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Capital Structure Decisions, Loss Aversion, and Equity Premium

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Previous studies suggest that equity is sold at a premium in capital markets and behavioral economists attribute this equity premium puzzle to investors' loss aversion. The market timing literature argues that market evaluation of equity affects capital structure decisions of firms. Combining the two strands, we theoretically and empirically show that investors' loss aversion positively affects the leverage of firms. The effect is robust to alternative regression approaches, definitions of leverage, subperiods, and subsamples. The positive relation between loss aversion and leverage vanishes for firms with high bankruptcy risks, with high foreign holdings, or with high institutional holdings. Controlling for additional preferences and cultural variables does not subdue the effect. Thus, unlike previous studies, we not only discuss whether mispricing of external financing instruments affects capital structure, but we elaborate on the reasons that generate mispricing in the first place.

Keywords: Capital Structure, Loss Aversion, Equity Premium, Leverage, Bankruptcy Risk

JEL classification: G02, G11, G32

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Abstract

Previous studies suggest that equity is sold at a premium in capital markets and behavioral economists attribute this equity premium puzzle to investors' loss aversion. The market timing literature argues that market evaluation of equity affects capital structure decisions of firms. Combining the two strands, we theoretically and empirically show that investors' loss aversion positively affects the leverage of firms. The effect is robust to alternative regression approaches, definitions of leverage, subperiods, and subsamples. The positive relation between loss aversion and leverage vanishes for firms with high bankruptcy risks, with high foreign holdings, or with high institutional holdings. Controlling for additional preferences and cultural variables does not subdue the effect. Thus, unlike previous studies, we not only discuss whether mispricing of external financing instruments affects capital structure, but we elaborate on the reasons that generate mispricing in the first place.

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1 Introduction

Determining the optimal capital structure is probably one of the most fundamental questions for every company. Since Modigliani and Miller (1958) laid out the framework for the irrelevancy theorem in perfect capital markets, researchers have tried to theoretically explain the determinants of optimal leverage ratio of a company based on different market imperfections such as taxes and bankruptcy costs (Modigliani and Miller, 1963), hidden action problems (Jensen and Meckling, 1976), informational asymmetries (Myers and Majluf, 1984), or limited rationality of investors (Stein, 1996).

Even after more than 50 years of research, there is still an ongoing debate about the actual determinants of capital structure and empirical research has not yet reached to a consensus about the limits and potentials of different theories. Since Titman and Wessels (1988), different studies have reached to different conclusions about the factors relevant for capital structure. For instance, Rajan and Zingales (1995) also discuss the potential determinants of capital structure and find completely different results compared to Titman and Wessels (1988) (see also Frank and Goyal, 2009). Shyam-Sunder and Myers (1999) advocates that firms prefer external debt over equity, in line with pecking order theory, while Frank and Goyal (2003) conclude that pecking order theory is much less successful than the trade-off theory. On the other hand, Bharath et al. (2009) finds that informational asymmetries are very important for capital structure choice, even though this does not mean pecking order hierarchy is completely successful in explaining leverage ratios. Lemmon and Zender (2010) also conclude that informational asymmetries cannot account for the capital structure decisions alone, but they seem to mitigate this problem by additionally controlling for the distress costs. Yet, Fama and French (2005) disagree with this finding. Furthermore, while some researchers find evidence supporting the market timing hypothesis (Baker and Wurgler, 2002; Huang and Ritter, 2009), there is also some skepticism towards the robustness of these results (Hovakimian, 2004).

Firm-specific factors are apparently only a part of the puzzle and cross-country studies reveal that country-specific factors such as GDP growth, corruption, and shareholder rights are also important determinants of capital structure (de Jong et al., 2008; Fan et al., 2012). Yet, not only legal factors separate countries from each other, but cross-country differences in investor preferences can also partially accommodate differences in the financial practices of different companies. Sekely and Collins (1988) and Chui et al. (2002) are among the first to analyze the relevance of different cultural orientations for capital structure (see also Zheng et al., 2012). These studies rely on cultural models of Hofstede (1980, 2001) or Schwartz (1994). Since these cultural values explain how important employee satisfaction is or how important mutual trust between principals and agents is, they are also indirectly related to the importance of market imperfections such as agency costs or informational asymmetries etc. Therefore, researchers analyze how cultural orientation can impact optimal financial policies based on these cultural models.

In this paper, we want to carry this approach even further with new parameters that are more directly linked to investor preference functions (see Kahneman and Tversky, 1979). Cultural values are defined very broadly and they can affect corporate financial practices in a myriad of ways. In contrast, we try to identify differences in preference patterns that can help us establish more straightforward connections between investor preferences and the value of external financing. Hence, our study is related to previous literature investigating the relation between culture and capital structure, but we use different preference parameters in our empirical analysis that are elicited in an original survey (see Rieger et al., 2015). This way, we can formulate hypotheses regarding capital structure policies (see also Breuer et al., 2014).

To be more precise, the foundation of our arguments can be in Benartzi and Thaler (1995). Based on Benartzi and Thaler (1995), we advocate that equity is valued less favorably compared to bonds due to the loss aversion of investors. This implies that the equity premium is going to be especially larger with increasing loss aversion of the investors (Barberis et al., 2001). Based on this relative favorability of debt to equity, we try to understand how managers adjust the capital structure of the firm. In this sense, our paper is related to the so-called market timing literature. Baker and Wurgler (2002) argue that managers are less likely to issue equity, if firm's equity is undervalued. Graham and Harvey (2001) confirm the relevance of this motive in their survey conducted with CFOs, as they find evidence that managers time both equity and debt markets. With this paper, we analyze whether loss aversion leads to different capital structure policies based on this story.

In a simple theoretical model, we show that the leverage of a firm increases with the loss aversion level of new investors, no matter the CEO's objective is to maximize the value to current shareholders, the expected value of her loss-averse utility, or her expected payoff with an option part in compensation.

We also show that the effect of loss aversion on leverage becomes weak when bankruptcy risk is high. Because when there is a certain likelihood of debt default, investors' loss aversion plays a role not only in the evaluation of equity, but also in the evaluation of debt.

Our general research question is similar to Niu and Zeng (2018). There are, however, some noteworthy differences in our approaches: Niu and Zeng (2018)'s simplification regarding the definition of the (loss averse) utility function can lead to wrong results in some situations. Secondly, the utility maximization in Niu and Zeng (2018) is non-standard (the price of the equity being the variable to be optimized), which seems problematic (Cao and Rieger, 2019).

In our empirical analysis conducted with a sample of more than 25,000 firms from 41 countries, we find a significantly positive relation between loss aversion and leverage, even after controlling for a number of firm-specific and country-specific variables. The result holds with different regression approaches, and is robust to alternative definitions of leverage, subperiods, and subsamples of countries. Furthermore, we find that the positive relation between loss aversion and leverage becomes insignificant for firms with high bankruptcy risks.

We also find the positive relation between loss aversion and leverage to be insignificant for firms with high foreign holdings or with high institutional holdings. This meets the expectation that the effect is evident mainly with domestic investors due to home bias, and mainly with individual investors. Adding other preference variables (such as patience, ambiguity aversion, and risk attitudes) and cultural variables (such as the Hofstede or the Schwartz dimensions) does not subdue the effect of loss aversion on leverage.

Hence, we contribute to the literature by discussing the implications of the equity premium puzzle on capital structure based on the market timing story. Although the relevance of loss aversion is well documented for the equity premium puzzle both theoretically and experimentally (Gneezy et al., 2010; Haigh and List, 2010), and there is substantial evidence confirming the importance of market timing for capital structure decisions (see also Henderson et al., 2006), there has been no attempt to understand the influence of loss aversion on capital structure decisions. This can be probably attributed to the lack of reliable data regarding investors' loss aversion preferences. Yet, our survey can address this issue, as we carefully collect information on the level of loss aversion in more than 40 countries. This allows us to analyze loss aversion as a potential determinant of capital structure decisions for the first time in the literature.

Our paper is organized as follows: In the next section, we present a simple theoretical model that formalizes our hypotheses linking loss aversion to capital structure decisions. In Section 3, we describe our survey, empirical approach, and the main results. Subsequently, in Section 4, we discuss the robustness of our results and further implications of our theory. Section 5 concludes. The appendix contains all proofs.

2 A simple theoretical model

In this section, we provide a simple theoretical framework to examine the capital structure predictions of investors' loss aversion. The model formalizes the hypotheses to be tested in the empirical analysis.

We consider a CEO's decision to undertake and finance a single, non-scalable investment project with cost I and random rate of return $\tilde{R}$. In the good state, $\tilde{R}$ is given by $R_G > 1$ with probability p $(0, 1)$; in the bad state, $\tilde{R}$ is $R_B < 1$ with probability $1 - p$.[1] The firm has existing capital C_0. Denote $C_1 = C_0 + I$ the total capital of the firm after I is raised. The project can be financed either by issuing equity or by issuing debt. The investment cost and the return distribution are common knowledge. We abstract from frictions like taxes, asymmetric information, and agency costs. We proceed the discussion first without default risk. Later, we allow for bankruptcy. Different objectives of the CEO are considered: (1) to maximize the expected value of the firm to existing shareholders; (2) to maximize his expected utility, which is aligned with existing shareholders; (3) to maximize his expected compensation including an option part. We assume perfectly competitive debt and equity markets and normalize the risk-free interest rate to zero. The net present value of the project is assumed to be positive, $pR_G + (1 - p)R_B > 1$.

We adopt the piecewise linear utility function used in Barberis et al. (2001) to model new investors' preference,

$$V_{investor}(\pi) = \begin{cases} \pi - I, & \text{if } \pi \geq I, \\ \lambda_{investor} \cdot (\pi - I), & \text{if } \pi < I, \end{cases} \tag{1}$$

[1]For explorative simplicity, we use the two-state return distribution. In Appendix 2, we provide discussions with a continuous return distribution for a shareholder value-maximizing CEO. The results are essentially the same as the case of the two-state distribution.

where π is their investment outcome, $\lambda_{investor} \geq 1$ is the loss aversion parameter of the new investors. The new investors' reference point is I, the amount they invest. This piecewise linear utility function captures loss aversion, but ignores other features of risk attitude such as concavity (convexity) over gains (losses) described in, e.g. Kahneman and Tversky (1979). This is because Benartzi and Thaler (1995) observes that loss aversion mainly drives their results.

The project can be financed either by equity or by debt. In equity financing, new investors buy s $(0, 1)$ fraction of shares of the firm with cost I. In the good state, their share value becomes $s \cdot R_G \cdot C_1$; In the bad state, their share value is $s \cdot R_B \cdot C_1$. To investigate the role played by loss aversion $\lambda_{investor}$ in equity financing, we impose an investment loss from equity in the bad state, $sR_BC_1 < I$. The expected utility of new investors is,

$$U_{equity}^{investor} = \mathrm{E}[V_{investor}(s\tilde{R}C_1)] = p(sR_GC_1 - I) + (1 - p)\lambda_{investor}(sR_BC_1 - I). \quad (2)$$

New investors can alternatively invest risk-free, with expected utility

$$U_{rf}^{investor} = \mathrm{E}[V_{investor}(I)] = 0. \quad (3)$$

2.1 No bankruptcy risk

In debt financing, new investors pay an amount I to buy debt with face value F from the firm. We first consider the case without default risk, i.e., $R_BC_1 \geq F$. Thus, in both the good state and the bad state, new investors always get the amount F back, and there is no investment loss from debt.

The expected utility of new investors is

$$U_{debt}^{investor} = \mathrm{E}[V_{investor}(F)] = p(F - I) + (1 - p)(F - I) = F - I. \quad (4)$$

Shareholder value-maximizing CEO

Consider the case that the CEO's objective is to maximize the value of current shareholders. If he chooses debt financing to raise the amount I, his expected utility is

$$U_{debt}^{CEO} = \mathrm{E}[(\tilde{R}C_1 - F)^+] = p(R_G C_1 - F) + (1 - p)(R_B C_1 - F). \quad (5)$$

If the CEO chooses equity financing, his expected utility becomes

$$U_{equity}^{CEO} = \mathrm{E}[(1 - s)\tilde{R}C_1] = (1 - s)\mathrm{E}[\tilde{R}]C_1 = p(1 - s)R_G C_1 + (1 - p)(1 - s)R_B C_1. \quad (6)$$

Proposition 1. *The shareholder value-maximizing CEO is indi erent between debt or equity financing, when new investors are loss neutral ($\lambda_{investor}$ = 1). If new investors are loss averse ($\lambda_{investor} > 1$), the CEO chooses debt financing. The more loss averse the new investors are, the more likely the CEO chooses debt financing.*

The intuition is that while the CEO can rationally evaluate equity and debt, new investors can only evaluate debt rationally. There is no bankruptcy with debt and it becomes risk-free. New investors' loss aversion does not play a role in evaluating debt. However, since equity incurs a loss in the bad state, loss aversion ($\lambda_{investor} > 1$) makes loss from equity hurt more than loss neutrality ($\lambda_{investor} = 1$) does. New investors, who are loss averse and pay a fixed amount I for equity thus require a larger fraction of shares from the firm to compensate the potential loss. In other words, new investors require a lower share price and thus a higher expected stock return, i.e. a higher equity premium. Meanwhile, the larger the fraction of shares sold to new investors, the less is left to current shareholders. Thus, the CEO, who acts to maximize the value of current shareholders is less willing to choose equity financing and more likely to choose debt financing.

Loss-averse CEO

It is also possible that either the CEO himself is loss averse, or the CEO's monetary payoff is aligned with the utility of current shareholders, who are loss averse. Both cases can be modeled by using a piecewise linear utility function for the CEO,

$$V_{CEO}(\pi) = \begin{cases} \pi - C_0, & \text{if } \pi \geq C_0, \\ \lambda_{CEO} \cdot (\pi - C_0), & \text{if } \pi < C_0, \end{cases} \tag{7}$$

where π is the value of current shareholders, $\lambda_{CEO} \geq 1$ is the CEO's loss aversion parameter. His reference point is C_0, the initial value of the current shareholders.

We impose a loss for current shareholders in the bad state, $(1 - s)R_B C_1 < C_0$, so that we can discuss the impact of loss aversion λ_{CEO} on equity financing.

Proposition 2. *The loss-averse CEO chooses debt financing, when new in-*

vestors are more loss averse than him. The more loss averse the new investors are, the more likely the CEO chooses debt financing.

Inesi (2010) provides experimental evidence that people in power are less loss averse, indicating that CEOs are less loss averse than investors.

CEO with option compensation

Assume that the loss-averse CEO's compensation is proportional to

$$\pi_{CEO}(\pi) = \theta\pi + (1 - \theta)\max(\pi - C_0, 0), \tag{8}$$

where π is the value of current shareholders, $\max(\pi - C_0, 0)$ represents the option part of the CEO's compensation with strike C_0, $1 - \theta$ is the fraction of the CEO's option compensation from his total compensation, $\theta \in (0, 1)$.

Then, his utility function is

$$V_{CEO}(\pi_{CEO}) = \begin{cases} \pi_{CEO} - \theta C_0, & \text{if } \pi_{CEO} \geq \theta C_0, \\ \lambda_{CEO} \cdot (\pi_{CEO} - \theta C_0), & \text{if } \pi_{CEO} < \theta C_0, \end{cases} \tag{9}$$

where his reference point is his compensation at the initial value of current shareholders, $\pi_{CEO}(C_0) = \theta C_0$.

Proposition 3. *The CEO with option compensation chooses debt financing, when $\theta\lambda_{CEO} < \lambda_{investor}$. The less loss averse the CEO is, the less the CEO's compensation depends on options, or the more loss averse the new investors are, the more likely the CEO chooses debt financing.*

The CEO chooses debt financing if $\theta\lambda_{CEO} < \lambda_{investor}$. Now the CEO's capital structure decision depends not only on the levels of his and new investors' loss aversions, but also on his compensation structure. Option compensation of the CEO leads to a looser requirement for loss aversions. The CEO does not have to be less loss averse than new investors. As long as $\theta\lambda_{CEO} < \lambda_{investor}$, he still chooses debt financing. Compare (29) with (7), $\theta\lambda_{CEO}$ becomes the *de facto* loss aversion parameter of the CEO. This result explains previous findings by Tosun (2016), who shows that when CEOs are paid with more options or CEO options become a higher percentage of future cash flows, firms decrease leverage.

The above theoretical discussions for three different objectives of the CEO all lead us to the following hypothesis:

Hypothesis 1. *With investors' increasing loss aversion, the leverage is going to increase, as long as the default probability remains negligible.*

2.2 Bankruptcy risk

So far, we have assumed no bankruptcy risk of the firm, i.e., $R_B C_1 \geq F$. In this subsection we allow for bankruptcy in the bad state ($R_B C_1 < F$), and in which case a deadweight loss $L > 0$ is incurred. We assume $R_B C_1 - L > 0$ and $R_B C_1 < I$.

Consider the case of the shareholder value-maximizing CEO without loss aversion or option compensation. In the bad state, the firm bankrupts and the value of the firm becomes zero. The CEO's expected utility of debt financing gets,

$$U^{CEO}_{debt} = p(R_G C_1 - F). \tag{10}$$

New investors' expected utility in debt financing becomes

$$U_{debt}^{investor} = p(F - I) + (1 - p)\lambda_{investor}(R_B C_1 - L - I). \quad (11)$$

Proposition 4. *The CEO is less likely to choose debt financing with default risk than he does without default risk.*

While new investors are able to evaluate the debt rationally in the case with no default risk, they are unable to do so when there is a bankruptcy in the bad state. The debt from the firm becomes risky in this case. New investors' loss aversion plays a role not only in evaluating equity, but also in evaluating debt. With a fixed amount I invested in debt, new investors require a higher face value of debt to be paid back. A higher debt repayment, however, decreases the value of current shareholders, at odds with the CEO's objective. Thus, when loss can occur both with the equity and with the debt, the CEO's preference of debt financing over equity financing becomes less significant.

The theoretical discussion about bankruptcy risk leads us to our second hypothesis:

Hypothesis 2. *With a high bankruptcy risk, the positive relation between loss aversion and leverage becomes less significant.*

3 Empirical analysis

After presenting the theoretical model, we turn our attention to the empirical validation of the hypotheses. First, we illustrate our survey methodologies that elicit data of loss aversion. Afterwards, we describe our empirical approach and discuss the results.

3.1 Data on investor preferences

We are mainly interested in the relation between capital structure and loss aversion. Since it is nearly impossible to obtain specific information for loss aversion preference of investors who own shares of a firm, we use country-specific preference proxies elicited from a comprehensive survey. In this sense, we rely on a very similar approach as the literature that investigates the relation between cultural values and economic decisions. Our survey is called the international test of risk attitudes (INTRA) survey. The original survey is filled by undergraduate economics students in 53 countries. Overall, about 7,000 university students have participated in the survey. In order to quantify participants' attitudes towards losses (i.e., loss aversion) in the INTRA survey, we work with simple matching tasks in our questionnaire following previous studies such as Abdellaoui et al. (2008). To be more precise, for a lottery with 50% probability of winning the amount X and the other 50% probability of losing the amount Y, students were requested to determine the minimum acceptable amount of X to participate in the lottery given Y. We have calculated the loss aversion parameter λ based on the relation between X and Y, and λ is the independent variable in the following empirical analysis.

We simply use the average loss aversion parameters of our survey participants in a country as our country-specific loss aversion parameter for investors in the empirical analysis. Hence, we implicitly assume that the level of loss aversion is systematically different among different countries and more or less similar for the general investor population in a country. Furthermore, we argue that home bias is still very strong despite the ongoing globalization trend and investors still prefer to invest in domestic stocks (Lau et al., 2010). Combining these assumptions, we can use country-specific preference parameters to understand corporate financial decisions, following the same approach as many prominent cultural studies in the literature (see e.g., Chui et al., 2002; Chui et al., 2010; Shao et al., 2010; Zheng et al., 2012).

Some readers might still doubt our methodology even if they accept our assumptions so far, as we only utilize students' responses to calculate the proxy for investor preferences. Recruiting homogenous groups such as students can be doubted, as some readers might be skeptical about the representativeness of student preferences for the general population. However, our purpose is to map cross-country differences in preference and using homogeneous groups from different countries help us eliminate confounding effects of demographic factors such as age or experience (see also Herrmann et al., 2008). There are substantial evidences in experimental economics that confirm how similar students and other classes of society with different demographic backgrounds tackle the same economic problems (see, e.g., King et al., 1993). Lastly, we find studying the preference of economics students particularly interesting, as these students are likely the investors, and perhaps the portfolio managers, of the future (see also Rieger et al., 2015).

Furthermore, these concerns have already been addressed in different studies which document that the INTRA survey yields reliable proxies. For instance, Breuer et al. (2014) succeed to connect risk and time preferences obtained in the same survey to dividend policies consistent with the catering theory of dividends (Baker and Wurgler, 2004). Breuer et al. (2017) link ambiguity aversion to cash holding decisions based on the precautionary motive of cash holdings. Hence, the relevance of the obtained investor preference proxies has been tested successfully in different fields of finance (Rieger et al., 2015).

3.2 Data on dependent and control variables

Our dependent variable is the leverage of a firm. We define leverage as the ratio between the book value of total debt and the book value of total assets. Following other studies (see e.g., Lemmon et al., 2008), we also use market leverage (the ratio between the book value of total debt and the sum of the market value of equity and the book value of total debt) in robustness tests. In another robustness test, we calculate the ratio between the book value of long-term debt and the book value of total assets (long-term leverage) and use this ratio as the dependent variable (Frank and Goyal, 2009).

Our controls include firm-specific and country-specific variables. Following the existing literature (Rajan and Zingales, 1995 and Frank and Goyal, 2009), our firm-specific control variables capture factors that are known to affect leverage. These include the market-to-book ratio (market value of equity over book value of equity), profitability (operating income over total assets), asset tangibility (net property, plant and equipment over total assets), firm size (logarithm of total assets), R&D/sales (R&D expenses over sales), and the industry leverage (median leverage of each Fama-French industry).

As we include companies from all over the world in our empirical analysis, we also have to add country-specific control variables to our regressions. With these country-specific variables, we control for the impact of different legal practices, macroeconomic conditions, and government efficiency on leverage. First of all, we include a common law dummy following previous studies such as Fan et al. (2012). La Porta et al. (1998) argue that common law offers better shareholder protection and makes external funding more accessible. As tax deduction potential through debt financing becomes more valuable with increasing inflation (Taggart, 1985), we also control for inflation rate. Lastly, we want to account for corruption, measured by the Corruption Perception Index from Transparency International, since higher corruption levels (lower values in Corruption Perception Index) indicate weaker public governance and this would make short-term debt financing a necessity for the firms.

Our dataset includes 48,015 listed companies from 49 countries for the time period from 1980 to 2013 from Datastream. We follow the literature (e.g. Baker and Wurgler, 2002 and Malmendier et al., 2011) to omit all financial, utility and telecommunication companies from our analysis (four digit SIC code numbers between 6000-6999 and 4800-4999, respectively), since these industries are highly regulated by the government. Companies with missing SIC codes are also omitted. Moreover, we exclude all firms in our analysis with total assets lower than 1 million in 1980 US dollar.[2] We only consider primary stocks in our analysis to eliminate duplicated data. Lastly, we limit our analysis to the countries where we conduct the INTRA survey. After the filtration we have 25,287 companies from 41 countries in the dataset. All ratio

[2] Firm size filter is also applied in other studies concerning the relation between stock return and capital structure, e.g. Baker and Wurgler (2002); Welch (2004).

variables are winsorized at the 1% level in both tails of the distribution. These include leverage, market leverage, long-term leverage, market-to-book ratio, profitability, tangibility, R&D/sales, and inflation rate. Summary statistics of the variables after the filtration and winsorization are presented in Table 1. Loss aversion, the common law dummy, and the Corruption Perception Index are static country-specific variables that are constant over time. The rest of the variables are panel data that vary both over time and across firms or countries.

[Table 1 about here]

3.3 Results

We use a pooled OLS model as our primary regression,

$$\text{leverage}_{it} = a + b\lambda_j + \beta_1 \Gamma_{it} + \beta_2 \Delta_{jt} + u_{it}, \tag{12}$$

where leverage_{it} is the leverage in percentage of firm i in year t, λ_j is the loss aversion parameter of country j that firm i belongs to, Γ_{it} and Δ_{jt} are vectors of the firm-specific and country-specific controls, respectively. Γ_{it} includes the market-to-book ratio, profitability, tangibility, logarithm of total assets in 1980 US dollar, R&D/sales, and the industry leverage in percentage of firm i in year t. Δ_{jt} includes the common law dummy, inflation rate in percentage, and the Corruption Perception Index of country j that firm i belongs to, in year t.

To account for correlations among different countries in the same year and different years in the same country, standard errors of the regression are calculated with double-clustering by country and by year. The regression estimates are reported in the first column of Table 2. In robustness tests, we also work with industry- and firm-level clustering.

To address the possible autocorrelation of the leverage, we also estimate a Fama-MacBeth regression (Fama and MacBeth, 1973; Fan et al., 2012), and a random effects regression with AR(1) errors.[3] Regression estimates are presented in the second and the third column of Table 2, respectively. Since the dependent variable leverage can only assume nonnegative values, we additionally estimate a pooled Tobit regression, again with double-clustered standard errors by country and year. The regression estimates are reported in the last column of Table 2.

The results in Table 2 are similar across the four regressions. Loss aversion is positive, highly significant, and of similar magnitude across the four models, even after controlling for a number of firm-specific and country-specific variables. In the pooled OLS regression for example, an increase of loss aversion from the sample's bottom 10% percentile (2.60) to its top 10% percentile (7.16), results in an 1% increase of leverage, statistically significant. It confirms our first hypothesis that leverage increases with loss aversion of the investors. The firm controls are all significant across the models, except for the market-to-book ratio, which is only significant in three regressions. The common law dummy and inflation rate are only significant in one regression, while the Corruption Perception Index is significant in three of the

[3]We use a random effect instead of a fixed effect regression, as Wooldridge (2010, p. 301) points out that without further assumptions, fixed effects models cannot include time-constant factors as independent variables–loss aversion in our case–because there is no way to distinguish the effects of time-invariant explanatory variables from the time-constant unobservable fixed effects.

four regressions. In the rest of the empirical analysis, we use the pooled OLS regression with double-clustering by country and year as our model.

In order to test our second hypothesis, we need some proxies for bankruptcy risk. For this purpose, we utilize two well-known bankruptcy risk measures just like previous studies such as Dichev (1998). These two most popular accounting based measures of bankruptcy risk are Altman's Z-score (Altman, 1968) and Ohlson's O-score (Ohlson, 1980). Both of these bankruptcy measures seem to fare well when it comes to accurately predicting bankruptcy, and neither of them can be clearly identified as superior to the other. Therefore, we use both of these proxies to discuss our second hypothesis. The two measures are winsorized in both tails at the 1% level in the following analysis. Their summary statistics are presented in Table 1. A low Z-score indicates a high bankruptcy risk, while a low O-score a low one.

Based on each of the two measures, we divide the sample into two subsamples. We consider firm-year observations with Z-scores (O-scores) below the first (second) tercile of all observations' Z-scores (O-scores) as a subsample with high bankruptcy risk. The rest is viewed as a subsample with low bankruptcy risk. We estimate the regression for each of the subsamples. Results are presented in Table 3. As the coe□cient for loss aversion is insignificant for the subsamples only consisting of firms with high bankruptcy risk, we find empirical support for our second hypothesis that the positive relation between loss aversion and leverage only applies to firms with low bankruptcy risk.

4 Discussion

After presenting the results of our primary regressions, we also want to discuss the robustness of our results. For this purpose, we provide a battery of robustness checks that should serve to remove doubts regarding the chosen empirical methodology, and the reliability of our theoretical and empirical assumptions. Furthermore, these tests also help us to investigate further implications of our theoretical model.

4.1 Empirical Methodology

In the primary regression, standard errors are clustered both by country and by year. Our first robustness test checks whether alternative clustering changes the result. In the first column of Panel A in Table 4, we estimate the regression with standard errors clustered both by industry and by firm. The t-statititc is even higher (t=6.59) than that estimated in the first column (t=4.02) of Table 2.

In the primary regression, our dependent variable is (book) leverage. Our second robustness test checks whether the result holds for alternative leverage measures. The second and the third column of Panel A in Table 4 use market leverage and long-term leverage as the dependent variable, and accordingly use median market leverage and median long-term leverage in each industry as industry leverage in the regression, respectively. The results are similar to the primary regression with (book) leverage as the dependent variable in the first column of Table 2.

Although our results seem to be theoretically justifiable and clearly statistically significant, we want to discuss whether they are only applicable for certain periods or in certain sets of countries. For this purpose, we repeat the empirical tests of Section 3 for four subperiods separately (1980-1988, 1989-1997, 1998-2005, and 2006-2013) and for a smaller sample excluding large countries. Estimation results are presented in Panel B and C of Table 4.

The coefficient of loss aversion is significant for all four subperiods, suggesting that the impact of loss aversion on leverage seems to be consistent over time. Although we elicit our loss aversion parameter fairly recently, this consistency in our findings for over three decades also implies that the preference of a society does not change very quickly. Hence, we predict that we can rely on our loss aversion parameter to explain investor preferences in the future as well. Moreover, We can still confirm our previous findings after excluding large countries such as the US, Canada, the UK, and Japan, both separately and together at the same time.

Our last robustness test checks if our second hypothesis holds for alternative clustering and alternative measures of leverage. In Table 5, Panel A, we repeat the procedure conducted in Table 3 with standard errors clustered both by industry and by firm. In Panel B and C, we estimate the regression with market leverage and long-term leverage as the dependent variable, respectively. In all three panels, we obtain similar results as in Table 3: loss aversion is significant in low bankruptcy risk subsamples, and insignificant in high bankruptcy risk subsamples, except that in long-term leverage regressions, loss aversion is significant in both the high Z-score (low bankruptcy risk) and the low Z-score (high bankruptcy risk) subsamples. However, the t-statistic in the high Z-score subsample (t=2.58) is larger than that in the low Z-score subsample (t=2.31).

4.2 Foreign holdings and the relevance of domestic preferences

We assume in our empirical model that the issued securities can only be purchased by domestic investors. Otherwise, the value of debt and equity would not be determined solely by the loss aversion of domestic investors and our empirical model would not be correct. We mention above that despite the globalization trend, this assumption should not be very restrictive due to the well-known home bias effect. Still, we want to understand whether our model predictions can only be affirmed, if the foreign ownership share in a company is low.

This requires us to first find reliable data about strategic foreign ownership in a company, which is provided by Datastream. Based on this information, we divide our sample into two parts. The first subsample consists of firm-year observations with the percentage of strategic share holdings in a country outside that of the issuer exceeding 40%. The second subsample covers the rest of the observations. We analyze these subsamples separately in Table 6 and we can observe clearly that only the second subsample generates a significant estimate for loss aversion.[4] This result also increases our confidence regarding the reliability of our findings, since our domestic investor preferences seem to be relevant for the capital structure policies only if we expect them to be so.

[4] We also repeat our tests with the cutoff levels 50% and 60%. Changing cutoff level for strategic foreign ownership does not change our conclusions.

4.3 Institutional ownership

Similarly, we expect the positive relation between leverage and loss aversion to be weaker among firms with higher institutional ownership. Stocks with lower institutional ownership are considered to have higher limits to arbitrage and thus are more subject to misvaluation. Low institutional ownership can impede arbitrage by reducing the supply of lendable stocks in the short-selling market (see, e.g., Nagel, 2005). Low institutional ownership can also strengthen the impact of loss aversion because it is likely that individual investors are particularly prone to loss aversion.

In Table 7, we divide our sample into two parts. The first subsample consists of firm-year observations with the fraction of institutional ownership[5] exceeding 65%. The second subsample covers the rest of the observations. We analyze these subsamples separately and find that loss aversion is only significant in the second subsample.[6]

4.4 Other preference and cultural variables

In this subsection, we add other preference and cultural variables into our primary regression (12). We want to check if the impact of loss aversion on leverage is subdued by other cultural or preference factors. For other preference variables, we consider patience, ambiguity aversion, and risk attitudes in gains and in losses. As loss aversion, these preference variables are also

[5]Institutional ownership is defined according to Datastream as the fraction of shares held as long-term strategic holdings by investment banks or institutions seeking a long-term return.

[6]We also repeat our tests with the cutoff levels 75% and 85%. Changing cutoff level for institutional ownership does not chang our conclusions.

elicited from the INTRA survey, see Rieger et al. (2015), Wang et al. (2017), and Wang et al. (2016) for more details on methodology and results. For cultural variables, we consider both the Hofstede (Hofstede, 1980) and the Schwartz (Schwartz, 1994, 2006) cultural dimensions. Hofstede's cultural dimensions include power distance, uncertainty avoidance, individualism, masculinity, and long-term orientation. Schwartz's cultural dimensions include affective autonomy, intellectual autonomy, embededness, hierarchy, egalitarianism, mastery, and harmony.

Given that culture affects risk and time preferences (Rieger et al., 2015; Wang et al., 2016; Wang et al., 2017), a certain degree of interaction between both is to be expected. We therefore run regression models, both with only preference variables and with preference and cultural variables together as controls, see Table 8. Loss aversion retains significant explanative power for leverage after controlling for the additional cultural and preference variables.[7] We can therefore conclude that the impact of loss aversion is not just a proxy for other preferences or cultural differences. Comparing the adjusted R^2 of the different regression models with the baseline in Table 2, Column 1, we also notice that the explanatory power of the additional variables is rather limited.

Besides working as a robustness test for our original model, the results of Table 8 are also interesting in itself, as they suggest some further factors that may influence capital structure decisions. Regarding the preference variables, patience and risk attitude in losses are the only variables that show a robust

[7] Loss aversion is significant at the 10% confidence level when using Hofstede's cultural variables together with other preference variables.

impact on leverage. The impact of risk attitude in losses seems natural: in our model we have assumed for simplicity a risk neutral behavior in losses[8]. This is only a rough approximation and it is therefore not surprising that risk attitude in losses also impact leverage. Indeed, an extension of our model considering these risk attitudes would be possible and would predict exactly the observed impact. Given that models for risk attitude in losses are less robust than the well-documented effect of loss aversion (see, e.g. Bosch-Doménech and Silvestre, 2006), we refrain from doing so. The robust influence of patience is also interesting and invites further investigation. It might be related to the effect of patience on dividend payout policy that has been discussed by Breuer et al. (2014).

Regarding the cultural dimensions of Hofstede and Schwartz, we find significant negative relations to masculinity and harmony. In a society that puts more emphasis on cooperation, less on competition, and less on harmony with nature, firms seem to have on average higher leverages. This is an interesting observation that could be explored in future studies. Consistent with Chui et al. (2002), embeddedness[9] and mastery have negative signs, but become insignificant in our model. In any case, we have to mention that all of these findings would require more analysis, in particular since interpreting regressions with such a high number of independent variables in Table 8 might be problematic due to multicollinearity.

[8]Recall that loss aversion only influences the risk behavior for mixed gambles, not for gambles that are purely in losses.

[9]This dimension is called conservatism in Chui et al. (2002)

5 Conclusion

Our paper provides the first theoretical and empirical analysis discussing the potential relevance of loss aversion parameter for the capital structure, following the general arguments of the market timing literature. Our theoretical model suggests that equity issues are valued less favorably compared to debt issues by loss-averse investors, especially if the bankruptcy risk is negligible. In this case, firms prefer to issue debt which increases the leverage as a result. Afterwards, we also find supporting empirical evidence for these predictions, integrating a novel country-specific loss aversion parameter in our empirical analysis that we elicit in a new survey conducted by us.

In this sense, the paper makes a great contribution to the behavioral corporate finance literature, as we present evidence how investor biases can be relevant not only for dividend policies (Shefrin and Statman, 1984; Breuer et al., 2014), but also for other financial decisions in corporations.

Furthermore, our paper can also provide further insights into the relation between capital structure decisions and market timing, since, unlike previous studies, we discuss not only whether mispricing of external financing instruments affects capital structure decisions, but we elaborate on the reasons that generate mispricing in the first place.

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	N	Mean	SD	Percentiles		
				10th	50th	90th
Loss aversion	41	5.20	6.42	2.60	3.60	7.16
		Leverage measures				
Leverage	314,013	0.22	0.20	0	0.19	0.50
Market leverage	282,923	0.26	0.25	0	0.19	0.65
Long-term leverage	304,079	0.12	0.15	0	0.06	0.32
		Firm controls				
M/B ratio	282,925	1.37	1.36	0.45	0.94	2.70
Profitability	313,133	0.02	0.18	-0.12	0.05	0.16
Tangibility	313,386	0.31	0.23	0.04	0.27	0.64
Log total assets	314,906	12.24	2.98	8.68	11.70	16.59
R&D/Sales	304,104	0.05	0.22	0	0	0.06
Industry leverage	1,428	0.20	0.07	0.11	0.21	0.29
		Country controls				
Common law	41	0.24	0.43	0	0	1
Inflation	990	4.09	3.47	0.86	2.85	10.92
Corruption	41	62.78	18.90	36	62	86
		Bankruptcy risk measures				
Z-score	211,077	40.02	185.72	0.97	3.59	33.22
O-score	131,191	-10.26	35.85	-13.12	-6.08	-1.61

Table 1: Summary statistics. The table provides the number of observations (N), mean, standard deviation (SD), 10th, 50th (median), and 90th percentiles of each variables. Loss aversion is the average loss aversion parameter of INTRA survey participants in a country. Leverage is the ratio between the book value of total debt and the book value of total assets of the firm. Market leverage is the ratio between the book value of total debt and the sum of the market value of equity and the book value of total debt. Long-term leverage is the ratio between the book value of long-term debt and the book value of total assets. M/B ratio is the market-to-book ratio (market value of equity over book value of equity). Profitabillity is the ratio between operating income and total assets. Tangibility is the ratio between net property, plant and equipment and total assets. Log total assets is the logarithm of total assets in 1980 US dollar. R&D/Sales is the ratio between R&D expenses and sales. Industry leverage is the median of Leverage in each industry according to the Fama-French classification. Common law is a dummy variable equal to 1 when a country adopts the common law system. Inflation is the inflation rate in percentage. Corruption is the Corruption Perception Index. Z-score and O-score are Altman (1968)'s Z-score and Ohlson (1980)'s O-score, respectively.

	Leverage in percentage			
	Pooled OLS	Fama-MacBeth	Random effect	Pooled Tobit
Loss aversion	**0.22**	**0.50**	**0.33**	**0.27**
	(4.03)	(2.91)	(9.45)	(4.12)
M/B ratio	-0.11	**-0.53**	**0.29**	**-0.43**
	(-0.54)	(-2.03)	(12.63)	(-2.17)
Profitability	**-24.84**	**-34.18**	**-17.49**	**-27.16**
	(-6.20)	(-7.06)	(-89.88)	(-6.11)
Tangibility	**17.67**	**17.28**	**15.45**	**19.41**
	(5.06)	(17.62)	(68.34)	(4.88)
Log total assets	**1.05**	**0.77**	**1.84**	**1.29**
	(7.86)	(3.30)	(55.43)	(7.04)
R&D/Sales	**-7.94**	**-10.76**	**-3.16**	**-10.00**
	(-5.33)	(-8.97)	(-18.66)	(-5.54)
Industry leverage	**0.45**	**0.31**	**0.49**	**0.53**
	(6.05)	(5.58)	(34.49)	(5.08)
Common law	0.45	1.96	**3.01**	0.08
	(0.38)	(1.54)	(13.50)	(0.06)
Inflation	0.29	0.40	**0.11**	0.31
	(1.66)	(1.80)	(8.61)	(1.55)
Corruption	**-0.10**	-0.06	**-0.08**	**-0.12**
	(-3.81)	(-1.36)	(-12.77)	(-3.73)
Constant	1.29	4.26	**-11.19**	-3.55
	(0.60)	(1.20)	(-15.64)	(-1.19)
N	254,061	254,061	254,061	254,061
Adj. R^2	15.34%	16.80%	15.34%	2.21%

Table 2: Regressions. The table reports estimation results of the pooled OLS regression, the Fama-MacBeth regression, the random effect regression, and the pooled Tobit regression. Dependent variable is leverage in percentage. In the pooled OLS regression and Tobit regression, standard errors are robust to double-clustering by year and by country. In the Fama-MacBeth regression, standard errors are adjusted following Newey and West (1987) with six lags. The random effect regression is estimated with AR(1) errors. t-statistics (z-statistics for the random effect and the Tobit regressions) are shown in parentheses. Bold type indicates a coefficient significant at the 5% level. N is the number of firm-year observations. Adj. R^2 is the adjusted R-squared (Pseudo R-squared for the pooled Tobit regression).

	Leverage in percentage			
	Z-score > 1st tercile	Z-score ≤ 1st tercile	O-score > 2nd tercile	O-score ≤ 2nd tercile
Loss aversion	**0.12**	0.06	0.09	**0.16**
	(4.15)	(1.14)	(1.11)	(2.97)
M/B ratio	**1.03**	**12.20**	**2.80**	-0.06
	(3.82)	(6.56)	(8.83)	(-0.08)
Profitability	**4.30**	**10.40**	**9.41**	-15.78
	(2.24)	(4.04)	(9.86)	(-1.36)
Tangibility	**5.69**	**6.59**	**11.78**	**10.47**
	(4.10)	(4.30)	(5.23)	(2.91)
Log total assets	**0.56**	**0.52**	**2.66**	**1.62**
	(3.67)	(2.83)	(6.55)	(9.46)
R&D/Sales	**-4.91**	**-8.14**	**-5.66**	**-14.81**
	(-4.25)	(-3.64)	(-9.51)	(-2.66)
Industry leverage	**0.29**	**0.23**	**0.47**	**0.25**
	(7.88)	(5.16)	(5.34)	(8.79)
Common law	1.39	0.89	2.23	**2.57**
	(1.29)	(0.66)	(1.65)	(2.16)
Inflation	0.24	0.14	0.11	**0.54**
	(0.93)	(0.93)	(0.67)	(3.15)
Corruption	-0.03	-0.02	-0.05	0.04
	(-0.70)	(-0.63)	(-1.04)	(1.58)
Constant	1.77	**17.58**	-4.66	**-15.38**
	(0.48)	(4.99)	(-0.99)	(-4.92)
N	129,071	64,108	37,290	79,721
Adj. R^2	7.17%	25.90%	20.56%	18.67%

Table 3: Bankruptcy risk. The first (second) column estimates the regression with firm-year observations whose Z-scores are larger than (smaller than or equal to) the first tercile of all observations' Z-scores. The third (fourth) column estimates the regression with observations whose O-scores are larger than (smaller than or equal to) the second tercile of all observations' O-scores. t-statistics are shown in parentheses. Bold type indicates a coe□cient significant at the 5% level. N is the number of firm-year observations. Adj. R^2 is the adjusted R-squared.

Panel A. Alternative clustering and leverage measures

	Leverage in percentage		
	Cluster by industry and by firm	Market leverage	Long-term leverage
Loss aversion	**0.22**	**0.32**	**0.24**
	(6.57)	(2.43)	(3.02)
Firm controls	Yes	Yes	Yes
Country controls	Yes	Yes	Yes
N	254,061	254,061	247,818
Adj. R^2	15.34%	27.38%	16.09%

Panel B. Subperiods

	Leverage in percentage			
	1980-1988	1989-1997	1998-2005	2006-2013
Loss aversion	**0.63**	**0.37**	**0.12**	**0.25**
	(5.16)	(4.91)	(2.27)	(3.69)
Firm controls	Yes	Yes	Yes	Yes
Country controls	Yes	Yes	Yes	Yes
N	7,282	32,782	77,112	136,885
Adj. R^2	15.27%	17.38%	14.13%	16.40%

Panel C. Countries

	Leverage in percentage				
	Ex US	Ex Canada	Ex UK	Ex Japan	Ex US, Canada, UK, Japan
Loss aversion	**0.25**	**0.22**	**0.21**	**0.13**	**0.16**
	(4.05)	(4.12)	(3.80)	(3.03)	(3.45)
Firm controls	Yes	Yes	Yes	Yes	Yes
Country controls	Yes	Yes	Yes	Yes	Yes
N	199,245	245,285	241,785	200,675	124,807
Adj. R^2	16.67%	15.56%	15.33%	16.13%	18.59%

Table 4: Robustness. Panel A: the first column estimates the regression with double-clustered standard errors by industry and by firm. The second and the third column use market leverage in percentage and long-term leverage in percentage as the dependent variable, and accordingly use median market leverage in percentage and median long-term leverage in percentage in each industry as industry leverage in the regression, respectively. Panel B estimates the regression in four subperiods. Panel C estimates the regression with samples excluding US firms, Canadian firms, UK firms, or Jananese firms, respectively. The last column excludes all firms from these four countries. Firm controls include the market-to-book ratio, profitability, tangibility, logarithm of total assets in 1980 US dollar, R&D/sales, and the industry leverage in percentage. Country controls include the common law dummy, inflation rate in percentage, and the Corruption Perception Index. t-statistics are shown in parentheses. Bold type indicates a coe□cient significant at the 5% level. N is the number of firm-year observations. Adj. R^2 is the adjusted R-squared.

Panel A. Bankruptcy risk - cluster by industry and by firm

	Leverage in percentage			
	Z-score > 1st tercile	Z-score ≤ 1st tercile	O-score > 2nd tercile	O-score ≤ 2nd tercile
Loss aversion	**0.12**	0.06	0.09	**0.16**
	(4.31)	(1.53)	(1.71)	(4.26)
Firm controls	Yes	Yes	Yes	Yes
Country controls	Yes	Yes	Yes	Yes
N	129,071	64,108	37,290	79,721
Adj. R^2	7.17%	25.90%	20.56%	18.67%

Panel B. Bankruptcy risk - market leverage

	Leverage in percentage			
	Z-score > 1st tercile	Z-score ≤ 1st tercile	O-score > 2nd tercile	O-score ≤ 2nd tercile
Loss aversion	**0.12**	0.24	0.12	**0.12**
	(2.13)	(1.41)	(0.82)	(2.07)
Firm controls	Yes	Yes	Yes	Yes
Country controls	Yes	Yes	Yes	Yes
N	129,071	64,108	37,290	79,721
Adj. R^2	19.69%	20.92%	41.59%	33.60%

Panel C. Bankruptcy risk - long-term leverage

	Leverage in percentage			
	Z-score > 1st tercile	Z-score ≤ 1st tercile	O-score > 2nd tercile	O-score ≤ 2nd tercile
Loss aversion	**0.15**	**0.25**	0.12	**0.18**
	(2.58)	(2.31)	(1.00)	(2.12)
Firm controls	Yes	Yes	Yes	Yes
Country controls	Yes	Yes	Yes	Yes
N	128,149	63,778	37,290	79,721
Adj. R^2	15.51%	23.93%	25.16%	20.14%

Table 5: Robustness (continued). The first (second) column estimates the regression with firm-year observations whose Z-scores are larger than (smaller than or equal to) the first tercile of all observations' Z-scores. The third (fourth) column estimates the regression with observations whose O-scores are larger than (smaller than or equal to) the second tercile of all observations' O-scores. Dependent variable is book leverage in Panel A, market leverage in Panel B, and long-term leverage in Panel C, respectively. Standard errors are clustered by industry and by firm in Panel A. t-statistics are shown in parentheses. Bold type indicates a coe□cient significant at the 5% level. N is the number of firm-year observations. Adj. R^2 is the adjusted R-squared.

	Leverage in percentage	
	Foreign holding $>$ 40%	Foreign holding ≤ 40%
Loss aversion	0.37	**0.22**
	(1.58)	(3.71)
M/B ratio	0.65	0.11
	(1.20)	(0.35)
Profitability	**-23.52**	**-23.69**
	(-4.68)	(-5.96)
Tangibility	**22.05**	**16.35**
	(6.44)	(4.22)
Log total assets	**0.67**	**0.98**
	(2.09)	(4.43)
R&D/Sales	**-8.90**	**-6.97**
	(-4.83)	(-4.99)
Industry leverage	**0.46**	**0.49**
	(5.68)	(6.31)
Common law	-2.51	0.50
	(-1.50)	(0.39)
Inflation	-0.42	0.33
	(-1.28)	(1.77)
Corruption	0.09	**-0.11**
	(1.60)	(-3.14)
Constant	-7.84	1.42
	(-1.13)	(0.43)
N	5,176	157,385
Adj. R^2	16.85%	15.11%

Table 6: Foreign holdings. The table estimates the regression with firm-year observations whose strategic foreign holdings are larger than 40% (first column), and smaller than or equal to 40% (second column), respectively. t-statistics are shown in parentheses. Bold type indicates a coe□cient significant at the 5% level. N is the number of firm-year observations. Adj. R^2 is the adjusted R-squared.

	Leverage in percentage	
	IO $>$ 65%	IO ≤ 65%
Loss aversion	0.23	**0.22**
	(1.41)	(3.73)
M/B ratio	0.05	0.14
	(0.22)	(0.43)
Profitability	**-45.42**	**-22.92**
	(-7.53)	(-5.94)
Tangibility	**19.43**	**16.51**
	(5.29)	(4.22)
Log total assets	**1.10**	**0.94**
	(3.11)	(4.32)
R&D/Sales	**-15.83**	**-6.76**
	(-3.44)	(-5.08)
Industry leverage	**0.36**	**0.50**
	(4.60)	(6.35)
Common law	1.28	0.29
	(0.61)	(0.23)
Inflation	-0.16	0.31
	(-0.45)	(1.78)
Corruption	-0.05	**-0.10**
	(-0.72)	(-3.12)
Constant	-0.28	1.63
	(-0.04)	(0.50)
N	9,392	153,194
Adj. R^2	16.85%	14.97%

Table 7: Institutional ownership. The table estimates the regression with firm-year observations whose fraction of institutional ownership (IO) is larger than 65% (first column), and smaller than or equal to 65% (second column), respectively. t-statistics are shown in parentheses. Bold type indicates a coefficient significant at the 5% level. N is the number of firm-year observations. Adj. R^2 is the adjusted R-squared.

		Leverage in percentage		
		(1)	(2)	(3)
Loss aversion		**0.21**	0.07	**0.21**
		(3.15)	(1.87)	(5.38)
Other preference	Patience	**14.24**	**10.14**	**9.06**
		(2.16)	(2.22)	(2.98)
	Ambiguity aversion	**-18.62**	**-12.98**	-5.77
		(-4.58)	(-6.03)	(-1.21)
	Risk attitude in gains	-10.45	11.67	-12.86
		(-1.51)	(1.72)	(-1.82)
	Risk attitude in losses	**0.64**	**0.53**	**0.36**
		(6.14)	(5.09)	(4.66)
Hofstede	Power distance		0.00	
			(0.11)	
	Uncertainty avoidance		-0.01	
			(-0.49)	
	Individualism		0.00	
			(0.04)	
	Masculinity		**-0.13**	
			(-4.45)	
	Long-term orientation		0.00	
			(0.07)	
Schwartz	Affective autonomy			2.18
				(0.93)
	Intellectual autonomy			-2.58
				(-0.67)
	Embeddedness			-5.20
				(-0.77)
	Hierarchy			-2.32
				(-1.76)
	Egalitarianism			5.64
				(1.42)
	Mastery			-1.52
				(-0.27)
	Harmony			**-6.56**
				(-2.99)
Firm control		Yes	Yes	Yes
Country control		Yes	Yes	Yes
N		254,061	234,795	253,796
Adj. R^2		15.98%	17.52%	16.77%

Table 8: Other preference and cultural variables. The table estimates the regression with additional preference and cultural variables. The first column adds other preference variables. The second column adds other preference variables together with the five cultural dimensions of Hofstede (Hofstede, 1980). The third column adds other preference variables together with the seven cultural dimensions of Schwartz (Schwartz, 2006). t-statistics are shown in parentheses. Bold type indicates a coefficient significant at the 5% level. N is the number of firm-year observations. Adj. R^2 is the adjusted R-squared.

Appendix 1. Proofs

Proof of Proposition 1. If the CEO chooses debt financing, his maximization problem is

$$\max_F U_{debt}^{CEO}, \tag{13}$$

subject to

$$U_{debt}^{investor} = U_{rf}^{investor} = 0, \tag{14}$$

where $U_{debt}^{investor}$ is $U_{debt}^{investor}$ at F, and F is the optimal face value of the debt in (13). Thus (14) is the participation constraint of the new investors: at face value F of the debt, they are indifferent between buying the debt and investing risk-free.

If the CEO chooses equity financing, his maximization problem is

$$\max_s U_{equity}^{CEO}, \tag{15}$$

subject to

$$U_{equity}^{investor} = U_{rf}^{investor} = 0, \tag{16}$$

where (16) is the participation constraint of the new investors.

From (4) and (14) we know that $F = I$. Plugging back into (13), we obtain the maximum,

$$U_{debt}^{CEO} = p(R_G C_1 - I) + (1 - p)(R_B C_1 - I) = pR_G C_1 + (1 - p)R_B C_1 - I. \tag{17}$$

From (16), we know

$$s^* = \frac{(p + (1 - p)\lambda_{investor})I}{(pR_G + (1 - p)\lambda_{investor}R_B)C_1}. \tag{18}$$

Denote with U^{CEO*}_{equity} the maximum of U^{CEO}_{equity} obtained at s^*. The CEO chooses debt financing, if

$$U^{CEO*}_{equity} < U^{CEO*}_{debt}, \tag{19}$$

namely

$$s^* > \frac{I}{(pR_G + (1 - p)R_B)C_1}, \tag{20}$$

in conjunction with (18), we have

$$\lambda_{investor} > 1. \tag{21}$$

Thus, the CEO is indifferent between debt or equity financing, when $\lambda_{investor} = 1$. When $\lambda_{investor}$ becomes larger, the CEO chooses debt financing.

Use the implicit function theorem and differentiate both sides of (16) with respect to $\lambda_{investor}$ to calculate $\frac{ds^*}{d\lambda_{investor}}$. We have

$$\frac{ds}{d\lambda_{investor}} = \frac{(1 - p)(I - s^* R_B C_1)}{pR_G C_1 + (1 - p)\lambda_{investor}R_B C_1}, \tag{22}$$

which is positive.

Because $\lambda_{investor}$ does not affect U^{CEO*}_{debt}, we have

$$\frac{d(U^{CEO*}_{debt} - U^{CEO*}_{equity})}{d\lambda_{investor}} = -\frac{dU^{CEO}_{equity}}{d\lambda_{investor}} = \frac{ds}{d\lambda_{investor}}\mathrm{E}[\tilde{R}]C_1, \tag{23}$$

which is positive. The more loss averse the new investors are, the more likely the CEO chooses debt financing. Q.E.D.

Proof of Proposition 2. In the loss-averse CEO's decision problem, new investors' participation constraints (14) and (16) stay the same as in the case of the shareholder value-maximizing CEO. Because $R_B < 1$, we have $R_B C_1 < C_0 + I$. From (4) we know that $F = I$, thus $R_B C_1 - F < C_0$. Namely, debt financing incurs a loss for current shareholders in the bad state. The CEO's expected utilities for debt financing and equity financing are respectively,

$$U^{CEO}_{debt} = p(R_G C_1 - F - C_0) + (1-p)\lambda_{CEO}(R_B C_1 - F - C_0), \tag{24}$$

$$U^{CEO}_{equity} = p((1-s)R_G C_1 - C_0) + (1-p)\lambda_{CEO}((1-s)R_B C_1 - C_0). \tag{25}$$

The CEO chooses debt financing, if $U^{CEO}_{equity} < U^{CEO}_{debt}$, namely

$$s > \frac{(p + (1-p)\lambda_{CEO})I}{(pR_G + (1-p)\lambda_{CEO}R_B)C_1}, \tag{26}$$

in conjunction with (18), we have

$$\lambda_{CEO} < \lambda_{investor}. \tag{27}$$

When new investors are more loss averse than the CEO, the CEO chooses debt financing.

Because $\frac{dU^{CEO'}_{equity}}{ds'} < 0$ and $\lambda_{investor}$ does not affect U^{CEO}_{debt} , we have again $\frac{\partial(U^{CEO'}_{debt} - U^{CEO'}_{equity})}{\partial\lambda_{investor}} > 0$. The more loss averse new investors are, the more likely the CEO chooses debt financing.

Moreover, we have

$$\frac{\partial(U_{debt}^{CEO} - U_{equity}^{CEO})}{\partial\lambda_{CEO}} = (1-p)(sR_BC_1 - I), \tag{28}$$

which is negative. The more loss averse the CEO is, the less likely he chooses debt financing. Q.E.D.

Proof of Proposition 3. Plugging (8) into (9),

$$V_{CEO} = \begin{cases} \pi - C_0, & \text{if } \pi \geq C_0, \\ \lambda_{CEO} \cdot \theta \cdot (\pi - C_0), & \text{if } \pi < C_0, \end{cases} \tag{29}$$

The CEO compares U_{debt}^{CEO} with U_{equity}^{CEO} to choose between debt and equity financing. Condition (27) becomes

$$\theta\lambda_{CEO} < \lambda_{investor}. \tag{30}$$

We have

$$\frac{\partial(U_{debt}^{CEO} - U_{equity}^{CEO})}{\partial\lambda_{CEO}} = (1-p)\theta(sR_BC_1 - I) < 0, \tag{31}$$

and

$$\frac{\partial(U_{debt}^{CEO} - U_{equity}^{CEO})}{\partial\theta} = (1-p)\lambda_{CEO}(sR_BC_1 - I) < 0, \tag{32}$$

and again $\frac{\partial(U_{debt}^{CEO} - U_{equity}^{CEO})}{\partial\lambda_{investor}} > 0$.

The less loss averse the CEO is, the less the CEO's compensation depends on options, or the more loss averse the new investors are, the more likely the CEO chooses debt financing. Q.E.D.

Proof of Proposition 4. The CEO compares U^{CEO}_{debt} and U^{CEO}_{equity} to decide between debt or equity financing. From the participation constraint of the new investors in debt financing $U^{investor}_{debt} = 0$, we have

$$F = I + \frac{1-p}{p}(I + L - R_B C_1)\lambda_{investor}. \tag{33}$$

The CEO's maximization problem in equity financing stays the same as the no bankruptcy case.

Denote with s_d the optimal share fraction of the firm decided by the CEO to sell to new investors. The participation constraint of the new investors in equity financing stays the same, which, as before, still gives

$$s_d = \frac{(p + (1-p)\lambda_{investor})I}{(pR_G + (1-p)\lambda_{investor}R_B)C_1}. \tag{34}$$

The CEO chooses debt financing, if $U^{CEO}_{debt} > U^{CEO}_{equity}$, which gives

$$s_d > \frac{pI + (1-p)(I + L - R_B C_1)\lambda_{investor} + (1-p)R_B C_1}{(pR_G + (1-p)R_B)C_1}, \tag{35}$$

comparing to the case without default risk in (20) and denoting $s^{min} = \frac{I}{(pR_G+(1-p)R_B)C_1}$, $s^{min}_d = \frac{pI+(1-p)(I+L-R_B C_1)\lambda_{investor}+(1-p)R_B C_1}{(pR_G+(1-p)R_B)C_1}$, we have

$$s^{min}_d - s^{min} = \frac{(\lambda_{investor} - 1)(1-p)I + (1-p)L\lambda_{investor} + (1-p)R_B C_1(1-\lambda_{investor})}{(pR_G + (1-p)R_B)C_1}, \tag{36}$$

which is positive.

Thus, (35) is a stricter condition than (20). Namely, in the case without default risk, $U^{CEO}_{debt} > U^{CEO}_{equity}$ is more likely to hold than in the case with default risk. The CEO is less likely to choose debt financing with default risk than he does without default risk. Q.E.D.

Appendix 2. Theoretical results with a continuous return distribution

In this section, we derive the theoretical result with a continuous return distribution. The result is essentially the same as the one derived with a two-state discrete return distribution in Section 2. We only provide the result for a shareholder-value maximizing CEO. For a loss-averse CEO without and with option compensation, the derivation becomes less tractable.

Let the return of the project, $\tilde{R}$, have a continuous distribution with probability density function $f_R(x)$, and probability distribution function $F_R(x)$.

In equity financing, new investors buy s $(0,1)$ fraction of shares of the firm with I. Their share value is $s \cdot \tilde{R} \cdot C_1$. The expected utility of new investors is,

$$\begin{aligned} U^{investor}_{equity} &= \mathrm{E}[V_{investor}(s\tilde{R}C_1)] \\ &= \int_{\{s\tilde{R}C_1 \geq I\}} (sxC_1 - I) f_R(x)dx + \lambda_{investor} \int_{\{s\tilde{R}C_1 < I\}} (sxC_1 - I) f_R(x)dx. \end{aligned} \tag{37}$$

New investors can alternatively invest risk-free, with expected utility

$$U_{rf}^{investor} = \mathrm{E}[V_{investor}(I)] = 0. \tag{38}$$

In debt financing, new investors pay an amount I to buy debt with face value F from the firm. The expected utility of new investors is

$$\begin{aligned} U_{debt}^{investor} = & \int_{\{\tilde{R}C_1 \geq F\}} (F - I) f_R(x) dx + \int_{\{L \leq \tilde{R}C_1 < F\}} \lambda_{investor}(xC_1 - L - I) f_R(x) dx \\ & - \int_{\{\tilde{R}C_1 < L\}} \lambda_{investor} I f_R(x) dx, \end{aligned} \tag{39}$$

where L is a deadweight loss of the firm associated with bankruptcy with $F - I < L < F$.

We consider the case with zero default risk, i.e., $\mathrm{P}[\tilde{R}C_1 \geq F] = 1$. We have $U_{debt}^{investor} = F - I$.

Let the objective of the CEO be to maximize the value of the current shareholders. If he chooses debt financing to raise the amount I, his expected utility is

$$U_{debt}^{CEO} = \mathrm{E}[(\tilde{R}C_1 - F)^+] = \mathrm{E}[\tilde{R}]C_1 - F. \tag{40}$$

His maximization problem is

$$\max_F U_{debt}^{CEO}, \tag{41}$$

subject to

$$U_{debt}^{investor} = U_{rf}^{investor} = 0, \tag{42}$$

where $U_{debt}^{investor}$ is $U_{debt}^{investor}$ at F , and F is the optimal face value of the debt in (41). Thus (42) is the participation constraint of the new investors: at face value F of the debt, they are indifferent between buying the debt and investing risk-free.

From $U^{investor}_{debt} = F - I$ we know that $F = I$. Plugging back into (41), we obtain the maximum,

$$U^{CEO}_{debt} = \mathrm{E}[\tilde{R}]C_1 - I. \tag{43}$$

If the CEO chooses equity financing, his expected utility becomes

$$U^{CEO}_{equity} = \mathrm{E}[(1 - s)\tilde{R}C_1] = (1 - s)\mathrm{E}[\tilde{R}]C_1. \tag{44}$$

His maximization problem is

$$\max_s U^{CEO}_{equity}, \tag{45}$$

subject to

$$U^{investor}_{equity} = U^{investor}_{rf} = 0, \tag{46}$$

where (46) is the participation constraint of the new investors.

From (46), we know

$$s = \frac{\left(1 - F_R(\frac{I}{s^* C_1})(1 - \lambda_{investor})\right) I}{(\int_{\frac{I}{s^* C_1}}^{\infty} x f_R(x)dx + \lambda_{investor} \int_0^{\frac{I}{s^* C_1}} x f_R(x)dx)C_1}. \tag{47}$$

Denote U^{CEO}_{equity} the maximum of U^{CEO}_{equity} obtained at s. The CEO chooses debt financing, if

$$U^{CEO}_{equity} < U^{CEO}_{debt} \,, \tag{48}$$

namely

$$s^* > \frac{I}{\mathrm{E}[\tilde{R}]C_1}, \tag{49}$$

in conjunction with (47), we have

$$\lambda_{investor} > 1. \tag{50}$$

Thus, the CEO is indifferent between debt or equity financing, when $\lambda_{investor} = 1$. When $\lambda_{investor}$ becomes larger, the CEO chooses debt financing.

Use the implicit function theorem and differentiate both side of $U^{investor}_{equity} = 0$ with respect to $\lambda_{investor}$ to calculate $\frac{\partial s^*}{\partial \lambda_{investor}}$,

$$\frac{\partial}{\partial \lambda_{investor}} \left[\int_{\{s^* \tilde{R} C_1 \geq I\}} (s^* x C_1 - I) f_R(x) dx + \lambda_{investor} \int_{\{s^* \tilde{R} C_1 < I\}} (s^* x C_1 - I) f_R(x) dx \right] = 0. \tag{51}$$

We obtain

$$\frac{\partial s^*}{\partial \lambda_{investor}} = \frac{\int_0^{\frac{I}{s^* C_1}} (I - s^* x C_1) f_R(x) dx}{C_1 \int_{\frac{I}{s^* C_1}}^{\infty} x f_R(x) dx + \lambda_{investor} C_1 \int_0^{\frac{I}{s^* C_1}} x f_R(x) dx}, \tag{52}$$

which is positive. Then,

$$\frac{d(U^{CEO}_{debt} - U^{CEO}_{equity})}{d\lambda_{investor}} = \frac{\partial s^*}{\partial \lambda_{investor}} \mathrm{E}[\tilde{R}] C_1 > 0, \tag{53}$$

because $\lambda_{investor}$ does not affect U^{CEO}_{debt}. The more loss averse new investors are, the more likely the CEO chooses debt financing.