firm profitability and equity payouts. These variables are directly related to the book value of equity and therefore book leverage.

5.2 The Evolution of Profitability

We have argued that the relationship between leverage and profitability received much attention as means to examine the validity of tradeoff theory models and has therefore been central to our discussion in Section 3. Moreover, analyzing profitability may help us to further understand not only comparative statics of firms which are at their refinancing optimum, but also shed light on the dynamic pattern of leverage. The extensive literature on profitability, its time series properties and in particular its persistence include Givoly and Hayn (2000), McGahan and Porter (1999), Goddard and Wilson (1999), and Gschwandtner (2010). We are, however, mostly interested in revealing differences between the time series behavior of profitability for refinancing firms and firms in the passive subsample. We start with the simulated economy and calculate operating profits normalized by book assets as in Strebulaev (2007). Figure 4 shows mean profitability for active firms (solid line) and mean profitability for the non-refinancing sample (dashed line). The two groups are very similar in year −10 prior to the event, but refinancing firms experience increasing profitability in years −5 to 0.

Now compare the predictions from the simulated economy to the data. Figure 5 shows the development of operating profit by total assets for refinancing firms (solid line) and passive firms (dashed line). Non-refinancing firms are matched by market-to-book and size to the refinancing sample. Observe that at −10, the two samples start from almost the same average profitability. After that, however, they develop in opposing directions. Especially in years −5 to −1, active firms become more profitable while passive firms stay put. These observations are perfectly consistent with dynamic tradeoff theory. Some firms experience an increase in profitability, and as a possible consequence their market leverage deceases. At some point market leverage is so low that it pays off for these firms to issue new debt and pay out cash to equityholders. However, there is no good reason so far to believe that an increase in profitability causes the decrease in market leverage in Figure 2. Also, why does book leverage of refinancing firms evolve differently from market leverage? All this depends on what the refinancing firms do with their increased

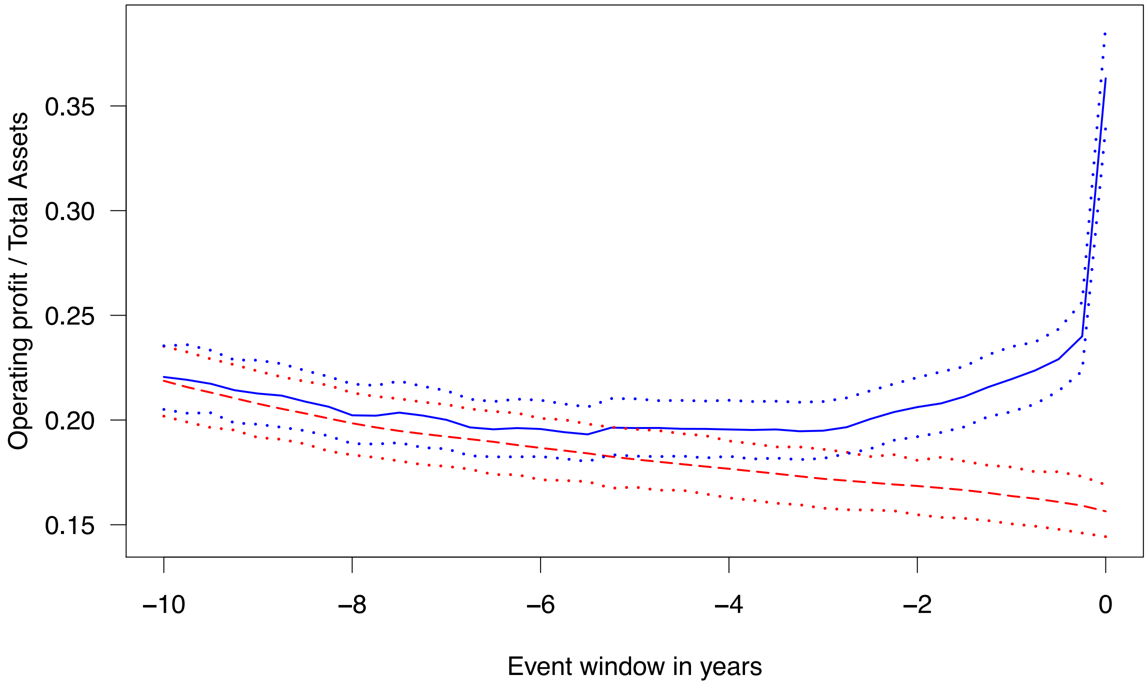

Figure 4: The Evolution of Profitability for the Simulated Economy Prior to Refinancing. Profitability is defined as operating profit by book assets. The solid line shows mean profitability for the refinancing subsample, whereas the dashed line depicts mean profitability for non-refinancing firms. The dotted lines show bootstrapped 90% confidence intervals for the means.

operating profits. This is the reason why we examine the payouts to equityholders in the next subsection.

5.3 The Evolution of Payouts to Equityholders

As in the previous subsection, we calculate payoffs to equityholders in the simulated economy of Strebulaev (2007). In his model there are no share repurchases, all payouts take the form of cash dividends. We normalize net dividends by book assets. Figure 6 depicts mean payouts for active firms (solid line) and mean payouts for the non-refinancing sample (dashed line). The two groups are very similar in year −10 prior to the event, but refinancing firms experience increasing payouts in years −5 to 0.

Figure 7 depicts the sum of cash dividends and repurchases of common and preferred stock relative to total assets for refinancing (solid line) and passive firms (dashed line). The non-refinancing sample is matched to the active firms by market-to-book, size and

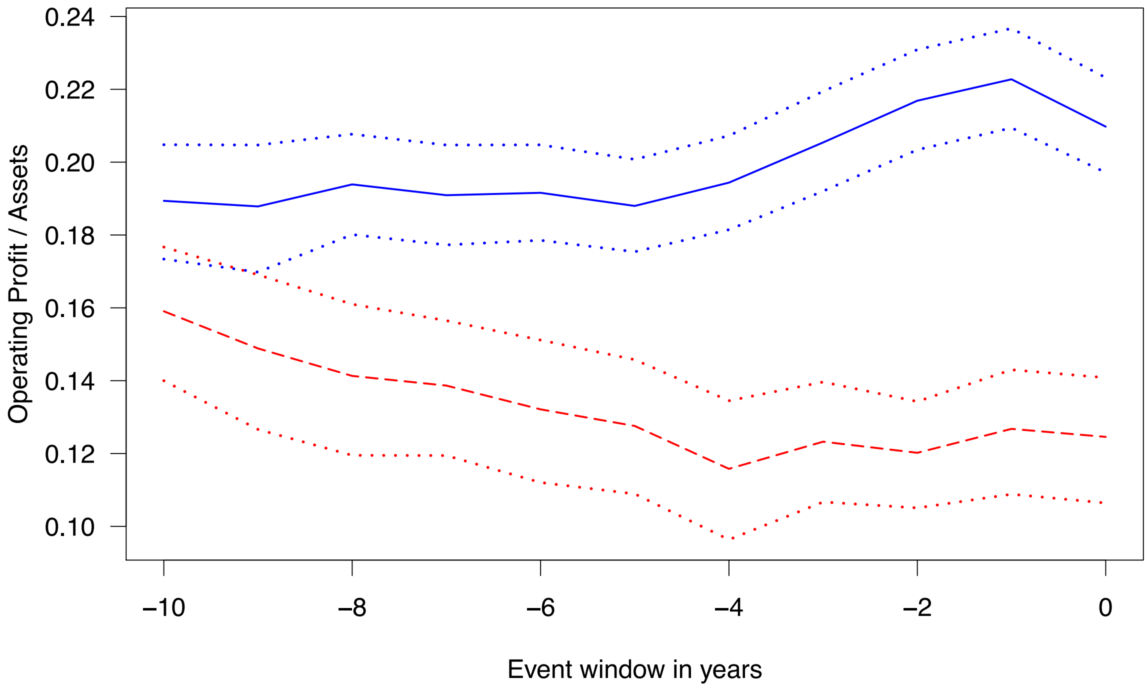

Figure 5: The Evolution of Profitability Prior to Refinancing. Profitability is defined as operating profit divided by total assets. The solid line shows mean profitability for the refinancing subsample, whereas the dashed line depicts mean profitability for non-refinancing firms. The dotted lines show bootstrapped 95% confidence intervals for the means. Non-refinancing firms are matched to refinancing firms based on market-to-book and size.

profitability. The first important observation is that at time -10 there is no difference between active and passive firms. Secondly, the payout ratio increases for refinancing firms starting from event year -5, while it is fairly constant for firms in the cross section. Note that qualitatively this Figure resembles the results from the simulated economy. In similar studies not reported here we further find that refinancing firms are not different from passive firms with respect to cash holdings and capital expenditures. This suggest that active firms use increased profits to pay out more to equityholders instead of saving or investing.

By putting the pieces of the puzzle together, we are now able to give a more detailed explanation of what happens around the time of the capital structure adjustment that we identify. The firms which eventually swap equity for debt to increase their leverage experience a series of positive shocks to profitability prior to the event. This increase in profits is not used to build up savings or to invest more. Instead these firms pay

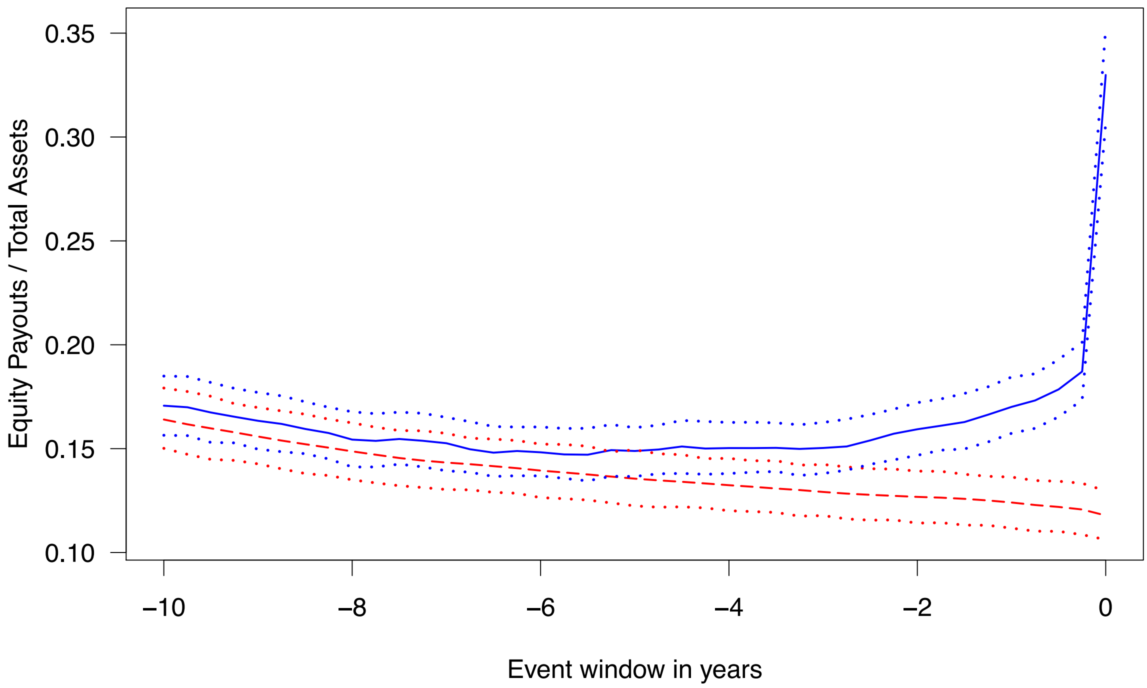

Figure 6: The Evolution of Equity Payouts for the Simulated Economy Prior to Refinancing. Equity payouts are defined as the net payment to equityholders by book assets. The solid line shows mean payouts for the refinancing subsample, whereas the dashed line depicts mean payouts for non-refinancing firms. The dotted lines show bootstrapped 90% confidence intervals for the means.

out more to equityholders. In the theoretical model of Strebulaev (2007), the market value of equity increases with operating profit. Under the hypothesis that his model is correct, an increase in profitability pushes market leverage down, through an increase in the market value of equity. After market leverage has reached a sufficiently low level, it is optimal to refinance. At this point in time firms issue new debt and increase their payout to equityholders. We are also in a position now to explain why book leverage behaves differently prior to the event. This is a simple mechanical effect that is caused by increasing payouts to equityholders. If the increase in profits is paid out to equityholders, then there is no effect on the book value of equity, and thus no effect on book leverage. At this point it is also worth noting that in a similar analysis Hovakimian (2004) looks at the dynamics of leverage around leverage increasing and leverage decreasing transactions. While he chooses book leverage and an event window of -3 to 3 years, his methodology is comparable to ours. He reports that there are no significant changes in leverage prior to restructuring, and thus rejects the hypothesis that firms issue debt to offset leverage

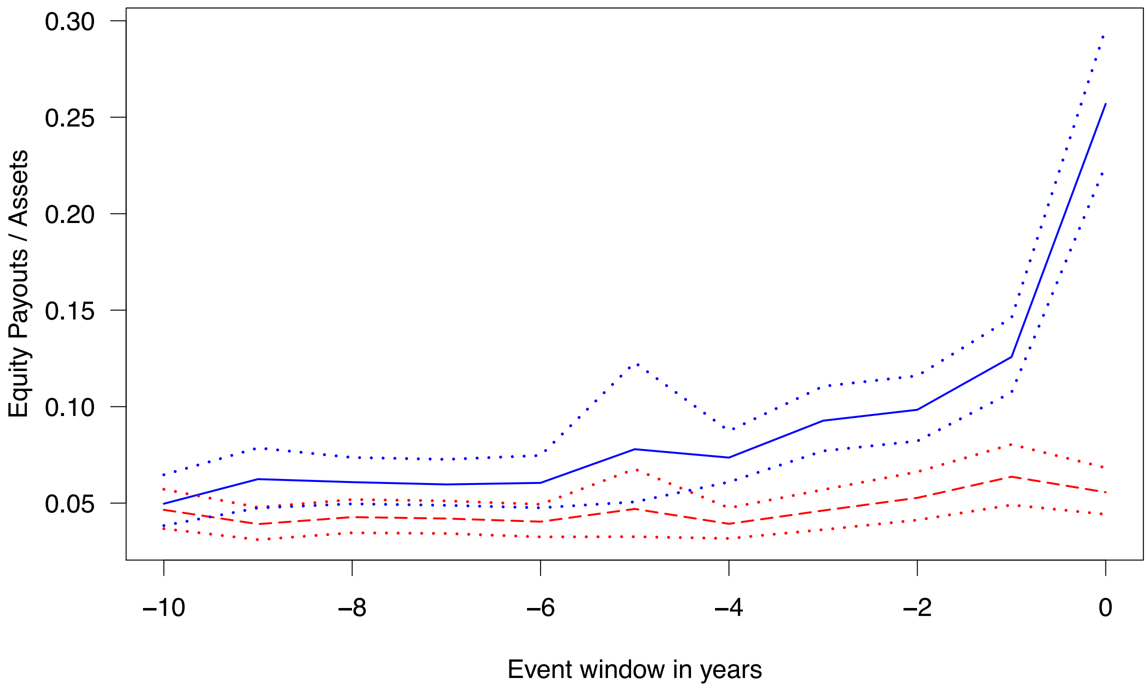

Figure 7: The Evolution of Payouts to Equityholders Prior to Refinancing. Payouts are defined as cash dividends and repurchases of common and preferred stock divided by total assets. The solid line shows mean payouts for the refinancing subsample, whereas the dashed line depicts mean payouts for non-refinancing firms. The dotted lines show bootstrapped 95% confidence intervals for the means. Non-refinancing firms are matched to refinancing firms based on market-to-book, size and profitability.

deficit accumulated in previous years. In contrast to his results we do find that leverage of refinancing firms changes before a restructuring. The main difference may be that we use market leverage instead of book leverage. Additionally we provide an explanation why book leverage behaves differenty from market leverage before rebalancings.

To summarize, the results of our event studies are in line with predictions of dynamic tradeoff theory. Admittedly, exogenous cash flow models as in Strebulaev (2007) might lack some features which are important in the real world. Still we show that the firms in our refinancing sample exhibit firm characteristics over time which are consistent with theoretical predictions.

6 Conclusive Remarks

There exists a wide array of models explaining the cross sectional variation of firm leverage. Yet until today, for the most part, these theories only proved to be convincing on fairly "perfunctory tests", as suggested by Welch (2010). This paper starts with a recent observation of Strebulaev (2007), who criticizes that while tests of dynamic capital structure theory should be applied to a sample of firms that are at their target leverage ratios, most applications consider samples of year-end observations. We present a test of the dynamic tradeoff theory of capital structure, based on the relationship between profitability and leverage. The theory predicts that most of the time firms do not rebalance their capital structure due to transaction costs. If the deviation from target leverage is large enough, however, they increase or decrease their debt ratio to the optimal level. At the optimum, we find a positive cross-sectional relationship between profitability and leverage, while most of the time the relationship is negative. This is consistent with theoretical predictions. We focus on firms which deliberately increase leverage by issuing debt and at the same time repurchase shares or pay cash dividends. The sample includes US firms from Compustat as well as firms from the UK, Canada, Australia and Japan. Our approach is different from target adjustment models, which assume that a large exogenous shock to leverage is followed by slow convergence to the optimum. We are closer to dynamic tradeoff theory, which predicts that a sequence of small shocks to profitability slowly pushes the debt ratio away from the target, and that rebalancing is a relatively large change in capital structure. In the second part of the paper we exploit the theoretical predictions on the dynamics of leverage and profitability around rebalancing points. We define leverage increasing transactions as an event and split our sample based on it. Then we look at the evolution of market leverage in the ten years prior to the event for rebalancing and non-rebalancing firms. Equivalent studies are also constructed for book leverage, profitability and payouts to equityholders. Our results are consistent with the predictions of dynamic tradeoff theory. In the five years prior to the event, rebalancing firms experience an increase in profitability, and pay out more to equityholders. Market leverage gradually decreases over this period, and then suddenly increases. For book leverage, on the other hand, no significant decline is observable prior to the event. Hovakimian (2004) finds the same result for book leverage and interprets it as evidence against dynamic tradeoff theory. We explain this by the fact that as profitability increases prior to refinancing, payouts to equityholder increase as well. As a result, there is no effect of higher profits on the book value of equity, hence no effect on book leverage. To summarize, both our regression results and discussion of dynamics of firm characteristics are consistent with predictions from dynamic tradeoff theory. Coming back to the relationship between profitability and leverage, possible avenues for future research include the empirical examination of comparative statics at the upper leverage boundary, where firms want to decrease their leverage. This is a challenging task as it requires identifying the different means through which firms can deleverage in a tradeoff model, i.e. asset sales and bankruptcy. Finally, as our examination of the dynamics of leverage and other firm variables is univariate in nature, more elaborate multivariate analyses may represent further opportunities for future research.

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8 Appendix

8.1 Appendix A: Variable Definitions

Book Leverage is calculated as in Baker and Wurgler (2002). First define book equity as total assets (Compustat item A6) - total liabilities (A181) - preferred stock liquidation value (A10) + deferred taxes (A35) + convertible debt (A79). If the liquidation value of preferred stock is missing, we use the redemption value of preferred stock (A56). Book debt is then total assets minus book equity, and book leverage is book debt divided by total assets.

Market Leverage is defined as book debt over the sum of book debt and market equity, where market equity is equal to common shares outstanding (A25) times stock price at the end of the fiscal year (A199).

Profitability is defined as operating profit (A13) over total assets (A6).

Size is the natural logarithm of net sales (A12).

Non-Debt Tax Shields (NDT) is defined as depreciation (A14) by total assets.

Market to Book (MTB) is the sum of market equity and book debt divided by total assets.

Tangible Assets (TA) is defined as net property/plant/equipment (A8) over total assets.

Risk is the standard deviation of the variable

$$\frac{\text{operating profit (A13) in year } t}{\text{operating profit in year } t-1},$$

where to obtain a value of risk for a particular year we calculate this variable for the last ten years before taking the standard deviation. If there are less than four observations for the variable above, then the firm-year is dropped from the sample.
Risk_SM stands for the alternative risk measure based on a structural model of the firm. The methodology is very similar to the implementation of Moody's KMV, as described in Lando (2004). We estimate the implied firm value process for each firm using a time series of equity values and face values of debt. Then we estimate the volatility of the firm value process. Using this estimate for unlevered firm volatility we again calculate the implied firm value process, and iterate this procedure until convergence. The methodology requires the following inputs. Market value of common stock is obtained as a monthly time series from CRSP for every firm that is in the intersection of CRSP and Compustat. For the face value of debt we use short-term debt and half of long-term debt, which is used by Moody's KMV according to Lando (2004). The debt levels are taken annually from Compustat and are assumed to be constant for 12 months after the end of a fiscal year. We account for the fact that firms may have fiscal years that deviate from calendar years. The starting value for firm value volatility is equity volatility. Lastly, the risk free interest rate is set to 0.05, and the theoretical maturity of debt is set to two years. Volatility of the firm value process is calculated for every year using debt and equity data for the past two years. If less than 20 monthly observations are available for an estimation then the risk measure is reported as not available, i.e. the firm-year is dropped from our sample. Firm volatility enters the regression analysis in annualized form.
Herfindahl Hirschman Index (HHI) for a particular industry is defined as the sum of squared market shares for all firms in a four-digit SIC industry. The market share of firm i is defined as net sales of firm i over the total net sales in the industry of firm i.
Cash is defined as cash and equivalents (A1) over total assets.
Equity Payouts is defined as the sum of cash dividends (A127) and purchases of common and preferred stock (A115) over total assets.
Capital Expenditures is capital expenditures (A128) over total assets.

8.2 Appendix B: Simulated Economy

In Section 5 we use the MATLAB code of Ilya Strebulaev to simulate an economy with 3000 firms as in Strebulaev (2007). For this we use the same values for the exogenous parameters as in the original paper. Some parameters values are identical for all firms, such as taxes. Other variables, such as capital adjustment costs, vary across firms. For most of the latter type of parameters, Strebulaev (2007) specifies a certain distribution and draws 3000 realizations from it. We use the same distributions as in the original paper. Additionally we need, for each of the 3000 firms, the beta β and the instantaneous volatility of the cash flow process σ. Unfortunately we do not have the empirical data used in Strebulaev (2007) to obtain the empirical distribution of these parameters, so we proceed as follows. The original paper provides the first two moments of β, with a mean of 0.993 and a standard deviation of 0.47. We approximate this distribution by drawing 3000 times from the normal distribution

$$\beta \sim N(0.993, 0.47^2).$$

Then, σ is calculated for each firm using the formula

$$\sigma = (\sigma_I^2 + \sigma_S^2 \beta^2)^{1/2},$$

where σ_I is the idiosyncratic volatility of a particular firm, and σ_S is the systematic component of volatility as specified in Strebulaev (2007).

8.3 Appendix C: Matching Procedure

For the event studies in Section 5 we use the following matching procedure. For a given sample size of refinancing firms, we draw an identically sized random sample of non-refinancing firms without replacement. First, determine which firms are refinancing firms and delete observations where market-to-book, size or profitability is not available. Then for each year separately, we find the 1/3 and 2/3 quantiles for the variable market-to-book for all firms, i.e. refinancing and non-refinancing. Then do the same for size and operating profits. The quantiles are calculated in the event year -10. Based on these quantiles we sort all firms in three market-to-book groups, three size groups, and three profitability groups. Taking the intersections of these groups yields 27 not equally sized bins. Then, for each bin separately, we look how many refinancing firms are in the bin, remove them, and draw the same number of non-refinancing firms from that bin. This yields a matched sample of the same size as the refinancing sample. For the event study of profitability we only match based on market-to-book and size.