Leverage and the Japanese Financial Crisis

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Abstract

Japanese firms responded to the country's lost decades (失われた20年) by reducing their debt. Average leverage fell from 27.49% in 1990 to 19.34% in 2014. Nearly-all-equity firms (firms with less than 5% leverage ratio) increased from 7% of the sample in 1990 to 22.1% in 2014. Japanese firms exhibit a reliance on internally generated funds and precautionary cash holdings to reduce debt. Japanese firms also appear to exploit *relative* optimism about their prospects to maintain higher debt levels.

1. Introduction

Japan's lost decades (失われた20年) present a natural experiment on firm behaviour during a period of prolonged economic distress.[1,2] Japan experienced an extraordinarily low interest rate regime during the lost decades. Conventional economic thinking would suggest that this would have forestalled the lost decades. Lower interest rates might have provided an impetus to domestic consumption. Furthermore, the low cost of debt in Japan during this time, effectively "free money", may have made debt more tempting for Japanese firms Schnabl (2015). Conventional economic wisdom, however, does not account for the lost decades. As interest rates approach some lower bound, it is possible that economies become mired in

[1] The Nikkei peaked at 38,916 in December 1989.

[2] Khuu, Durand and Smales (forthcoming) summarise salient features relating to the Japanese equity market. They model the bear market using text-based sentiment proxies and find that the prevailing mood of the market was negative.

liquidity traps; aggregate demand is depressed and recessions are prolonged (Eggertsson and Krugman 2012; Korinek and Simsek 2016).

Japanese firms reduced their debt during the lost decades. Figure 1 plots the average book leverage ratio from 1990 to 2014. It shows that average leverage falls from 27.49% to 19.34. The economy-wide deleveraging within the Japanese economy has been documented (Ueda 2012). The analysis presented in this paper extends our understanding of this process by analysing firms' behaviour using the theoretical and empirical framework provided by studies in corporate finance. Japanese firms rely on internally generated funds and precautionary cash holdings to have lower leverage. We also present evidence that Japanese firms appear to have exploited ***relative*** optimism about their prospects to maintain higher debt levels.

--- Insert Figure 1 here ---

The deleveraging of Japanese firms is remarkable. A striking feature of the Japanese dataset is the marked increase in all equity (*AE*) and low levered (*LL*) firms. Strebulaev and Yang (2013), Bessler et al. (2013) and D'Mello and Gruskin (2014) have highlighted the rise of no and low leverage firms in the United States (US). In Table 1 we report the annual distribution of firms classified by the level of leverage across the sample period and depict these numbers in Figure 2. A firm is defined as an all equity (*AE*) firm if it holds no debt in its capital structure. Following Strebulaev and Yang (2013), we classify firms to be low levered (*LL*) when they hold a leverage ratio of less than or equal to five percent. The five percent limit is generally below the optimum estimated by theoretical models using reasonable parameters (Strebulaev and Yang 2013; Devos et al. 2012). We define the combination of *AE*

and *LL* firms as nearly-all-equity (*NAE*) firms. The remaining firms in the sample, that is, firms with a leverage ratio greater than five percent, are defined as *levered* firms.

--- Insert Table 1 here ---

--- Insert Figure 2 here ---

In Table 1 and Figure 2 we observe 3.2% of the sample consists of *AE* firms in 1990. This increases to 7.9% in 2008 but falls to 4.3% in 2014. 3.8% are *LL* firms in 1990, 14.3% in 2008 and 17.7% in 2014. In contrast, the proportion of firms with more than five percent leverage (*levered* firms) falls from 86.1% in 1990 to 55.9% in 2014. We discuss the patterns of leverage we observe in further detail in Section 3 and then analyze the determinants of *NAE* in Section 4 of the paper. Variables associated with the level of leverage are found to be associated with the likelihood of a firm being *NAE* in the ways we would have expected given the literature. Baker and Wurgler (2002) present evidence that US markets "time" the market, exploiting periods of relatively higher valuation to raise equity: the cumulative effects of market timing have long run repercussions for firms' capital structures. The marginal effect for the external finance weighted average market-to-book ratio (*EFWAMB*) suggests that the historical effect of timing the market to raise equity has a positive association with a firm being *NAE*.

We analyze the factors associated with leverage for the remaining firms in Section 4 of the paper. The size of the firm, tangible assets, profitability and cash have been used in the literature to model leverage (as we discuss below) and we find that the signs of the coefficients we estimate for Japan are the same as those found in other papers discussing the determinants

of leverage. The results for depreciation are, in most cases consistent, with the literature, suggesting that Japanese firms are exploiting non-debt tax shields. We take the opportunity to compare the results we obtain for Japan with a sample of US firms examined over the same period. In all but one instance, we find the sign of the effects is the same but their magnitudes are greater in Japan. In general, variables associated with the propensity and, or, the ability to hold more debt have a greater influence in Japan than they do in America. We also see a greater reliance on internally generated funds and precautionary cash holdings for Japanese firms.

Our findings regarding Japanese firms "timing" (Baker and Wurgler, 2012) are mixed and influenced by the depressed share market during Japan's lost decades. The lost decades have seen prolonged negative and flat equity returns and, consequently, 48% of the observations in our sample have market-to-book values less than 1.[3] Book values are not necessarily accurate values of firms' assets but *M/B* values less than 1 would suggest a *prima facie* arbitrage opportunity: it may be the case that investors could buy firms' shares on the market and sell their assets for a risk-free profit.[4] Consequently, we observe the consequences of market timing when equity valuation is less dubious in about 5% of the sample where market-to-book ratios are over 2.[5] The leverage of the remaining firms is consistent with firms timing *relatively* higher valuations to issue debt. Before beginning the analysis, we discuss the data.

[3] The number of observations ub the analysis in Table 10 is 39,409 (42,241 – 2,832) due to our need for lagged accounting variables. 19,047 of the observations in the sample (39,409) have lagged market to book values less than 1.

[4] In Japan, however, it may be the case that such a strategy is difficult to implement due to interlocking share ownership among firms.

[5] 1,897 of the observations in the sample (39,409) have lagged market to book values greater than 2.

2. Data Selection and Description

We analyze Japanese firms listed on the Tokyo Stock Exchange (TSE) from collected for the period 1990 to 2014.[6] Given our focus on the behaviour of Japanese firms during the lost decades, 1990, the beginning of the lost decades, is an appropriate starting point for our study. We obtain our data from Datastream.[7] After excluding observations with missing accounting data, our initial sample consists of 46,786 firm-year observations. In 1,275 cases, we find the book leverage ratio (*BL*) is greater than 1, suggesting that the data might be problematic. Therefore, we exclude these cases. Following Baker and Wurgler (2002) and Hovakimian (2006), for example, we also exclude 134 firm-year observations where the market-to-book ratio (*M/B*) exceeds ten. Finally, we drop the 3,136 firms operating in the financial sector and firms in the utility sector.[8] Table 2 illustrates the screening process for the firm-year observations, leaving a final sample of 42,241 firm-year observations (2,832 unique firms) for analysis.

--- Insert Table 2 here ---

When collecting the data, we found what we thought to be a surprising number of firms we came to call '*new*' firms; we found this surprising as we did not expect to see new firms during the prolonged bear market of the two lost decades. '*New*' firms are those which appear in our dataset on or after the crash of 1990. In contrast, '*existing*' firms are those firms already listed prior to the crash of 1990. This dichotomy, as well as that between *NAE* and *levered*

6 We have, however, also conducted the analyses with uneven samples and found that the influences we make are robust. These additional analyses are available from the corresponding author upon request.

7 We note that there is a paucity of data before this period and we were unable to extend our analysis to include some consideration of how firms behaved in the period preceding the lost decades.

8 These firms are excluded from the sample because their leverage ratios differ from the leverage of other firms in the sample and are determined by other features of the market.

firms (defined in Section 1 above), proves to be important in our analysis. Table 3 illustrates the breakdown of firm-year observations into *new* and *existing* firms. 21.23% of the sample are *NAE* firms while 78.77% are *levered* firms. *New* firms represent 92.31% (30,715 out of 33,274 firm-year observations) of *levered* firms and *existing* firms make up the remaining 7.69% (2,559 out of 33,274 firm-year observations). In the group of *NAE* firms, we find 6.46% are *existing* firms (579 out of 8,967 firm-year observations) and 93.54% are *new* firms (8,388 out of 8,967 firm-year observations). The comparison indicates the tendency of maintaining low leverage ratio, that is a five percent leverage ratio, is stronger in the group of *new* firms.

--- Insert Table 3 here ---

Table 4 presents the summary statistics of the sample firms' characteristics, while definitions of variables are presented in Appendix A.[9] These initial findings are suggestive of market timing. Firms with higher market-to-book ratios (*M/B*) will have lower leverage ratios: they can raise equity capital when the market values of their assets are relatively higher than their book values (see, for example, Baker and Wurgler 2002). *NAE* firms have higher market-to-book ratios (1.2643). External finance weighted average market-to-book ratio (*EFWAMB*) is a measurement of a firm's historical market valuation. It takes a high value when the firm raises external funds via equity when its market to book ratios was high. *EFWAMB* is greatest for *existing* firms (1.8397), indicating that the historical market valuation is highest for *existing* firms, although evidence on the effect of historical valuation on leverage for Japanese firms is inconclusive.

[9] These variables, and their construction, are well known in literature on capital structure. These definitions follow previous capital structure studies such as Hosono (2003), Guney, Ozkan, and Ozkan (2007), Mahajan and Tartaroglu (2008) and Bessler et al. (2013).

--- Insert Table 4 here ---

NAE firms' profitability (*PROFIT*) and cash reserves (*CASH*) seem at odds with their observed leverage. *NAE* firms appear to be more profitable (0.0776) than *levered* firms (0.0632). This is consistent with Frank and Goyal (2009) who find that more profitable firms have higher market valuations and therefore use less debt. *NAE* firms also have higher cash reserves (0.2657) than *levered* firms (0.1397).[10]

Levered firms have higher levels of tangible assets (0.3268) and are larger (18.0354) than *NAE* firms (*PPE*=0.2194 and *Ln(TA)*=17.5788). Larger firms, or firms with greater asset tangibility, may be expected to hold higher levels of leverage, as their tangible assets can serve as collateral, thus increasing debt capacity (Titman and Wessels 1988; Hovakimian, Hovakimian, and Tehranian 2004).

Existing firms appear to be less profitable (0.0481) and have higher levels of leverage (0.2388) than *new* firms (*BL*=0.2357 and *PROFIT*=0.0677). Pecking order theory predicts that higher profitability should be associated with less leverage (see, for example, Frank and Goyal 2009; Rajan and Zingales 1995). They also appear to be larger (18.8486), which is consistent with the observed relationship between *levered* and *NAE* firms.

Table 5 reports the correlation coefficients between leverage ratio and firm specific characteristics. The full sample is presented in Panel A. The relationships between leverage ratio (*BL*) and asset tangibility (*PPE*), firm size (*Ln(TA)*), profitability (*PROFIT*) and

[10] John (1993) suggests that leverage of a firm acts as a proxy for its ability to issue debt. Thus, firms are less likely to issue debt when their cash holdings are high.

depreciation (*DEP*) are positive, and there is a negative relationship between leverage (*BL*) and growth opportunities (*M/B*), the external financing weighted average market to book ratio (*EFWAMB*) and cash (*CASH*). These results are consistent with previous evidence (see, for example, Titman and Wessels 1988; Rajan and Zingales 1995). The correlation coefficients for *new* firms can be found in Panel B and are consistent with Panel A. *Existing* and *NAE* firms are presented in Panels C and D. We find consistent results except for the negative relationship between leverage (*BL*) and profitability (*PROFIT*), which can be explained by pecking order theory. Pecking order theory states that more profitable firms should use their retained earnings to support their operations and investments, therefore higher profitability should result in less leverage. *Levered* firms are presented in Panel E, in which we find consistent results except for the positive relationship between leverage (*BL*) and growth opportunities (*M/B*).

--- Insert Table 5 here ---

3. Variation in leverage

The analyses presented in Section 1 (Table 1, Figures 1 and 2) indicate the declining tendency of carrying a substantial amount of debt (that is, a leverage ratio of more than five percent). This data suggests that low leverage policy is not a short term phenomenon. This finding is consistent with previous studies (for example, Strebulaev and Yang (2013), Bessler et al. (2013) and D'Mello and Gruskin (2014)).

DeAngelo and Roll (2015) find that capital structure stability is temporary and occurs at low leverage. Their finding motivates us to consider the leverage of Japanese firms over long horizons. In this way, we can "dig deeper" into the "headline" numbers presented in Section 1. Therefore, in Table 6, we analyze the leverage movement of each of the 2,832 unique firms in our sample.

--- Insert Table 6 here ---

Each of the 2,832 firms are in our sample for *n* years. Table 6 reports firms' leverage ratios in the first year they appear in our dataset and then reports their leverage in the last year they are observed, *n* years from the first observation. We illustrate this using the first column of the table. This column reports firms which are *NAE* the first time they are observed (that is, their leverage is between zero and five percent). There are 525 such firms. Of these, 192 are in the sample between 1 and 10 years and were *NAE* in the last year for which we have data. 132 were in the sample between 11 and 20 years and were *NAE* in the last year for which we have data. 43 are in the sample between 21 and 24 years and were *NAE* in the last year for which we have data. Together, these firms represent 69.9% of the 525 initially *NAE* firms. The tendency is for *NAE* firms to remain *NAE*.

Inspection of Table 6 reveals that, as we move to the columns to the right of the *NAE* firms, we see that stable leverage becomes less common. For example, only 21.48% of firms starting with leverage ratios between 0.05 and 0.1 remain in the same range in the last year they are observed in our dataset. We highlight in grey the percentage of stable firms in the diagonal. We have noted the stable leverage of 69.9% of *NAE* firms. For the remaining

cohorts, leverage stability ranges from 10.26% (firms with leverage ratios of 0.7 or higher) to 28.95% (firms with leverage ratios between 0.1 and 0.2).

The statistics in Table 6 show that *levered* firms, when compared to *NAE* firms, tended to change their leverage. Table 6 also shows that *levered* firms tended to reduce their leverage. Firms *above* the shaded diagonal have a lower leverage in their last observation than their first with firms *below* the shaded diagonal and *vice versa*. For example, we find that 43.33% of firms starting with leverage ratios between 0.05 and 0.1 decreased their leverage. For firms whose initial leverage was between 0.4 and 0.5, 22.07% remain stable, 9.7% increase their leverage and the remaining 68.23% decrease their leverage. Only 5.69% became *NAE*. Table 6 only allows us to compare firms the first and last times we see them. It is silent on what might have happened between the first and last observations. It is also silent on *why* the change occurred. It does, however, flesh out the impression we have gleaned from Figures 1 and 2: Japanese firms reduced their debt and there was considerable growth in *NAE* firms. We examine the *NAE* decision in the following section and we will examine the choices of levered firms in Section 5.

4. Determinants of *NAE* firms

In Section 1 we found Japanese firms' leverage has, on average, fallen during the lost decades. We also established that the proportion of *NAE* firms has risen. In the previous section, we have documented that, on average, firms with low leverage maintained their low leverage. Other firms reduced their leverage. In this section we model *NAE* firms using a

binary choice model where the dependent variable takes the value of one if the firm is *NAE* and zero otherwise. The data are a panel and we estimate a random effects panel logit of the form:

$$PR\left(NAE_{i,t} = 1\right) = \alpha + \widehat{\beta_1} Ln(TA)_{t-1} + \widehat{\beta_2} PPE_{t-1} + \widehat{\beta_3} M/B_{t-1} + \widehat{\beta_4} EFWAMB_{t-1} + \widehat{\beta_5} PROFIT_{t-1} + \widehat{\beta_6} DEP_{t-1} + \widehat{\beta_7} CASH_{t-1} \quad [1]$$

where *NAE* takes the value of one if the firm has a leverage ratio of less than or equal to five percent, and zero otherwise. The independent variables used in Equation [1] are the determinants of capital structure considered in the previous literature that are related to the trade-off between the costs and benefits of debt and equity.[11] The definitions of the independent variables appearing in Equation [1] are presented in Appendix A. Choosing random effects avoids the incidental parameters problem (Greene and Hensher 2010, 697). Mindful of the difficulty in interpreting coefficients derived using logit, our discussion focusses on the marginal effects at the mean for each variable.[12]

In Table 7 we present the estimates for Equation [1] estimated over the sample period.[13] The full sample is presented in Model 1, the results for *existing firms* can be found in Model 2 and those for *new firms* in Model 3. Three variables the literature has associated with the capacity to have higher leverage – the size of the firm (*Ln(TA)*), tangible assets (*PPE*) and depreciation (*DEP*) - have negative marginal effects for the entire sample in Model 1: they are associated with a lower likelihood that a firm is *NAE*. The negative effect of firm size and

[11] Fama and French (2002), Hovakimian et al. (2001), Kayhan and Titman (2007), Rajan and Zingales (1995), Hovakimian and Li (2011) and Lemmon et al. (2008).

[12] Marginal effects, however, are calculated at the means of the explanatory variable and, given the distributions of the US and Japanese markets are not the same. Therefore, we cannot use the coefficients and marginal effects reported in Table 7 to compare Japan and the US as we will do in the following section when we discuss the results reported in Table 8.

[13] The number of observations for analysis in Table 7 is 39,409 (42,241 – 2,832) due to our need for lagged accounting variables.

tangible assets is found in *all* (Model 1), *existing* (Model 2) and *new firms* (Model 3). This is consistent with D'Mello and Gruskin (2014) who find that firms that are smaller and have a lower value of tangible assets are more likely to have little or no debt in their capital structure. It is also consistent with the trade-off theory that large firms are more diversified, have easier access to debt markets and have lower external financing costs (Titman and Wessels 1988). Firms with a higher level of tangible assets may use these as collateral to take on more debt (Rajan and Zingales 1995).

--- Insert Table 7 here ---

The results for depreciation (*DEP*) are mixed: its marginal effect for the entire sample (Model 1) is negative but we see that this is driven by *new* firms (Model 3);[14] that is, firms with higher levels of depreciation expenses (non-debt tax shields) are *less* likely to be *NAE*. Bradley, Jarrell, and Kim (1984) provide an important early analysis that firms that invest heavily in tangible assets and generate high levels of depreciation and tax credits tend to hold a higher level of leverage. In contrast, depreciation has a positive marginal effect on *existing* firms (Model 2) suggesting that the presence of these non-debt tax shields has a perverse effect on these firms' decisions. These tax shields remain unused as *existing* firms choose to have economically negligible levels of debt.

Two variables the literature has associated with lower leverage – profitability (*PROFIT*) and cash holding (*CASH*) - have positive marginal effects for the entire sample in Model 1 and the sub-samples in Models 2 and 3: they are associated with a *higher* likelihood that a firm is

[14] Although new firms drive this result, and the majority of the sample (84.26%) consists of new firms, in Table 7 we do not see the pattern of new firms driving the findings all instances.

NAE. The positive association between profitability and probability of being a *NAE* firm can be explained by pecking order theory. Pecking order theory states that more profitable firms should use their retained earnings to support their operations and investments. If pecking order theory holds, higher profitability should result in less leverage (see, for example, Frank and Goyal 2009; Rajan and Zingales 1995). The relationship between cash holdings and the probability of being a *NAE* firm is consistent with the notion that firms try to hold sufficient cash to meet unexpected contingencies or exploit investment opportunities (Opler et al. 1999).

Baker and Wurgler (2002) introduce and employ *EFWAMB* to capture the long-run effect of firms' marketing timing behaviour on their capital structure. They provide evidence that firms have an incentive to raise equity capital when their historical market valuations are high. The marginal effect for *EFWAMB* suggests that the historical effect of timing the market has a positive association with being *NAE*. The effect, however, is driven by the significant result for *new* firms; the coefficient and marginal effect for *existing* firms is insignificant. This finding for *existing* firms might be a function of the dataset which, unfortunately, cannot go further back than 1990; we can only speculate on market timing during Japan's great bubble.

EFWAMB measures the cumulative effect of market timing. In contrast, firms' market-to-book ratios might be associated with contemporaneous market timing. The market-to-book ratio (*M/B*) is negative and statistically significant for *existing firms*, suggesting its marginal effect is associated with a *lower* likelihood of being *NAE*. This finding is consistent with Baker and Wurgler (2002) who find that, for their full sample, *M/B* has a positive association with leverage (see Baker and Wurgler 2002, 16).[15] There is, however, a *prima facie* tension in these findings for *EFWAMB* and *M/B*. The positive effect of *EFWAMB* suggests that, in the long

[15] In Panel A of Table III, the coefficient of *M/B* for all firms is 2.2.

run, firms raise equity (reduce leverage) when it is overvalued. However, the negative short run effect of *M/B* suggests that firms exploit overvaluation to issue debt (increase leverage). We explore and resolve this apparent paradox in the following section.

5. Leverage and Firm Characteristics

Table 7 models the dichotomy between *NAE* and *levered* firms. We now consider the *level* of firms' leverage (that is, the book leverage ratio) including both *NAE* firms and *levered* firms. Book leverage, however, cannot fall below zero, nor can it rise beyond 100%. Therefore, we recognize these constraints and use the explanatory variables to model the level of leverage utilizing random effects Tobit estimation.[16,17] The results are presented in Table 8. We follow this practice in Table 7: Model 1 presents the results for *all* firms and the sub-samples for *existing* and *new* firms are presented in Models 2 and 3. In addition, in Table 8 we take the opportunity to gauge the *relative* importance of the variables by repeating the analysis for a sample of *all*, *existing* and *new* firms from the U.S.[18] Therefore, in addition to saying which variables are important, we can compare if they are more or less important for firms in an economy which experienced a variety of states during the study period.

--- Insert Table 8 here ---

[16] Greene (2004) demonstrates that fixed effects Tobit estimation results in standard errors biased towards zero.

[17] We discussed the use of marginal effects in Logit in footnote 12. The following interpretation of the Tobit coefficients reported in Table 8, and the comparisons of US and Japanese results, are simpler than those discussed in footnote 12 as the (unreported) marginal effects are negligibly different from the coefficients we report.

[18] We follow the sample selection process we use for Japan (reported in Section 2 and summarised in Table 2). We follow the format of Table 2 to report the sample selection process for the US in Appendix B. Summary statistics for these US firms are reported in Appendix C using the same format as Table 4.

The positive association of the size of the firm (*Ln(TA)*) and tangible assets (*PPE*) with increasing debt is consistent with the *NAE* decision (Table 7) and also with our expectations given prior literature.[19] When compared with the coefficients we estimate for our US sample, we find that the effects of *Ln(TA)* are, on average, *greater* in Japan while those associated with *PPE* are lower. Therefore, factors associated with the propensity and, or, ability to take on debt in US are the same as those we find in Japan, although the relative influence of these effects differs.

Similarly, the negative associations of profitability (*PROFIT*) and cash holdings (*CASH*) with the level of debt in Table 8 are both consistent with the changes modelled with the *NAE* decision presented in Table 7 and also the literature.[20] The coefficients of *PROFIT* for Japan are greater in absolute terms than those reported for the US. The results for *PROFIT* in the all the models we present suggest that Japanese firms are more sensitive to pecking order than firms in the US, relying on retained earnings to support their continued operations and, perhaps, their survival. The findings for *CASH* suggest that Japanese firms use cash as a precautionary measure (Opler et al, 1999) but that this effect is not as great as that which we find for US firms.

Consistent with our expectations, depreciation (*DEP*) is found to have a positive relationship with debt. A positive relationship of depreciation and leverage is consistent with firms, on average, exploiting tax credits associated with depreciation (Bradley, Jarrell, and Kim 1984). We find, however, that this expected relationship of debt and depreciation, as with the analysis of *NAE* firms, is driven by *new* firms. As with the analysis for *NAE* firms, depreciation

[19] See D'Mello and Gruskin (2014) and Titman and Wessels (1988) mentioned in the preceding section.

[20] We referred to Frank and Goyal (2009) and Rajan and Zingales (1995) above when discussing the relationship of profitability to debt. We referred to Opler et al. (1999) when discussing the precautionary role of cash. Baker and Wurgler (2002) discuss *EFWAMB*.

has a negative effect on *existing* firms. When we examine the effect of depreciation for *existing* US firms, we find the expected positive relationship: the coefficient of 0.1251 is significant at the 1% level. The finding of a negative relationship of depreciation and leverage for *existing* Japanese firms is perplexing; economically rational managers should be exploiting tax shields, not eschewing them.

As was the case for the *NAE* firms examined in Table 7, in Table 8 we find a negative association of leverage with the external-financing weighted average market-to-book ratio variable (*EFWAMB*) a. Also in keeping with our findings in Table 7, we find a positive relationship of *M/B all, existing* and *new* firms in Table 8. This is consistent with our findings for *NAE* firms (Table 7) but, in discussing the finding for *M/B* in Table 7, we suggested that is *prima facie* some tension between the findings for *EFWAMB* and *M/B*. The positive effect of *EFWAMB* suggests that, in the long run, firms raise equity (reduce leverage) when it is overvalued. However, the negative short run effect of *M/B* suggests that firms exploit overvaluation of their shares to issue debt (increase leverage). The findings for *M/B* in both Tables 7 and 8 suggest *prima facie* perverse market timing: managers take advantage of overpriced equity to sell debt. Managers should sell what is overpriced and we see this behaviour in the consistently negative coefficients for *M/B* for the US sample.

Features of our data may bias our analysis towards finding perverse market timing. The *existing* firms in our dataset are first observed at the end of Japan's bull market when *M/B* would have been exaggerated and unusual. The *new* firms in our sample may be a function of these firms being IPOs and, in these instances, *M/B* might also be higher (Pagano, Panetta, and Zingales 1998). Therefore we rerun Table 8, excluding the first observation for each firm in our sample. The results are reported in Table 9: the inferences we made on the basis of the

analyses in Table 8 are robust to the exclusion of the first observation for each of the firms in both our Japanese and US samples.

--- Insert Table 9 here ---

The analysis in Table 9 is based on assumptions taken from analyses of markets that, when compared to Japan, seem "normal". The Japanese lost decades (失われた20年) are anything but normal. Khuu, Durand, and Smales (forthcoming) document negative average returns and link those returns to pervasive negative sentiment affecting the market. Rather than higher values of *M/B* reflecting investors' optimism about stocks, we might rather emphasize how lower values of *M/B* reflect investors' gloominess about firms' prospects. 19,047 (approximately 48%) of the firm-year observations in our sample had values of *M/B* less than 1; their market capitalizations were less than the book value of their assets. *M/B* of values less than 1 would suggest an arbitrage opportunity if book values are accurate measures of the value of firms' assets. Book values are not necessarily accurate values of firms' assets. Book values are based on historical values and adjusted arbitrarily over the passage of time. Given that the book values we observe will have been recorded during the boom years before the lost decades, it is likely that they will reflect the optimism of that time and be overvalued.

We consider if the inferences we make regarding *prima facie* perverse market timing may be a function of low values of *M/B* in Table 10. Panel A of Table 10 repeats the analysis we conducted in Table 8 with the 19,047 observations where values of *M/B* are less than 1, Panel B reports the analyses for firms where the value of *M/B* are between 1 and 2 (18,465 observations representing (approximately 47% of the sample) and Panel C reports analyses where the values of *M/B* are greater than 2 (approximately 5% of the sample).

--- Insert Table 10 here ---

The findings in Panel A of Table 10 are consistent with those we reported in Table 8. We find a positive relationship of *M/B* for all, *existing* and *new* firms: the signs and significance of the coefficients of the other variables remain unchanged. Market timing suggests that firms with higher *M/B* exploit the market, valuing the shares more than the book value of their assets to raise equity (as it is relatively overvalued). In Panel A, however, all of the firms have *prima facie* undervalued equity. In this case it would be counterintuitive at best and irrational at worst for firms to reduce their leverage; they could be seen to be "giving away" their shares. The positive coefficient of *M/B* suggests that firms have more leverage as *M/B* approaches its apparent fair value of 1. We suggest that, in this cohort of firms, relatively higher values of *M/B* perhaps reflect investors' *relatively* greater optimism about firms' prospects (though not so great as to drive this ratio beyond 1). If this were the case, firms may have exploited this optimism to hold higher levels of debt to assist them to meet the challenges of the lost decades (Koh et al. 2015).

The 18,465 firm-year observations analyzed in Panel B of Table 10 have values of *M/B* between 1 and 2. As with Panel A, we find positive relationships of *M/B* for *all*, *existing* and *new* firms. We noted that historical book values reported by firms may be optimistic during the lost decades and, if this is the case, *M/B* will be biased upwards. We speculate that the pattern we observe for firms where *M/B* is less than 1 (Panel A of Table 10) is also observed for the firms studied in Panel B: firms exploit relative optimism about their prospects to hold debt rather than "giving away" potentially undervalued equity. It is only in the small cohort of firms where *M/B* is greater than 2 (Panel C of Table 10) that we observe negative and

statistically significant coefficients for *M/B* predicted by market timing theory. In these instances, where there was perhaps less doubt about the market's positive misvaluation of the firms' assets, we find evidence consistent with firms having timed the market.

6. Conclusion

This paper explores the leverage of Japanese firms from 1990 to 2014, a period that incorporates the country's lost decades (失われた20年). Japan's misfortune presents a unique opportunity to examine how firms respond to the challenges of an extraordinarily prolonged economic downtown.

Japanese firms' leverage fell. Average leverage fell from 27.49% in 1990 to 19.34% in 2014. We document a remarkable increase in the proportion of *NAE* (nearly all equity) firms (firms with less than a five percent leverage ratio). At the beginning of the sample period, 7% of firms are *NAE*; at the end, 22.1% are *NAE*. *NAE* firms appear to be carrying less than an optimal level of debt.

We use a suite of explanatory variables to model the choice of leverage and find, in almost all instances, that these variables function as we expect, given the literature. We take the opportunity to compare the results we obtain for Japan with a sample of US firms examined over the same period. In almost all instances, we find that that variables which are used to model debt in the US "work" in the same way in Japan, although the relative effects differ.

Japan's lost decades (失われた20年) are associated with firms having low *M/B* values and this reflects investors' pessimism during this period. Indeed, around 48% of our sample has *M/B* values less than 1. We argue that unexpected findings regarding *M/B* reflect Japanese firms' rational responses to low share valuations. Rather than selling undervalued shares to reduce their debt, Japanese firms exploited *relative* optimism about their prospects to maintain higher debt levels. It is only when *M/B* more clearly suggests firms' shares are overvalued (in only about 5% of the cases that we observe), that we see evidence of lower leverage consistent with market timing.

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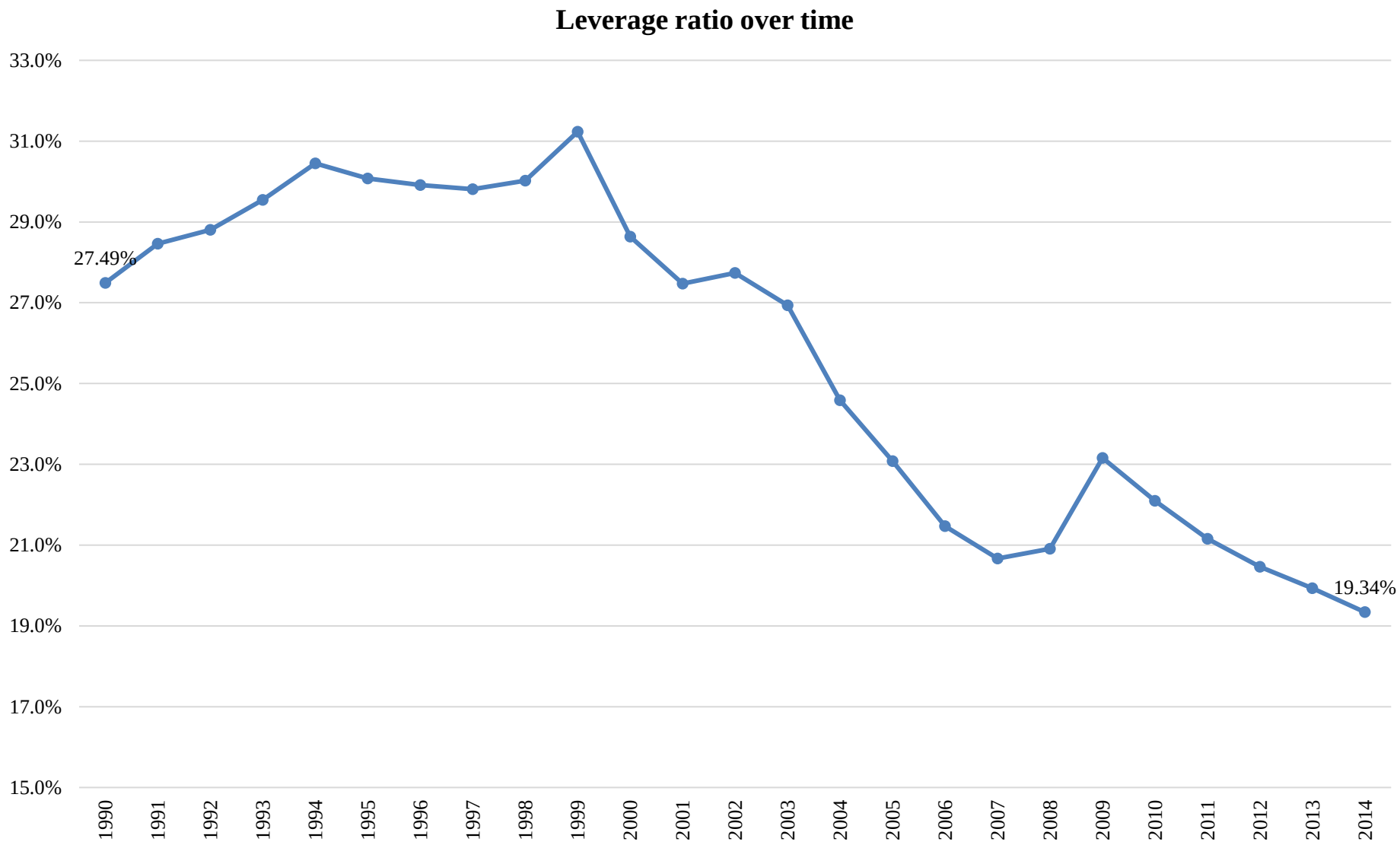

Figure 1 average leverage ratio in the Japanese market between 1990 and 2014: This graph plots the average leverage ratio in the Japanese market between 1990 and 2014.

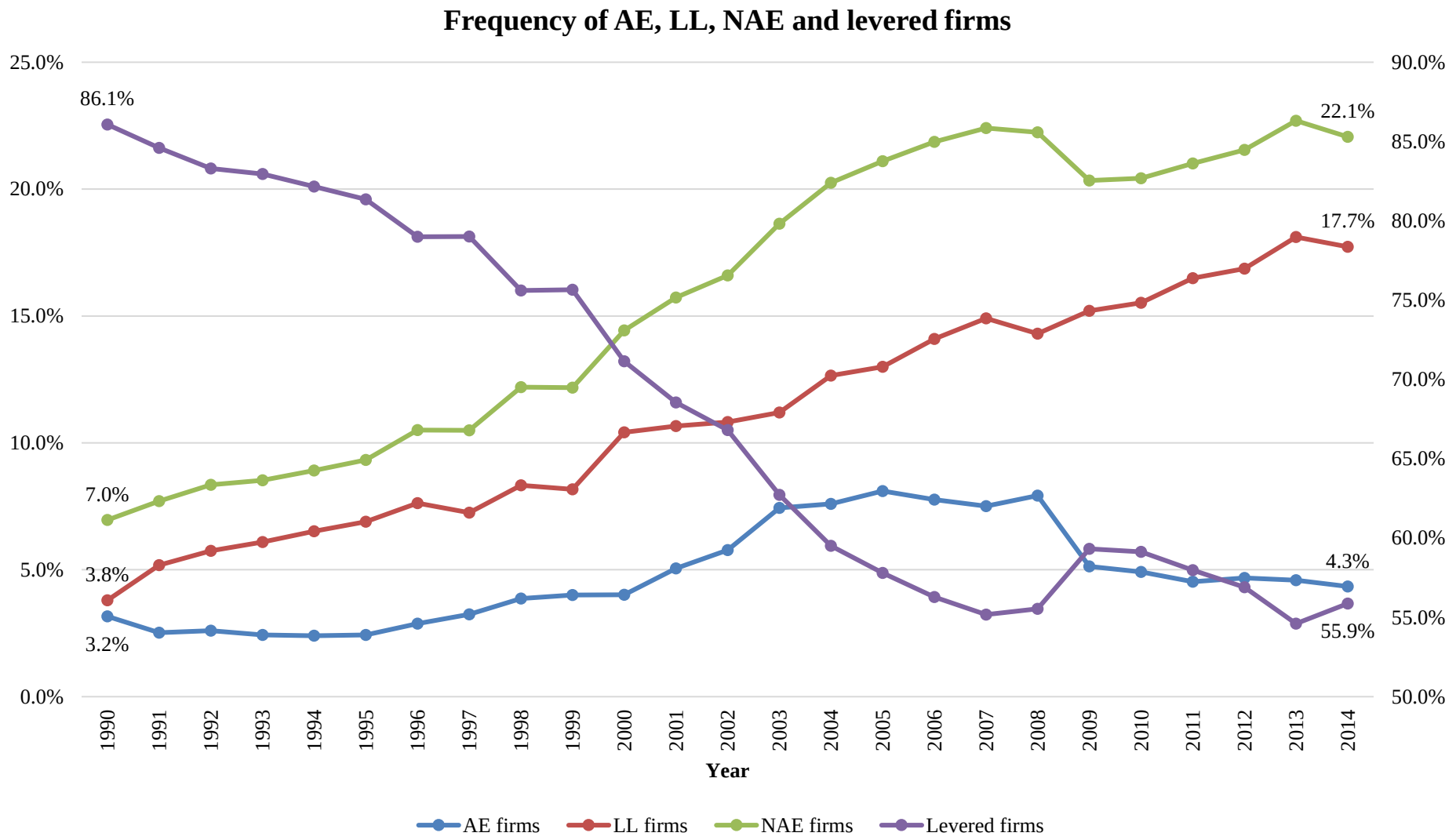

Figure 2 Frequency of *AE*, *LL*, *NAE* and *levered* firms: This graph plots the percentage of firms between 1990 and 2014. It includes all equity firms (*AE*), firms with less than or equal to five percent (*LL*), the combination of all equity and positive leverage less than or equal to five percent (*NAE*) and firms with leverage greater than five percent (*levered*).

Table 1: Distribution of *AE*, *LL*, *NAE* and *levered* firms

Table 1 summarise the number of firms (N) and percentages (%) between 1990 and 2014. All-equity (*AE*) firms have no debt in the current year. Low levered (*LL*) firms have positive leverage less than or at least five percent in the current year. Nearly-all-equity firms (*NAE*) include all-equity (*AE*) firms and firms with positive leverage less than five percent (*LL* firms). *Levered* firms refers to firms which have leverage ratios of more than five percent.

	AE firms		*LL* firms		*NAE* firms		*Levered* firms		Total
Year	N	%	N	%	N	%	N	%	N
1990	5	3.2%	6	3.8%	11	7.0%	136	86.1%	158
1991	18	2.5%	37	5.2%	55	7.7%	604	84.6%	714
1992	29	2.6%	64	5.7%	93	8.3%	928	83.3%	1114
1993	34	2.4%	85	6.1%	119	8.5%	1158	83.0%	1396
1994	35	2.4%	95	6.5%	130	8.9%	1198	82.2%	1458
1995	35	2.4%	99	6.9%	134	9.3%	1169	81.4%	1437
1996	51	2.9%	135	7.6%	186	10.5%	1399	79.0%	1771
1997	60	3.2%	134	7.3%	194	10.5%	1460	79.0%	1848
1998	73	3.9%	157	8.3%	230	12.2%	1426	75.6%	1886
1999	72	4.0%	147	8.2%	219	12.2%	1361	75.7%	1799
2000	91	4.0%	236	10.4%	327	14.4%	1612	71.1%	2266
2001	118	5.1%	249	10.7%	367	15.7%	1600	68.6%	2334
2002	136	5.8%	255	10.8%	391	16.6%	1574	66.8%	2356
2003	184	7.4%	277	11.2%	461	18.6%	1551	62.7%	2473
2004	191	7.6%	318	12.6%	509	20.2%	1496	59.5%	2514
2005	212	8.1%	340	13.0%	552	21.1%	1512	57.8%	2616
2006	207	7.8%	376	14.1%	583	21.9%	1501	56.3%	2667
2007	205	7.5%	407	14.9%	612	22.4%	1507	55.2%	2731
2008	215	7.9%	388	14.3%	603	22.2%	1506	55.5%	2712
2009	133	5.1%	394	15.2%	527	20.3%	1537	59.3%	2591
2010	125	4.9%	395	15.5%	520	20.4%	1505	59.1%	2545
2011	115	4.5%	419	16.5%	534	21.0%	1473	58.0%	2541
2012	119	4.7%	429	16.9%	548	21.5%	1447	56.9%	2543
2013	120	4.6%	474	18.1%	594	22.7%	1429	54.6%	2617
2014	92	4.3%	376	17.7%	468	22.1%	1185	55.9%	2121

Table 2: Sample selection

Table 2 presents the breakdown of the total sample firm-year observations. The sample is an unbalanced panel which consists of 2,832 firms (42,241 firm-year observations) over the period 1990-2014.

	Sample		
	Initial	Excluded	Remaining
Number of firm-year observations	46,786		
Less:			
Firm-year observations with book leverage ratio (*BL*) greater than 1		(1,275)	
Firm-year observations with market-to-book ratio (*M/B*) greater than ten		(134)	
Financial and utilities firms		(3,136)	
Firm-year observations available for the study			42,241

Table 3: Breakdown of firm-year observations into *new*, *existing*, *NAE* and *levered* firms

Table 3 presents the sample firm-year observations by *Existing* firms, *New* firms, *Levered* firms and *NAE* firms. *New* firms are those which appear in the dataset on or after the crash of 1990. *Existing* firms are those firms already listed prior to the crash of 1990. Nearly-all-equity (*NAE*) firms refer to firms which have leverage ratios less than or equal to five percent. *Levered* firms refer to firms which have leverage ratios of more than five percent.

		Existing firms	*New* firms	Total
Levered firms	N	2,559	30,715	33,274
	%	6.06%	72.71%	78.77%
NAE firms	N	579	8,388	8,967
	%	1.37%	19.86%	21.23%
Total	N	3,138	39,103	42,241
	%	6.76%	84.26%	

Table 4: Summary statistics of firm-specific variables

Table 4 presents the summary statistics for a sample of Japanese firms covered by Datastream. The sample is an unbalanced panel consisting of 46,409 firm year observations over the period 1990-2014. *New* firms are those which appear in the dataset on or after the crash of 1990. *Existing* firms are those firms already listed prior to the crash of 1990. Nearly-all-equity (*NAE*) firms refer to firms which have a leverage ratio less than or equal to five percent. *Levered* firms refers to firms which have leverage ratios of more than five percent. The definitions of the variables used in this table are presented in Appendix A. * and ** denote statistical significance of the difference between *new* (*NAE*) and *existing* (*levered*) firms at the 5% and 1% confidence levels respectively.

		BL	*Ln(TA)*	*PPE*	*M/B*	*EFWAMB*	*PROFIT*	*DEP*	*Cash*
	Mean	0.2360	17.9385	0.3040	1.1693	1.6487	0.0663	0.0468	0.1664
All observations	S.D.	0.1901	1.5071	0.1689	0.6374	1.0962	3.1850	3.0373	0.1665
	N	42,241	42,241	42,241	42,241	42,241	42,241	42,241	42,241
	Mean	0.2357	17.8654**	0.3059**	1.1616**	1.6334**	0.0677	0.0480	0.1670**
New firms	S.D.	0.1908	1.4903	0.1708	0.6393	1.1005	3.3103	3.1568	0.1698
	N	39,103	39,103	39,103	39,103	39,103	39,103	39,103	39,103
	Mean	0.2388	18.8486	0.2806	1.2650	1.8397	0.0481	0.0322	0.1594
Existing firms	S.D.	0.1812	1.4149	0.1401	0.6051	1.0217	0.0475	0.0237	0.1189
	N	3,138	3,138	3,138	3,138	3,138	3,138	3,138	3,138
	Mean	0.0141**	17.5788**	0.2194**	1.2643**	1.8159**	0.0776	0.0279	0.2657**
NAE firms	S.D.	0.0157	1.3286	0.1368	0.9496	1.3235	0.1005	0.0252	0.2782
	N	8,967	8,967	8,967	8,967	8,967	8,967	8,967	8,967
	Mean	0.2958	18.0354	0.3268	1.1437	1.6037	0.0632	0.0519	0.1397
Levered firms	S.D.	0.1701	1.5373	0.1694	0.5193	1.0217	3.5882	3.4221	0.1048
	N	33,274	33,274	33,274	33,274	33,274	33,274	33,274	33,274

Table 5: Correlation matrix

Table 5 reports the correlation coefficients between the book leverage ratio and the explanatory variables (defined in Appendix A). The sample is an unbalanced panel consisting of 46,409 firm year observations over the period 1990-2014. *New* firms are those which appear in the dataset on or after the crash of 1990. *Existing* firms are those firms already listed prior to the crash of 1990. Nearly-all-equity (*NAE*) firms refer to firms which have leverage ratios less than or equal to five percent. *Levered* firms refer to firms which have a leverage ratio more than five percent. Coefficients of correlations that are significantly different from zero at the 5% and 1% confidence level are marked with * and **, respectively.

	BL	*Ln(TA)*	*PPE*	*M/B*	*EFWAMB*	*PROFIT*	*DEP*
Panel A: All firms							
Ln(TA)	0.1628**	1					
PPE	0.3737**	0.0670**	1				
M/B	-0.0411**	-0.0422**	-0.1252**	1			
EFWAMB	-0.0671**	0.0025	-0.0786**	0.2363**	1		
PROFIT	0.0004	0.0014	-0.0031	0.0060	-0.0004	1	
DEP	0.0070	0.0021	0.0019	-0.0017	-0.0021	0.9997**	1
CASH	-0.3099**	-0.1582**	-0.2752**	-0.2122**	-0.0040	0.0062	0.0056
Panel B: *New* firms							
Ln(TA)	0.1759**	1					
PPE	0.3733**	0.0790**	1				
M/B	-0.0416**	-0.0571**	-0.1243**	1			
EFWAMB	-0.0691**	0.0055	-0.0810**	0.2355**	1		
PROFIT	0.0008	0.0015	-0.0031	0.0057	-0.0003	1	
DEP	0.0072	0.0024	0.0016	-0.0017	-0.0021	0.9998**	1
CASH	-0.3076**	-0.1617**	-0.2754**	-0.2099**	-0.0049	0.0064	0.0058

Panel C: *Existing* firms							
Ln(TA)	0.0081**	1					
PPE	0.3925*	0.0102	1				
M/B	-0.0374*	0.0447*	-0.1169**	1			
EFWAMB	-0.0431**	-0.1690**	-0.0095	0.2232**	1		
PROFIT	-0.3339**	0.1706**	-0.1526**	0.4608**	0.0386*	1	
DEP	0.0922**	0.2353**	0.4705**	-0.0234	-0.0356*	0.0742**	1
CASH	-0.3661**	-0.1060**	-0.2912**	-0.2593**	0.0257	-0.0345	-0.1646**
Panel D: *NAE* firms							
Ln(TA)	0.1099**	1					
PPE	0.1549**	0.1155**	1				
M/B	-0.0933**	-0.0799**	-0.1808**	1			
EFWAMB	-0.0584**	0.0160	-0.1062**	0.3052**	1		
PROFIT	-0.0763**	0.0083	-0.0645**	0.4474**	0.1389**	1	
DEP	0.0450**	-0.0001	0.3400**	0.0945**	0.0543**	0.0815**	1
CASH	-0.1211**	-0.1350**	-0.1335**	-0.2718**	-0.0674**	-0.1449**	-0.1084**
Panel E: *Levered* firms							
Ln(TA)	0.1196**	1					
PPE	0.3022**	0.0214**	1				
M/B	0.0143**	-0.0158**	-0.0912**	1			
EFWAMB	-0.0272**	0.0117*	-0.0488**	0.1900**	1		
PROFIT	0.0020	0.0017	-0.0025	0.0019	-0.0020	1	
DEP	0.0063	0.0019	0.0006	-0.0023	-0.0023	0.9999**	1
CASH	-0.2678**	-0.1536**	-0.3145**	-0.2292**	0.0009	0.0130*	0.0125*

Table 6: Leverage in Firms' First and Last Observations

Table 6 shows the frequency of firms whose leverage ratios change from the first year they appear in our dataset to the last year they are observed, *n* years from the first observation. Shading indicates the proportion of firms remaining stable (that is, in the same leverage band in their first and last years in the sample).

Leverage ratio in the last available calendar year:	Years after the first observation	Leverage ratio in the first available calendar year: 0 – 0.05	0.05 – 0.1	0.1 – 0.2	0.2 – 0.3	0.3 – 0.4	0.4 – 0.5	0.5 – 0.6	0.6 – 0.7	0.7 or higher
0 – 0.05	1 ≤ n ≤ 10	192	26	27	9	8	1	2	1	0
	11 ≤ n ≤ 20	132	51	70	46	21	8	4	1	0
	21 ≤ n ≤ 24	43	40	62	30	24	8	3	0	0
		69.90%	43.33%	32.19%	17.03%	11.86%	5.69%	5.17%	2.35%	0.00%
0.05 – 0.1	1 ≤ n ≤ 10	16	24	13	5	6	2	1	0	0
	11 ≤ n ≤ 20	22	22	26	24	19	1	2	0	1
	21 ≤ n ≤ 24	13	12	30	21	14	9	3	3	1
		9.71%	21.48%	13.97%	10.02%	8.72%	4.01%	3.45%	3.53%	5.13%
0.1 – 0.2	1 ≤ n ≤ 10	24	18	48	23	14	5	0	0	0
	11 ≤ n ≤ 20	30	17	48	50	37	21	10	3	1
	21 ≤ n ≤ 24	12	15	47	52	39	18	5	0	0
		12.57%	18.52%	28.95%	25.05%	20.13%	14.72%	8.62%	3.53%	2.56%
0.2 – 0.3	1 ≤ n ≤ 10	5	9	18	37	17	6	3	2	0
	11 ≤ n ≤ 20	13	10	27	43	37	28	10	2	1
	21 ≤ n ≤ 24	4	9	26	54	40	21	6	4	2
		4.19%	10.37%	14.37%	26.85%	21.03%	18.39%	10.92%	9.41%	2.56%
0.3 – 0.4	1 ≤ n ≤ 10	7	5	8	19	34	21	5	2	0
	11 ≤ n ≤ 20	1	6	12	27	25	37	18	5	2
	21 ≤ n ≤ 24	2	2	9	16	26	18	8	7	1
		1.90%	4.81%	5.87%	12.42%	19.02%	25.42%	17.82%	16.47%	7.69%
0.4 – 0.5	1 ≤ n ≤ 10	4	1	5	8	9	28	5	2	0
	11 ≤ n ≤ 20	0	0	7	8	16	21	15	4	4
	21 ≤ n ≤ 24	2	1	3	5	22	17	10	6	3
		1.14%	0.74%	3.04%	4.21%	10.51%	22.07%	17.24%	14.12%	7.69%
0.5 – 0.6	1 ≤ n ≤ 10	2	0	3	9	12	8	20	6	0
	11 ≤ n ≤ 20	0	1	1	4	10	5	11	5	2
	21 ≤ n ≤ 24	0	1	1	1	4	3	5	7	1
		0.38%	0.74%	1.01%	2.81%	5.82%	5.35%	20.69%	21.18%	17.95%
0.6 – 0.7	1 ≤ n ≤ 10	1	0	1	1	4	2	8	10	2
	11 ≤ n ≤ 20	0	0	0	3	1	2	3	4	1
	21 ≤ n ≤ 24	0	0	0	1	0	4	7	0	1
		0.19%	0.00%	0.20%	1.00%	1.12%	2.68%	10.34%	16.47%	7.69%
0.7 or higher	1 ≤ n ≤ 10	0	0	2	2	4	3	8	5	15
	11 ≤ n ≤ 20	0	0	0	1	4	2	2	6	0
	21 ≤ n ≤ 24	0	0	0	0	0	0	0	0	1
		0.00%	0.00%	0.40%	0.60%	1.79%	1.67%	5.75%	12.94%	10.26%
	Total observations	525	270	494	499	447	299	174	85	39

Reducing leverage ratios

Increasing leverage ratios

Table 7: The effects of firm-specific characteristics on *NAE* firms

Table 7 presents the estimated coefficients using a random effects logit model with *NAE* as a dependent variable. The dependent variable takes a value of one if the leverage ratio is less than or equal to five percent, otherwise zero. The sample is an unbalanced panel consisting of 46,409 firm year observations over the period 1990-2014. *New* firms are those which appear in the dataset on or after the crash of 1990. *Existing* firms are those firms already listed prior to the crash of 1990. The definitions of the explanatory variables used in this table are presented in Appendix A. Model 1 shows the estimated coefficients and marginal effects (z-statistics are in parentheses) for firms between 1990 and 2014. Model 2 shows the estimated coefficients and marginal effects (z-statistics are in parentheses) for *existing* firms only. Model 3 shows the estimated coefficients and marginal effects (z-statistics are in parentheses) for *new* firms in the sample. * and ** denote significance at the 5% and 1% confidence levels respectively.

	Model 1: *All* firms				Model 2: *Existing* firms				Model 3: *New* firms			
	Japanese firms		US firms		Japanese firms		US firms		Japanese firms		US firms	
	Est. Coeff.	Marginal effect	Est. Coeff.	Marginal effect	Est. Coeff.	Marginal effect	Est. Coeff.	Marginal effect	Est. Coeff.	Marginal effect	Est. Coeff.	Marginal effect
Intercept	3.380**		-1.263**		-7.436*		-1.801**		4.341**		-0.823**	
	4.20		*-14.92*		*-1.96*		*-13.08*		*5.14*		*-7.53*	
Ln(TA)	-0.385**	-0.014**	-0.360**	-0.037**	0.110	0.003	-0.344**	-0.024**	-0.440**	-0.017**	-0.379**	-0.047**
	-8.80	*7.40*	*-31.52*	*-31.47*	*0.57*	*0.56*	*-19.55*	*-17.38*	*-9.52*	*-7.85*	*-25.15*	*-26.24*
PPE	-4.947**	-0.183**	-2.088**	-0.213**	-3.172	-0.080	-2.458**	-0.174**	-5.206**	-0.199**	-1.912**	-0.236**
	-14.99	*10.00*	*-21.24*	*-20.66*	*-1.93*	*-1.57*	*-13.78*	*-12.54*	*-15.27*	*-10.14*	*-15.92*	*-15.91*
M/B	-0.035	-0.001	0.477**	0.049**	-0.645***	-0.016*	0.542**	0.038**	-0.003	-0.0001	0.425**	0.053**
	-0.83	*-0.83*	*40.43*	*40.06*	*-3.42*	*-2.45*	*24.19*	*20.53*	*-0.06*	*-0.06*	*30.09*	*31.42*
EFWAMB	0.220**	0.008**	0.144**	0.015**	0.237*	0.006	0.144**	0.010**	0.228**	0.009**	0.139**	0.017**
	8.17	*7.29*	*15.26*	*15.21*	*2.11*	*1.79*	*7.90*	*7.69*	*8.13*	*7.28*	*12.49*	*12.58*
PROFIT	5.642**	0.209**	-0.001	-0.0001	13.983**	0.351**	0.669**	0.047**	5.432**	0.207**	-0.001	-0.0001
	13.03	*9.44*	*-0.96*	*-0.96*	*6.26*	*2.84*	*5.38*	*5.27*	*12.31*	*9.22*	*-0.99*	*-0.99*
DEP	-5.914**	-0.219**	-0.002	-0.0002	35.738**	0.896**	-1.808**	-0.128**	-5.694**	-0.217**	-0.001	-0.0002
	-13.02	*-10.10*	*-0.13*	*-0.13*	*4.73*	*2.64*	*-2.69*	*-2.68*	*-12.31*	*-9.80*	*-0.11*	*-0.11*
CASH	4.307**	0.160**	5.767**	0.590**	3.837**	0.096*	6.020**	0.425**	4.352**	0.166**	5.447**	0.673**
	18.35	*11.72*	*48.15*	*47.31*	*4.66*	*2.53*	*30.11*	*23.90*	*17.64*	*11.59*	*36.26*	*38.58*
Observations	39,409		97,713		2,991		42,543		36,418		55,170	

Table 8: The effects of firm-specific characteristics on level of leverage

Table 8 presents the estimated coefficients using random effects Tobit estimation with the book leverage ratio as the dependent variable. The sample is an unbalanced panel consisting of 46,409 firm year observations over the period 1990-2014. *New* firms are those which appear in the dataset on or after the crash of 1990. *Existing* firms are those firms already listed prior to the crash of 1990. The definitions of the explanatory variables used in this table are presented in Appendix A. Model 1 shows the estimated coefficients and *t*-statistics for firms between 1990 and 2014. Model 2 shows the estimated coefficients and *t*-statistics for *existing* firms only. Model 3 shows the estimated coefficients and *t*-statistics for *new* firms in the sample. * and ** denote significance at the 5% and 1% confidence levels respectively.

	Model 1: *All* firms		Model 2: *Existing* firms		Model 3: *New* firms	
	Japanese firms	US firms	Japanese firms	US firms	Japanese firms	U.S. firms
Intercept	-0.4006**	0.1572**	-0.3197**	0.2084**	-0.4208**	0.1182**
	-16.12	*38.01*	*-3.19*	*33.94*	*-16.32*	*21.21*
Ln(TA)	0.0351**	0.0170**	0.0327**	0.0130**	0.0364**	0.0205**
	25.95	*32.54*	*6.36*	*17.79*	*25.79*	*27.91*
PPE	0.0815**	0.1185**	0.0226	0.1020**	0.0875**	0.1235**
	10.65	*27.62*	*0.67*	*15.33*	*11.14*	*21.76*
M/B	0.0127**	-0.0224**	0.0272**	-0.0293**	0.0116**	-0.0185**
	11.27	*-42.46*	*7.10*	*-31.95*	*9.83*	*-27.96*
EFWAMB	-0.0083**	-0.0075**	-0.0052**	-0.0065**	-0.0087**	-0.0076**
	-13.02	*-16.74*	*-2.60*	*-7.94*	*-12.93*	*-14.00*
PROFIT	-0.4444**	0.0001	-0.9411**	-0.0185**	-0.4299**	0.0001
	-43.41	*1.51*	*-19.45*	*-7.35*	*-41.04*	*1.64*
DEP	0.4661**	-0.0001	-0.9346**	0.1251**	0.4509**	-0.0002
	43.43	*-0.18*	*-6.66*	*6.89*	*41.05*	*-0.42*
CASH	-0.0898**	-0.2627**	-0.1268**	-0.3272**	-0.0895**	-0.2273**
	-15.04	*-56.91*	*-5.99*	*-42.08*	*-14.42*	*-38.91*
Observations	39,409	97,713	2,991	42,543	36,418	55,170

Table 9: The effects of firm-specific characteristics on level of leverage *excluding* the initial observation

Table 9 presents the estimated coefficients using random effects Tobit estimation with the book leverage ratio as the dependent variable. It differs from Table 8 by excluding the first observation for each firm in the sample. The sample is an unbalanced panel consisting of 46,409 firm year observations over the period 1990-2014. *New* firms are those which appear in the dataset on or after the crash of 1990. *Existing* firms are those firms already listed prior to the crash of 1990. The definitions of the explanatory variables used in this table are presented in Appendix A. Model 1 shows the estimated coefficients and *t*-statistics for firms between 1990 and 2014. Model 2 shows the estimated coefficients and *t*-statistics for *existing* firms only. Model 3 shows the estimated coefficients and *t*-statistics for *new* firms in the sample. * and ** denote significance at the 5% and 1% confidence levels respectively.

	Model 1: *All* firms		Model 2: *Existing* firms		Model 3: *New* firms	
	Japanese firms	U.S. firms	Japanese firms	U.S. firms	Japanese firms	U.S. firms
Intercept	-0.4700**	0.1625**	-0.4343**	0.1955**	-0.4893**	0.1348**
	-18.01	*36.07*	*-4.21*	*30.28*	*-18.05*	*21.69*
Ln(TA)	0.0385**	0.0171**	0.0382**	0.0139**	0.0397**	0.0198**
	27.1	*30.62*	*7.2*	*18.17*	*26.79*	*24.82*
PPE	0.0912**	0.1099**	0.0483	0.1062**	0.0968**	0.1102**
	11.53	*24.04*	*1.39*	*15.47*	*11.93*	*17.84*
M/B	0.0167**	-0.0223**	0.0313**	-0.0287**	0.0158**	-0.0184**
	13.07	*-38.68*	*7.00*	*-30.54*	*11.83*	*-24.7*
EFWAMB	-0.0085**	-0.0093**	-0.0053**	-0.0066**	-0.0089**	-0.0105**
	-12.87	*-18.11*	*-2.63*	*-7.78*	*-12.72*	*-16.04*
PROFIT	-0.5012**	-0.0066**	-0.9654**	-0.0174**	-0.4885**	-0.0047**
	-45.37	*-6.59*	*-19.2*	*-6.79*	*-43.09*	*-4.26*
DEP	0.5257**	0.0293**	-1.0317**	0.1162**	0.5123**	0.0179**
	45.38	*4.79*	*-7.23*	*6.24*	*43.10*	*2.69*
CASH	-0.0782**	-0.2827**	-0.1157**	-0.3251**	-0.0775**	-0.2541**
	-12.82	*-54.63*	*-5.4*	*-39.67*	*-12.22*	*-37.55*
Observations	36,812	86,437	2,852	39,170	33,960	47,267

Table 10: The effects of firm-specific characteristics on level of leverage

Table 10 presents the estimated coefficients using random effects Tobit estimation with the book leverage ratio as the dependent variable. The sample is an unbalanced panel consisting of 46,409 firm year observations over the period 1990-2014. *New* firms are those which appear in the dataset on or after the crash of 1990. *Existing* firms are those firms already listed prior to the crash of 1990. The definitions of the explanatory variables used in this table are presented in Appendix A. Panel A shows the estimated coefficients and *z* statistics for Japanese and U.S. firms with a market to book ratio (*M/B*) less than 1. Panel B shows the estimated coefficients and *z* statistics for Japanese and U.S. firms with a market to book ratio (*M/B*) between 1 and 2. Model 3 shows the estimated coefficients and *z* statistics for Japanese and U.S. firms with a market to book ratio (*M/B*) greater than 2. * and ** denote significance at the 5% and 1% confidence levels respectively.

	Model 1: *All* firms		Model 2: *Existing* firms		Model 3: *New* firms	
	Japanese firms	U.S. firms	Japanese firms	U.S. firms	Japanese firms	U.S. firms
			Panel A: *M/B* < 1			
Intercept	-0.6643**	0.1151**	-0.5669**	0.1792**	-0.6840**	0.0605**
	-19.92	*15.51*	*-3.95*	*16.06*	*-19.84*	*6.07*
Ln(TA)	0.0452**	0.0290**	0.0367**	0.0201**	0.0465**	0.0357**
	24.83	*28.22*	*4.82*	*13.62*	*24.67*	*25.41*
PPE	0.1543**	0.0887**	0.2829**	0.0913**	0.1515**	0.0879**
	15.32	*12.66*	*5.58*	*7.55*	*14.71*	*9.98*
M/B	0.0542**	-0.0264**	0.0654**	-0.0226**	0.0541**	-0.0236**
	16.97	*-12.89*	*4.88*	*-5.02*	*16.48*	*-10.11*
EFWAMB	-0.0066**	-0.0163**	-0.0005	-0.0171**	-0.0072**	-0.0152**
	-8.38	*-15.41*	*-0.24*	*-9.3*	*-8.66*	*-11.71*
PROFIT	-0.5152**	0.0123**	-0.7444**	-0.0394*	-0.5120**	0.0142**
	-32.07	*3.12*	*-9.26*	*-2.34*	*-31.12*	*3.4*
DEP	0.5403**	-0.0281**	-0.3795	0.1738**	0.5369**	-0.0329**
	32.07	-3.03	-1.72	2.83	31.13	-3.38
CASH	-0.0526**	-0.1995**	-0.0285	-0.2579**	-0.0539**	-0.1719**
	-8.08	*-32.52*	*-1.15*	*-22.36*	*-8.01*	*-23.39*
Observations	19,047	21,224	1,074	8,583	17,973	12,641

Panel B: 1≤M/B<2

Intercept	-0.1930**	0.2267**	0.0289	0.2656**	-0.2181**	0.1894**
	-5.99	*40.73*	*0.24*	*33.23*	*-6.47*	*24.47*
Ln(TA)	0.0256**	0.0116**	0.0158*	0.0073**	0.0270**	0.0159**
	14.73	*17.35*	*2.53*	*8*	*14.74*	*16.59*
PPE	0.1640**	0.1162**	-0.0091	0.0912**	0.1745**	0.1274**
	14.21	*20.84*	*-0.2*	*10.86*	*14.59*	*16.85*
M/B	0.0079**	-0.0295**	0.0232**	-0.0344**	0.0061**	-0.0253**
	3.79	*-28.16*	*3.59*	*-18.44*	*2.78*	*-19.24*
EFWAMB	-0.0089**	-0.0092**	-0.0113**	-0.0076**	-0.0086**	-0.0098**
	-8.68	*-13.54*	*-3.47*	*-6.63*	*-8.03*	*-11.58*
PROFIT	-0.6764**	0.0000	-1.0424**	-0.0477**	-0.6542**	0.0000
	-40.22	*-0.43*	*-16.16*	*-8.84*	*-37.52*	*-0.29*
DEP	-0.5016**	0.0000	-0.8988**	0.1601**	-0.4721**	-0.0001
	-10.87	*0.05*	*-4.87*	*6.62*	*-9.9*	*-0.12*
CASH	-0.0509**	-0.3591**	-0.0784*	-0.3887**	-0.0512**	-0.3400**
	-4.02	*-46.73*	*-2.01*	*-32.74*	*-3.82*	*-33.15*
Observations	18,465	51,839	1,758	24,812	16,707	27,027

Panel C: M/B≥2

Intercept	0.0486 *0.72*	0.1271** *17.62*	0.0485 *0.16*	0.1538** *14.06*	0.0525 *0.74*	0.1096** *11.4*
Ln(TA)	0.0061 *1.6*	0.0135** *14.96*	0.0051 *0.31*	0.0129 *10.26*	0.0063 *1.58*	0.0137** *10.94*
PPE	0.2151** *6.29*	0.0667** *7.79*	0.2348 *1.42*	0.0375** *2.74*	0.2103** *5.97*	0.0796** *7.2*
M/B	-0.0050* *-1.99*	-0.0175** *-21.6*	-0.0013 *-0.18*	-0.0196** *-14.63*	-0.0058* *-2.15*	-0.0162** *-15.54*
EFWAMB	-0.0042 *-1.78*	-0.0055** *-7.41*	0.0105 *1.32*	-0.0028 *-1.93*	-0.0060* *-2.43*	-0.0061** *-6.92*
PROFIT	-0.1970** *-7.28*	0.0002 *1.12*	-0.3631* *-2.53*	-0.0170** *-4.62*	-0.1908** *-6.89*	0.0002 *1.05*
DEP	0.1967 *1.79*	0.0010 *0.49*	-1.0267 *-1.83*	0.0621 *1.74*	0.2495* *2.21*	0.0008 *0.36*
CASH	-0.2948** *-6.17*	-0.3398** *-25.46*	-0.0305 *-0.21*	-0.3833** *-15.9*	-0.3325** *-6.5*	-0.3206** *-19.37*
Observations	1,897	24,650	159	9,148	1,738	15,502

Appendix A: Variables' sources and definitions

Variables: sources and definitions

Table A details the variable construction for analysis. For Japanese firms, accounting data between 1990 and 2014 are collected from the Datastream database. For US firms, accounting data between 1990 and 2014 are collected from the Compustat and Centre for Research in Security Prices (CRSP) database from Wharton Research Data Services (WRDS).

Variables	Definitions
Market Equity	$Closing\ share\ price_{i,t} * Outstanding\ common\ share_{i,t}$
Leverage (*BL*)	$\frac{Short\ term\ debt_{i,t} + Long\ term\ debt_{i,t}}{Total\ assets_{i,t}}$
Firm Size (*Ln(TA)*)	$Natural\ logarithm\ of\ total\ assets_{i,t}$
Tangibility (*PPE*)	$\frac{Plant,property\ and\ equipment\ expense_{i,t}}{Total\ assets_{i,t}}$
Market-to-Book ratio (*M/B*)	$\frac{Total\ assets_{i,t} - Book\ equity_{i,t} + Market\ equity_{i,t}}{Total\ assets_{i,t}}$
Research & Development (*R&D*)	$\frac{Research\ \&\ Development\ expense_{i,t}}{Sales_{i,t}}$
Profitability (*PROFIT*)	$\frac{Operating\ income_{i,t}}{Total\ assets_{i,t-1}}$
Depreciation (*DEP*)	$\frac{Depreciation\ and\ Amortisation_{i,t}}{Total\ assets_{i,t-1}}$
Cash (*CASH*)	$\frac{Cash_{i,t} + Current\ invesment_{i,t}}{Total\ assets_{i,t}}$
External Financing Weighted Average Market-to-Book ratio (*EFWAMB*)	$\sum_{s=0}^{t-1} \frac{e_s + d_s}{\sum_{r=0}^{t-1} e_r + d_r} * (M/B)_s$ *e* denotes net equity issues, *d* denotes net debt issues and the summation is from the first observation available for study (Baker and Wurgler, 2002). *M/B* is defined above.

Appendix B: U.S. sample selection

U.S. sample selection

Table B presents the breakdown of the total sample firm-year observations. The sample is an unbalanced panel which consists of 13,697 firms (111,410 firm-year observations) over the period 1990-2014.

	Sample		
	Initial	Excluded	Remaining
Number of firm-year observations	285,998		
Less:			
Firm-year observations with book leverage ratio (*BL*) greater than 1		36,889	
Firm-year observations with market-to-book ratio (*M/B*) greater than ten		3,443	
Missing accounting variables		106,036	
Financial and utilities firms		28,220	
Firm-year observations available for the study			111,410

Appendix C: Summary statistics of firm-specific variables for the U.S. sample

Summary statistics of firm-specific variables for the U.S. sample

Table C presents the summary statistics for a sample of U.S. firms covered by the Compustat database from Wharton Research Data Services (WRDS). The sample is an unbalanced panel consisting of 111,410 firm year observations over the period 1990-2014. *New* firms are those which appear in the dataset on or after the crash of 1990. *Existing* firms are those firms already listed prior to the crash of 1990. Nearly-all-equity (*NAE*) firms refers to firms which have a leverage ratio less than or equal to five percent. *Levered* firms refer to firms which have a leverage ratio more than five percent. The definitions of the variables used in this table are presented in Appendix A. * and ** denote statistical significance of the difference between *new* (*NAE*) and *existing* (*levered*) firms at the 5% and 1% confidence levels respectively.

		BL	*Ln(TA)*	*PPE*	*M/B*	*EFWAMB*	*PROFIT*	*DEP*	*Cash*
	Mean	0.2109	5.4551	0.3102	1.7947	2.2706	0.0226	0.0589	0.1190
All observations	S.D.	0.1961	2.2696	0.2558	1.2807	1.7088	10.1494	0.8713	0.4003
	N	111,410	111,410	111,410	111,410	111,410	111,410	111,410	111,410
	Mean	0.1987**	5.2274**	0.3042**	1.9153**	2.4508**	-0.0489**	0.0636*	0.1368**
New firms	S.D.	0.2039	2.1487	0.2717	1.4278	1.9082	13.2716	1.1388	0.4899
	N	65,132	65,132	65,132	65,132	65,132	65,132	65,132	65,132
	Mean	0.2280	5.7755	0.3185	1.6251	2.0169	0.1233	0.0523	0.0939
Existing firms	S.D.	0.1833	2.3931	0.2313	1.0148	1.3398	0.2800	0.0488	0.2165
	N	46,278	46,278	46,278	46,278	46,278	46,278	46,278	46,278
	Mean	0.0080**	4.4592**	0.2178**	2.2572**	2.9689**	-0.1145*	0.0489**	0.2313**
NAE firms	S.D.	0.0134	1.7940	0.2356	1.6748	2.0500	14.4189	0.4088	0.7011
	N	33,394	33,394	33,394	33,394	33,394	33,394	33,394	33,394
	Mean	0.2977	5.8813	0.3497	1.5968	1.9716	0.0813	0.0632	0.0709
Levered firms	S.D.	0.1724	2.3177	0.2540	1.0054	1.4398	7.6225	1.0062	0.1034
	N	78,016	78,016	78,016	78,016	78,016	78,016	78,016	78,016