Debt Renegotiation, Default Risk and Risk-Shifting Incentives

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Abstract

This paper addresses the role of debt renegotiation in mitigating firm's risk-shifting incentives, with a particular emphasis on the role of firm's default risk. We challenge the view that highly distressed firms increase more risk relative to their industry pears and show that, allowing high-risk firms to renegotiate their debt obligations decreases their risk-shifting incentives. Our findings indicate that debt renegotiation is more effective in mitigating firm's risk-taking behavior when

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debt renegotiation packages contain modifications to loan amount and maturity.

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1. Introduction

Risk-shifting, also known as asset substitution in the corporate literature, stands for the shareholders' incentives to increase risk at the expense of creditors, after debt is in place. This paper provides empirical evidence that debt renegotiation decreases risk-shifting by mitigating the managerial incentives to take on suboptimal high-risk projects. We find that the effectiveness of debt renegotiation in mitigating such shareholder-creditor conflicts is stronger in high-risk firms than in intermediate- and low-risk ones. We also argue that the effect of debt renegotiation on risk-shifting differs depending on amended loan terms and therefore is more pronounced for debt renegotiation packages involving modifications to loan amount and maturity.

The risk-shifting problem was first studied by Jensen and Meckling (1976), in a context where shareholders-managers take on risky projects to increase the value of equity to the detriment of creditors. The structure of the risk-shifting problem can be better explained using Merton (1974) structural approach that considers firm's equity as a call option on its underlying assets. Given limited liability, the value of equity is a convex and increasing function of the underlying asset value, from which it follows that shareholders have strong incentives to alter the firm risk profile, by increasing firm risk.

Risk-shifting is a principal source of inefficiency with several studies examining possible ways to solve this problem. In particular, the use of secured debt (Smith and Warner, 1979), convertible bonds (Green, 1984) or short-term debt (Myers, 1977; Calomiris and Kahn, 1991; Barclay and Smith, 1995; Leland and Toft, 1996; Larsen, 2006) are only some of the most well-known and well-discussed tools that have been proposed as a solution to the risk-shifting problem. Despite ample theoretical and empirical research proposing approaches to mitigate shareholders' risk-shifting incentives, little evidence exists on the effectiveness of debt renegotiation to mitigate risk-shifting. The theoretical framework of Flor (2011) as well as the empirical study of Favara et al. (2017) provide a first insight into the role of renegotiable debt in reducing the risk-shifting problem.

To address the lack of empirical evidence, this paper studies the risk-shifting problem for both debt renegotiating and non-renegotiating firms. Following Fang and Zhong (2004), we measure risk-shifting incentives by the "industry risk adjustment ratio" ($IRAR$), computed by subtracting the median industry RAR in a given year, determined at the 2-digit SIC code, from the sample firm's RAR. RAR is defined as asset volatility the following year divided by asset volatility the current year. According to the efficient market hypothesis, the value of the firm's assets is fully reflected in stock price, hence we infer the unobservable value and volatility of firm's assets from the observable stock price history. To calculate the implied asset values and volatilities as well as the likelihood of default, we apply the structural approach of Merton (1974) as extended by Moody's KMV Company (Crosbie and Bohn, 2003).

This study combines three databases (Bloomberg, Compustat and CRISP) to obtain firm-specific information on 1,345 U.S. firms that have issued loans with effective dates from January 1999 to December 2017. The final sample includes 16,831 firm-year observations and 30,108 loan amendments between January 1999 and December 2017. The final number of firms consists of 1,141 firms that have renegotiated at least one of their loan obligations during the sample period and 204 firms that have never renegotiated their loan obligations. In addition, we gather detailed data on the type of amended loan terms and the number of renegotiation rounds.

The results from univariate analysis and multivariate Fama-MacBeth (1973) regressions support the hypothesis that debt renegotiation mitigates risk-shifting. In particular, the effect of debt renegotiation on risk-shifting is significantly stronger in highly distressed firms, and this finding is robust to alternative proxies for firm's default risk. We also show that the type of amended loan term is a key determinant of the relationship between debt renegotiation and risk-shifting. We find that loan modifications following renegotiation, that change the loan amount and maturity are the most effective in mitigating risk-shifting.

This study contributes to the existing literature in multiple ways. First, our empirical findings shed light on the relationship between firm's risk-shifting behavior and distress risk. We challenge the well-established view in a large strand of the risk-shifting literature (Vassalou and Xing, 2004; Fang and Zhong, 2004; Eisdorfer, 2008; Kapadia, 2011; among others) that high-risk firms have the tendency to shift more risk relative to their industry peers. In fact, our results indicate that financially distressed firms reverse

their tendency to engage in high-risk projects, when they are given the option to renegotiate their debt.

Second, to our knowledge, this study is the first to use data on loan amendments to directly examine whether debt renegotiating firms engage in risk-taking behavior. Previous related studies assess the effect of debt renegotiation on risk-shifting indirectly through the use of proxy variables. The studies of Favara et al. (2012, 2017), for example, focus on debt renegotiation, using proxies for renegotiation frictions across countries with different debt enforcement mechanisms. Favara et al. (2012) show that equity risk is reduced under the threat of firm's strategic default, while Favara et al. (2017) find that debt renegotiation induces distressed firms to engage in less risky projects.

Finally, we provide the first evidence that the main amended loan terms and more precisely the loan amount and maturity are associated with lower risk shifting. These results suggest that debt renegotiation and amended loan characteristics serve as significant mechanisms to mitigate shareholder-creditor conflicts resulting from risk-shifting.

The rest of the paper is structured as follows. Section 2 presents the model setup, and the measures of risk-shifting and default risk. Section 3 describes the sample selection procedure and summary statistics. Section 4 presents the empirical results and the robustness tests and Section 5 concludes.

2. Model Setup

In line with previous literature (e.g., Brown et al., 2001; Vassalou and Xing, 2004; Fang and Zhong, 2004; Larsen, 2006), this paper considers the uncertainty about the value of the firm's assets as the main determinant of firm's risk. Therefore, shareholders' risk-shifting incentives should be related to an increase in firm's asset value volatility. In the context of the efficient market hypothesis, our analysis adopts the structural model of Merton (1974) and its extension by KMV company (Crosbie and Bohn, 2003) in order to infer the implied value and volatility of the firm's assets from the firm's observable stock price and debt obligations. Similar Merton-model implementations were suggested by Garlappi et al. (2008), Favara et al. (2017) and Alanis et al. (2018) among others in their estimations of firm's default probability. The choice of Merton's structural approach instead of a more sophisticated structural credit risk model is primarily motivated by the study of Forssbæck and Vilhelmsson (2017). In particular, this study compares the performance of the Merton and Leland models (1994a,b) in terms of their ability to predict bankruptcy. The empirical findings show that the standard Merton model, as well as its generalization proposed by Vassalou and Xing (2004) and also adopted by Bharath and Shumway (2008), have superior default prediction power.

Merton's approach assesses the default risk of a firm by modelling the value of the firm's equity as a call option on its assets. In Merton's model, the firm is financed with equity and a zero coupon debt and default occurs only at debt maturity, T. The main assumption of the model is that the firm's asset

value V follows geometric Brownian motion

$$\frac{dV_t}{V_t} = \mu_V dt + \sigma_V dW, \tag{1}$$

where W is a Wiener process, with a constant drift μ_V and volatility σ_V. The equity value E is given by the famous Black–Scholes (1973) formula:

$$E = VN(d_1) - Xe^{-rT}N(d_2), \tag{2}$$

where

$$d_1 = \frac{ln(V/X) + (r + 1/2\sigma_V^2)\,T}{\sigma_V\sqrt{T}},$$

$$d_2 = d_1 - \sigma_V\sqrt{T}$$

and X is the default barrier, r the risk-free interest rate and $N(.)$ the cumulative distribution function of the standard normal distribution. A key difference between the Merton model and its KMV implementation adopted in the current study, is the definition of the default barrier. More precisely, X is the face value of debt in Merton's model, whereas it is the weighted average of short-term and long-term debt in KMV-Merton model.

Following KMV iterative algorithm, we obtain the unknown value and volatility of firm's asset from Equation (2) given the observable market value of equity, the default barrier, the time horizon of the evaluation, and the risk-free borrowing rate. Consistent with previous studies (Vassalou and Xing, 2004; Fang and Zhong, 2004; Bharath and Shumway, 2008) and KMV model, we set the default barrier equal to debt due within one year plus one half of

long term liabilities, and the default horizon equal to one year. Furthermore, one-year T-bill rates at the end of January are served as a proxy for the risk-free interest rate in a given calendar year.

The iterative procedure, described in detail in Crosbie and Bohn (2003), begins by obtaining the initial estimate of asset volatility σ_V, which is calculated as the annualized standard deviation of daily stock returns over the past year. Once initial σ_V is estimated, we calculate the daily asset values V over a one-year period from the Black–Scholes formula (2) given the daily market values of equity E. Next, using the implied asset values, we compute an improved estimate of σ_V, which serves as an initial guess for the next iteration. The same procedure repeats until σ_V converges [1].

With the final daily asset values V in place, we calculate the drift μ_V as the mean of the change in $\ln V$. This serves as input for determining the probability of default, which measures the likelihood over a specified period, here one year, that the asset value V will go bellow the default barrier X. We first calculate the distance to default by the following formula

$$DD = \frac{\ln\left(V_t/X_t\right) + \left(\mu_V - 1/2\sigma_V^2\right)T}{\sigma_V\sqrt{T}} \tag{3}$$

and the default probability at time t is given by

$$p_t = N(-DD) \tag{4}$$

As shown in Vassalou and Xing (2004), p_t does not represent the actual

[1] The convergence tolerance has been set at 1.0E−6.

default probability, but rather a default likelihood indicator (DLI). We adopt this view, and we call our proxy of default risk, DLI instead of p_t.

3. Data and Summary Statistics

We collect loan amendments data from Bloomberg database. We first extract all U.S. loan renegotiations[2] with effective dates from January 1999 to December 2017. This data set contains detailed information about the type of amended loan terms, the number of amended loan terms and the number of renegotiation rounds. Following Godlewski (2017, 2019) we aggregate types of amended loan terms into eight categories, namely, the amount, maturity, pricing, definition, covenants financial, covenants non financial, issue status and loan collateral. We then extract all loans[3] to U.S. borrowers with effective dates over the same period. The specified data set contains unique borrower identifiers (e.g. name, sector, country). This allows us to restrict the sample to include U.S. firms that have issued loans between January 1999 and December 2017. After excluding financial firms and government entities, the sample consists of firms that have renegotiated at least one loan facility during the period of interest and non-renegotiating firms.

We rely on the annual Compustat data files as a source of firm-specific accounting information, whereas the daily CRISP data files are used to extract the firms' market value of equity. At this stage, the size of our sample is significantly reduced due to the company name matching procedure across Bloomberg, Compustat and CRISP databases. This is not always a trivial

[2]Bloomberg function CACT.
[3]Bloomberg function LSRC.

task as the databases do not share common firm identifiers[4] and in many cases the best approach was to manually match the entries by company name.

Consistent with Vassalou and Xing (2004), Fang and Zhong (2004) and others, we compute the default barrier as the sum of debt in current liabilities (debt in one year) and half the long-term debt (debt in more than one year) from Compustat balance sheet data. The whole sample period is from January 1999 to December 2018. Financial data for a given calendar year correspond to the values of the preceding fiscal year. The sample excludes utilities, financial and government entities as well as firms for which we cannot estimate asset volatility in two successive years.

We compute the firms' market capitalization from the CRISP daily data files, by taking the total number of shares outstanding times the stock's closing price. If the closing price of one stock is missing we consider the average of the last bid/ask price for that stock. A firm is included only if it has at least 100 valid stock prices in a given calendar year. We estimate risk-free interest rates, by obtaining one-year T-bill rates from the Federal Reserve Statistical Release.

Applying all previously described criteria results in an unbalanced panel data that includes 16,831 firm-year observations. The final sample consists of 1,345 firms from which 1,141 firms have renegotiated at least one of their loan obligations during the sample period, whereas 204 firms have never renegotiated their loan obligations. In particular, our final sample consists of 30,108 loan renegotiations. The data sources and the description of all

[4]Firms in the Bloomberg database are identified by *ticker* and *ISIN*, in the Compustat database by *gvkey* and in the CRISP database by *PERMNO* and *PERMCO*.

variables are reported in Table 1.

Insert Table 1 Here

Figure 1 provides the time distribution of renegotiating firms and renegotiations. Not surprisingly, we find an important increase in the number of renegotiations and, to a lesser extend, in the number of renegotiating firms after the 2008 global financial crisis. Figure 2 illustrates the percentage distribution of amended loan terms. Definition change corresponds to the most amended loan term (29%), followed by amount (22%) and pricing (16%). Changes to maturity, financial and non-financial covenants occur in almost the same percentage (close to 10%), whereas changes to issue status and loan collateral are so rare ($< 1\%$) that can be considered insignificant. Moreover, we find that 73.2% of loans are renegotiated multiple times. This finding is in accordance with Roberts (2015) who shows that 79.5% of renegotiations involve multiple rounds. Figure 3 shows the distribution of renegotiation rounds. Clear from the figure is that first to fifth renegotiation rounds are the most likely to occur, an observation which is in accordance with Roberts (2015) and Godlewski (2017).

Insert Table 2 Here

Panel A of Table 2 reports the sample summary statistics. The Newton–Raphson iterative method was chosen to infer the implied asset value and volatility, whereas the drift was calculated from the final implied asset values. The outliers are fixed by winsorizing the equity volatility σ_E, asset volatility σ_V and drift μ_V at the 1% level. The mean and median equity

volatility is 0.46 and 0.40 respectively, while the mean and median asset volatility is 0.39 and 0.33 respectively. These values are consistent with the values of equity volatility and asset volatility reported in previous studies, particularly the median asset volatility, is very close to the 0.34 reported in Larsen (2006). The average default likelihood indicator is 0.0316 with a median less than 0.0001.

In line with Brown et al. (1996) and Fang and Zhong (2004), we adopt the "risk adjustment ratio" (RAR) as a proxy of firm's risk-taking incentives. This measure is computed as asset volatility the following year divided by asset volatility the current year ($RAR = \sigma_V^{t+1}/\sigma_V^t$). Hence, a ratio greater than 1, is indicative of a firm that has increased its risk. Moreover, according to Fang and Zhong (2004), we consider the "industry risk adjustment ratio" ($IRAR$), calculated by subtracting the median industry RAR in a given year, determined at the 2-digit SIC code, from the sample firm's RAR. Thus, a ratio greater than 0, indicates a firm that has increased its risk compared to the industry peers. The mean of $IRAR$ is 0.0427 and the median of RAR is 0.9726, showing that firms generally do not shift their risk over the period 1999-2017.

Panel B of Table 2 reports the means and medians of equity volatility σ_E, asset volatility σ_V and RAR in each sample year. We observe a significant increase in both equity volatility and asset volatility around the global financial crisis in 2008. Not surprisingly, the mean and median of RAR reached their maximum values, 1.8025 and 1.7490 respectively in 2007, suggesting that firms almost doubled their risk from 2007 to 2008.

Insert Table 3 Here

We expect firms renegotiating their debt obligations to shift less risk (lower RAR) than non-renegotiating firms. To investigate the validity of this hypothesis, each year firms are classified by whether they were renegotiating their debt obligations or not. Panel A of Table 3 shows the distribution of mean and median RAR across the two sample subgroups. The mean value of RAR in each sample year is presented in the first line, whereas the median and number of firms are presented in the second and third line, respectively. Similarly, Panel B of Table 3 shows the distribution of mean and median $IRAR$ in each sample year.

In most years, the mean RAR and $IRAR$ in the debt renegotiating firm group are lower than the mean RAR and $IRAR$ in the non-renegotiating firm group. These findings constitute preliminary evidence for the hypothesis, although the comparison of medians suggests a rather mixed picture. The number of renegotiating firms shows a strong upward trend from 1999 to 2009, rising from only 3 in 1999 to 401 in 2009. The extremely small number of firms that renegotiate their debt obligations in 1999 explains why we have chosen not to extend the sample period prior to 1999.

The key independent variable of multivariate regressions includes a renegotiation dummy variable (DR) equal to 1 if the firm in a given year is under a renegotiation process, and 0 otherwise. We also control for current asset volatility, logarithm of implied asset value used as a proxy for firm size and long-term debt ratio. In further analysis, we consider additional control variables to account for $EBITDA$-*to-total assets* and $Market$-*to-book ratio*.

Insert Table 4 Here

Table 4 provides Spearman rank correlations for the dependent and independent variables. Although there is a moderate correlation (from 0.26 to 0.50) between few variables, none of these correlations, raises concerns. Looking at the main variables of interest, we observe that DR is negatively correlated with both RAR and $IRAR$, indicating preliminary support that non-renegotiating firms increase more risk than debt renegotiating firms.

4. Empirical Results

4.1 Risk-shifting incentives of financially distressed firms

Previous literature (Fang and Zhong, 2004; Larsen, 2006; among others) showed that firms in high financial distress have the tendency to increase their risk more than firms in intermediate or low financial distress. This finding is reasonable since a firm that is close to default is more likely to gamble for resurrection or, in other words, to engage in risk-shifting. However, the position of a firm that has nothing to lose completely changes when debt renegotiation is possible. We argue that the prospect of debt renegotiation moderates firm's risk-shifting incentives, since firm's default risk becomes lower. Thus, we expect the tendency of highly distressed firms to shift risk to be reversed when they are allowed to renegotiate their debt service. According to this perspective, our first hypothesis is:

- H1: *Firms renegotiating their loan obligations will shift less risk (lower*

RAR) than non-renegotiating firms, and this effect will be more pronounced for firms in the highest default risk group.

Insert Table 5 Here

To investigate the validity of this hypothesis, each year from 1999 to 2017, we classify firms into default risk deciles using the default likelihood indicator (DLI) computed from Equation (4). High-risk firms are those in the upper default risk decile. Table 5 reports characteristic differences between high-risk firms renegotiating their debt obligations and non-renegotiating firms. *Size* is the natural logarithm of the sum of market value of equity and book value of debt. *Debt ratio* is the ratio of long-term debt to total assets. Not surprisingly, both the mean and median of DLI in the first group are notably higher than their values in the second group. Moreover, the first group has consistently higher mean and median asset volatility. Compared to the non-renegotiating firms, the high-risk firms that renegotiate their loan obligations are considerably smaller firms, as shown by both the implied asset value and firm size measures, with higher debt ratios.

The most interesting finding of Table 5, however, comes from the difference of means and medians in RAR and $IRAR$ between the two groups. Renegotiating firms in the upper default risk decile have mean and median RAR of 0.990 and 0.896, respectively, while the corresponding numbers for non-renegotiating firms are 1.050 and 0.975. Similarly, the mean and median of $IRAR$ in the first group are 0.006 and -0.047 respectively, while their values in the second group are 0.045 and 0. The fact that the differences of means and medians in RAR and $IRAR$ between the two groups are statistically

significant, provides a preliminary support for our first empirical hypothesis.

To further investigate the role of debt renegotiation and default risk in risk-shifting hypothesis, we conduct multivariate Fama-MacBeth (1973) regressions. Consistent with relevant studies (e.g. Fang and Zhong, 2004; Vassalou and Xing, 2004; Larsen, 2006; Favara et al., 2012), we employ the Fama and MacBeth (1973) methodology, correcting the standard errors for serial correlation and heteroscedasticity following the Newey and West (1987) adjustment.

Insert Table 6 Here

Table 6 reports the results of annual cross-sectional regressions, performed on $IRAR$ for the period 1999-2017. $DLI(H)$ explains the differences between firms in the upper default likelihood indicator decile and the remaining firms. Following Fang and Zhong (2004), we control for the current asset volatility, firm size and debt ratio. To measure firm size, we use the natural logarithm of implied asset value inferred from the KMV-Merton approach described in Section 2. According to Garlappi et al. (2008), the use of market value of assets instead of market value of equity as a proxy for the firm's size is fundamental: "this can mitigate the potential bias caused by small equity values of firms close to bankruptcy even though they have a substantial asset base and a diffuse group of debt-holders". In further analysis we follow Favara et al. (2017) and include additional firm-specific control variables to account for firm's growth opportunities ($Market\text{-}to\text{-}book\ ratio$) and profitability ($EBITDA\text{-}to\text{-}total\ assets$).

The results from Table 6 reveal several interesting findings. First, the

coefficient on the renegotiation dummy (DR) in the baseline regression (1) is negative and statistically significant (-0.0244 at the 5% level) and remains negative and statistically significant (-0.0186 at the 5% level) in regression (5) after adding all control variables, confirming the intuition that firms have the tendency to shift less risk when they renegotiate their debt.

Second, to study the role of firm's default risk, we focus on the interaction terms in regressions (2) and (6) caused by the multiplication of high default risk and renegotiation dummies. These terms show the additional change in $IRAR$ when highly distressed firms renegotiate their debt service. The interaction terms in both regressions are all negative and highly significant (at the 1% level).

Third, when we break the sample into high-risk and low-risk samples, the results in models (3) and (4) indicate a stronger negative effect for highly distressed firms (-0.1111 at the 5% level), as predicted in H1. Note that high-risk firms are those in the upper default likelihood indicator decile, while the remaining firms constitute the low-risk sample. After controlling for $EBITDA$-*to-total assets* and $Market$-*to-book ratio* in regression (7), the coefficient on the renegotiation dummy remains negative and statistically significant (-0.1035 at the 5% level).

Turning to the control variables our results confirm the findings of Fang and Zhong (2004) showing a highly significant negative relationship between our risk-shifting measure and firm size. Moreover, in accordance with Fang and Zhong (2004) and Larsen (2006), current asset volatility enters the regressions with a a highly significant negative coefficient. However, we find that the coefficients on debt ratio are insignificant. The remaining results

on our additional control variables show that profitability has a negative and statistically significant sign, whereas firm's growth opportunities have a positive effect on risk-shifting.

4.2 Amended loan terms and risk-shifting incentives

Empirical studies have shown that the breakdown of amended loan characteristics is not homogeneous and renegotiation packages include various amended loan terms. Godlewski (2019) focuses on the design of European renegotiation packages and finds that the main determinants of renegotiated credit agreements are the loan amount and maturity. The empirical findings in previous subsection indicated that debt renegotiation mitigates firms' tendency to shift risk. A reasonable extension of those findings might be to investigate the effect of various amended loan terms on risk-shifting. In particular, we expect that renegotiation packages accounting for the main amended loan characteristics such as the loan amount or maturity, will have a stronger negative effect on the risk-shifting incentive. Based on these arguments, our second hypothesis is:

- H2: *Firms renegotiating their loan obligations will shift less risk (lower RAR) than non-renegotiating firms, and this effect will be more pronounced for firms renegotiating the main amended loan terms, such as the loan amount and maturity.*

Insert Table 7 Here

To examine the validity of this hypothesis, each year between 1999 and 2017, we sort firms according to whether they were renegotiating their debt

obligations or not. In addition, firms are classified according to the type of amended loan terms thus, $DR(AM)$, $DR(DE)$, $DR(MA)$, $DR(PR)$, $DR(CF)$ and $DR(CNF)$ are dummy variables equal to 1, if the firm in a given year is renegotiating the following loan characteristics: amount, definition, maturity, pricing, covenants financial and covenants non financial, respectively. We exclude the categories issue status and loan collateral since their frequency in our sample is negligible.

Table 7 reports the distribution of RAR and $IRAR$ across the aforementioned subgroups. The average mean (median) values of RAR and $IRAR$ are presented in the first (second) line, while the number of firm-years are presented in the third line. The reference group consists of non-renegotiating firms, allowing us to examine whether risk-shifting incentives differ, as we move from the group of non-renegotiating firms to debt renegotiating firms and firms renegotiating specific amended loan terms.

The results confirm the difference in risk-shifting incentives across the described subgroups. Firms renegotiating the loan amount have the minimum average mean and median values of RAR (1.0145 and 0.9763, respectively), while firms renegotiating the loan maturity have the minimum average mean and median values of $IRAR$ (0.0040 and -0.0179, respectively). Thus, firms renegotiating the loan amount or maturity shift less risk relative to their industry peers, confirming our second hypothesis.

Insert Tables 8 & 9 Here

Table 8 shows the results of annual Fama-MacBeth (1973) regressions, conducted on $IRAR$ for the period 1999-2017. The independent variables

include debt renegotiation dummies for the six main categories (amount, definition, maturity, pricing, covenants financial, covenants non-financial) of amended loan terms. Control variables include current asset volatility, logarithm of implied asset value and debt ratio. Regression (1) is the base case, presented in Table 6 and reported here as a reference. With the exception of non-financial covenants, all the coefficients on the renegotiation dummies are negative and significant. In addition, the value of the coefficient on the $DR(MA)$ ($DR(AM)$) is more than (about) two times higher than that of the DR, supporting the second hypothesis.

In Table 9 we additionally control for $EBITDA$-*to-total assets* and $Market$-*to-book ratio* and the results are qualitatively similar. Moreover, the coefficients on the renegotiation dummies $DR(AM)$, $DR(MA)$ and $DR(CF)$ are negative and significant, while the coefficients on $DR(DE)$, $DR(PR)$ and $DR(CNF)$ are insignificant.

4.3 Robustness tests

For robustness, we also measure firm's default risk using firm-specific accounting information. To do so, we rely on two of the best-known indicators of firm's default risk, the Altman's (1968) Z-score and the Ohlson's (1980) O-score. Lower Altman's Z-score and higher Ohlson's O-score values indicate higher risk of financial distress.

Insert Table 10 Here

Table 10 reports Spearman rank correlations for the adopted measures of default risk. The default likelihood indicator is significantly negatively

correlated (-0.5074) with the Altman's Z-score and significantly positively correlated (0.4228) with the Ohlson's O-score. These results are consistent with rank correlation results in Fang and Zhong (2004).

Insert Tables 11 & 12 Here

In Tables 11-12, we perform the same regressions with Table 6 with only difference being the adopted default risk measure. Particularly, in Table 11 we consider the dummy variable $ZSCORE(H)$ that takes the value of 1, if the firm in a given year is in the highest default risk decile, where default risk is measured by the Altman's Z-score. Similarly, in Table 12 we define the dummy variable $OSCORE(H)$ taking the value of 1, if the firm in a given year is in the highest default risk decile, where default risk is measured by the Ohlson's O-score. The regression results presented in both tables verify that our findings are not sensitive to the choice of default risk proxy.

Insert Tables 13, 14 & 15 Here

To be consistent with previous studies (e.g. Fang and Zhong, 2004), we have also used the natural logarithm of the sum of market value of equity and book value of debt as an alternative proxy of firm's size. In Table 13, we present the results supporting the first hypothesis, while in Tables 14-15 we conduct regressions supporting the second hypothesis. The results are robust across all regressions.

5. Conclusion

This paper studies whether allowing firms to renegotiate their debt obligations induces shareholders to shift less risk. Specifically, the current study is concerned with the risk-shifting problem, first introduced by Jensen and Meckling (1976) and the role of debt renegotiation as a possible mitigation mechanism.

Following Vassalou and Xing (2004), we adopt the KMV-Merton approach (Crosbie and Bohn; 2003) to infer the implied asset value and volatility from stock price history and debt structure. This allow us to derive a direct measure of risk-shifting, based on the change in asset volatility between two successive years. We focus on debt renegotiation by extracting 30,108 loan amendments in U.S. with effective dates from January 1999 to December 2017. To examine whether a particular type of amendment is more effective in mitigating the risk-shifting problem, we collect detailed information on the type of amended loan terms.

The research findings provide strong evidence that firm's default risk plays a key role in determining the effect of debt renegotiation on risk-shifting and for this reason, several proxies are used for default risk (default likelihood indicator from Merton's (1974) model, Altman's (1968) Z-score and Ohlson's (1980) O-score). Based on all default risk proxies, the results show that debt renegotiation moderates risk-shifting and this effect is more pronounced for highly distressed firms. In particular, debt renegotiating firms in the highest default risk decile exhibit considerably less risk-shifting than debt renegotiating firms in the rest default risk deciles as well as non-renegotiating

firms.

We also test for whether the effect of debt renegotiation on risk-shifting differs depending on types of amended loan terms during the renegotiation process. The findings indicate that this effect is more pronounced for firms renegotiating the main loan terms, such as the loan amount and maturity.

Overall, this study argues that debt renegotiation has a negative effect on risk-shifting and this effect is stronger for highly distressed firms, and firms with renegotiation packages that involve modifications to loan amount and maturity. The findings are robust to the use of alternative proxies for default risk and firm size, and to the inclusion of additional firm-specific control variables.

This study has a twofold contribution to the risk-shifting literature. First, it challenges the conventional wisdom that firms tend to increase risk when they are close to default, by showing that if high-risk firms are allowed to renegotiate their debt obligations they have lower incentives to risk-shift. Second, to the best of our knowledge, this paper is the first to directly evaluate the risk-shifting behavior of debt renegotiating firms, using a large sample of loan renegotiations rather than proxy variables for assessing the debt renegotiation frictions.

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Figures.

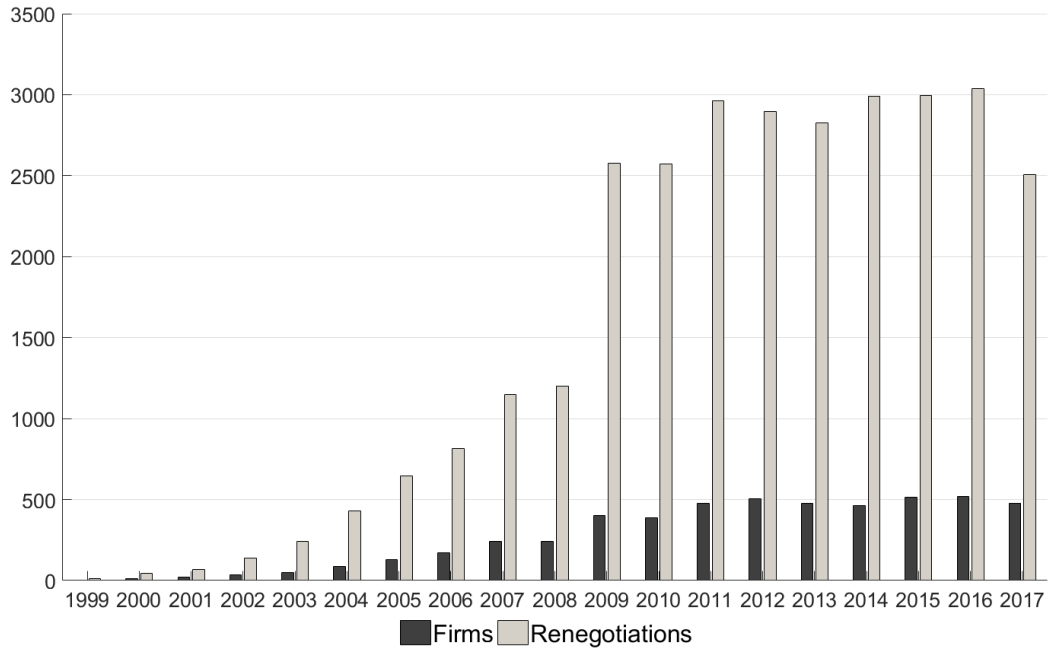

Figure 1. This figure illustrates the distribution of the number of firms that renegotiate their debt obligations and the number of renegotiations by year.

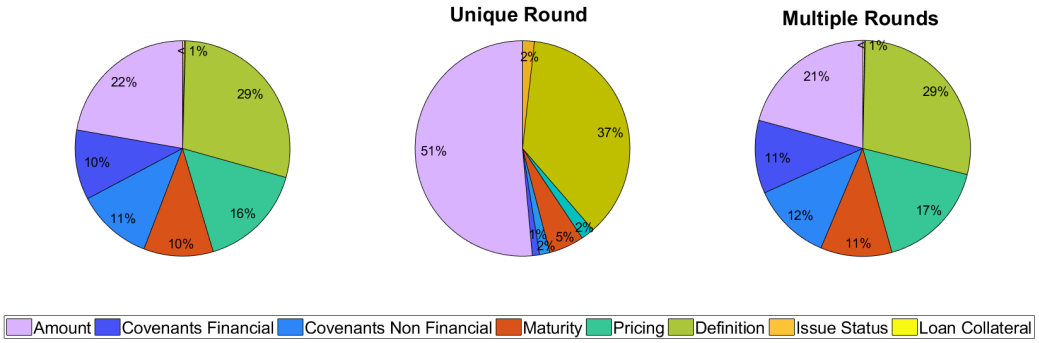

Figure 2. This figure shows the percentage distribution of amended loan terms for the whole sample of loan renegotiations and by renegotiation rounds.

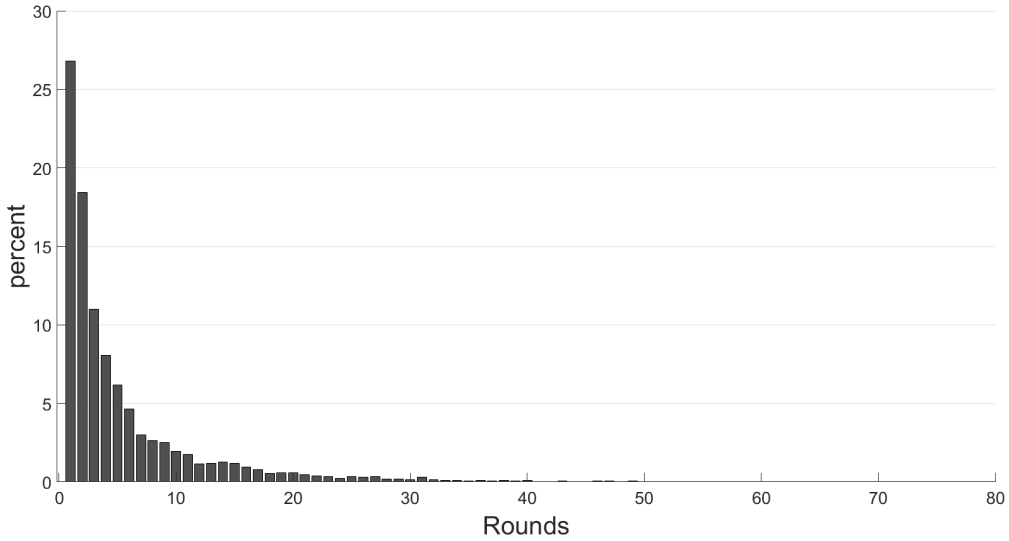

Figure 3. This figure shows the histogram of renegotiation rounds.

Tables.

Table 1. Description of the variables.

Variable	Description	Source
RAR	Risk adjustment ratio: measure of firm's risk-shifting behavior, asset volatility the following year divided by asset volatility the current year ($\sigma_V^{t+1}/\sigma_V^t$).	Compustat/ CRISP
$IRAR$	Industry risk adjustment ratio: measure of firm's risk-shifting behavior, calculated by subtracting the median industry RAR in a given year, determined at the 2-digit SIC code, from the sample firm's RAR.	Compustat/ CRISP
DR	Dummy variable that takes the value of 1, if the firm in a given year is under a renegotiation process and the value of 0 otherwise.	Bloomberg
DLI	Default likelihood indicator based on Merton's (1974) model.	Compustat/ CRISP
$DLI(H)$	Dummy variable that takes the value of 1, if the firm in a given year is in the upper default likelihood indicator decile and the value of 0 otherwise.	Compustat/ CRISP
Current asset vol.	Implied asset volatility inferred from the KMV-Merton approach (Crosbie and Bohn, 2003).	Compustat/ CRISP
$Log(Implied\ asset\ value)$	Natural logarithm of implied asset value inferred from the KMV-Merton approach (Crosbie and Bohn, 2003).	Compustat/ CRISP
Debt ratio	Total long-term debt / Total assets	Compustat
$EBITDA$-*to-total assets*	Ratio of EBITDA to total assets	Compustat
$Market$-*to-book ratio*	(Total assets + market value of equity - book equity) / Total assets	Compustat/ CRISP
$Firm\ size$	Natural logarithm of the sum of market value of equity and book value of debt.	Compustat/ CRISP
$DR(AM)$	Dummy variable that takes the value of 1, if the firm in a given year is under a renegotiation process that modifies the borrowed, borrowing base, tranche, outstanding, facility, line of credit or prepay amount and the value of 0 otherwise.	Bloomberg
$DR(DE)$	Dummy variable that takes the value of 1, if the firm in a given year is under a renegotiation process that modifies the definition of main terms in loan contract and the value of 0 otherwise.	Bloomberg
$DR(MA)$	Dummy variable that takes the value of 1, if the firm in a given year is under a renegotiation process that modifies the loan maturity and the value of 0 otherwise.	Bloomberg

Table 1. Description of the variables. **(continued)**

Variable	Description	Source
$DR(PR)$	Dummy variable that takes the value of 1, if the firm in a given year is under a renegotiation process that modifies the pricing grid or the loan fee and the value of 0 otherwise.	Bloomberg
$DR(CF)$	Dummy variable that takes the value of 1, if the firm in a given year is under a renegotiation process that modifies the financial covenants and the value of 0 otherwise.	Bloomberg
$DR(CNF)$	Dummy variable that takes the value of 1, if the firm in a given year is under a renegotiation process that modifies the non-financial covenants and the value of 0 otherwise.	Bloomberg
Altman's $ZSCORE(H)$	Dummy variable that takes the value of 1, if the firm in a given year is in the upper default risk decile, where default risk is measured by the Altman's (1968) Z-score, and the value of 0 otherwise.	Compustat/ CRISP
Ohlson's $OSCORE(H)$	Dummy variable that takes the value of 1, if the firm in a given year is in the upper default risk decile, where default risk is measured by the Ohlson's (1980) O-score, and the value of 0 otherwise.	Compustat

Table 2. Panel A shows summary statistics of the main variables of interest for the whole sample period (1999 to 2017). DLI denotes the default likelihood indicator, computed from Equation (4). RAR is the measure of firm's risk-shifting incentives, computed as asset volatility the following year divided by asset volatility the current year. $IRAR$ is calculated by subtracting the median industry RAR in a given year, determined at the 2-digit SIC code, from the sample firm's RAR. Panel B shows the means and medians of equity volatility, σ_E, asset volatility, σ_V and RAR in each sample year.

(A) Sample statistics

Variables	NBOS	Mean	Median	Std. dev.	Min	Max
Equity volatility, σ_E	16831	0.4647	0.3966	0.2534	0.1498	1.4971
Implied asset value, V	16831	9248.91	1379.48	30273.45	2.24	679708.74
Asset volatility, σ_V	16831	0.3858	0.3311	0.2071	0.1210	1.2233
Asset drift, μ_V	16831	0.0616	0.0781	0.3986	-1.2504	1.2409
DLI	16831	0.0316	0	0.1314	0	0.9999
RAR	16831	1.0468	0.9726	0.4369	0.0989	9.3226
$IRAR$	16831	0.0427	0	0.3610	-1.4418	8.6099

(B) Means and medians of equity volatility, σ_E, asset volatility, σ_V and RAR in each sample year.

year	NOBS	Mean equity volatility	Mean asset volatility	Mean RAR	Median equity volatility	Median asset volatility	Median RAR
1999	675	0.5540	0.4734	1.1830	0.4768	0.4028	1.1374
2000	708	0.6645	0.5545	0.9137	0.5631	0.4579	0.8841
2001	743	0.5962	0.4960	1.0071	0.5319	0.4225	0.9458
2002	758	0.5749	0.4716	0.8131	0.4874	0.3999	0.7552
2003	759	0.4403	0.3655	0.9900	0.3733	0.3071	0.9325
2004	757	0.3887	0.3408	1.0259	0.3383	0.2975	0.9718
2005	777	0.3720	0.3306	1.0331	0.3303	0.2936	1.000
2006	796	0.3605	0.3229	1.1448	0.3362	0.2999	1.1080
2007	835	0.3975	0.3536	1.8025	0.3710	0.3217	1.7490
2008	889	0.7491	0.6077	0.8342	0.7024	0.5678	0.7799
2009	895	0.6572	0.4970	0.7346	0.5799	0.4560	0.7042
2010	894	0.4207	0.3481	1.2020	0.3890	0.3220	1.1769
2011	940	0.4838	0.4059	0.7903	0.4471	0.3817	0.7371
2012	972	0.3818	0.3174	0.9426	0.3429	0.2824	0.8868
2013	1000	0.3425	0.2886	1.0845	0.2954	0.2504	1.0371
2014	1052	0.3629	0.3100	1.1545	0.3062	0.2663	1.1064
2015	1086	0.4129	0.3376	1.0789	0.3412	0.2892	1.0258
2016	1132	0.4462	0.3502	0.8881	0.3733	0.3051	0.8385
2017	1163	0.3677	0.2980	1.2486	0.3039	0.2554	1.1951
Average	886	0.4723	0.3931	1.0459	0.4153	0.3463	0.9985

Table 3. This table shows the distribution of mean and median risk adjustment ratio (RAR) and industry risk adjustment ratio ($IRAR$) across the two sample subgroups. Each year, firms are classified according to whether they were renegotiating their debt obligations or not. The mean value of RAR ($IRAR$) in each sample year is presented in the first line of Panel A (Panel B), whereas the median and number of firms are presented in the second and third line of Panel A (Panel B), respectively.

(A) Means and medians of RAR in each sample year.

Year	Renegotiation	No-Renegotiation	Year	Renegotiation	No-Renegotiation
1999	1.0949	1.1834	2009	0.7405	0.7298
	1.0264	1.1376		0.6925	0.7099
	3	672		401	494
2000	0.8987	0.9140	2010	1.1567	1.2364
	0.9136	0.8839		1.1372	1.1973
	12	696		386	508
2001	0.9863	1.0076	2011	0.7930	0.7876
	1.0134	0.9448		0.7429	0.7286
	19	724		477	463
2002	0.8080	0.8134	2012	0.9607	0.9230
	0.7501	0.7557		0.8988	0.8768
	34	724		505	467
2003	1.0581	0.9854	2013	1.0904	1.0791
	0.9802	0.9263		1.0465	1.0339
	48	711		475	525
2004	1.0244	1.0261	2014	1.1483	1.1594
	0.9273	0.9789		1.1106	1.1004
	87	670		463	589
2005	1.0131	1.0371	2015	1.0945	1.0649
	1.0182	0.9986		1.0325	1.0216
	130	647		514	572
2006	1.1232	1.1508	2016	0.8602	0.9115
	1.1046	1.1081		0.8220	0.8535
	173	623		517	615
2007	1.7908	1.8072	2017	1.2191	1.2693
	1.7607	1.7379		1.1566	1.2188
	240	595		479	684
2008	0.8387	0.8325	Average	1.0368	1.0483
	0.7958	0.7765		0.9963	0.9994
	240	649	Total	5203	11628

(B) Means and medians of $IRAR$ in each sample year.

Year	Renegotiation	No-Renegotiation
1999	-0.1001	0.0350
	-0.0635	0.0000
	3	672
2000	0.0179	0.0266
	0.0426	0.0000
	12	696
2001	0.0567	0.0549
	0.0694	0.0000
	19	724
2002	0.0506	0.0518
	-0.0159	0.0000
	34	724
2003	0.1239	0.0468
	0.0688	0.0000
	48	711
2004	0.0526	0.0471
	-0.0094	0.0000
	87	670
2005	0.0083	0.0318
	-0.0060	0.0000
	130	647
2006	0.0171	0.0456
	0.0000	0.0000
	173	623
2007	0.0033	0.0273
	0.0039	0.0000
	240	595
2008	0.0477	0.0432
	0.0059	0.0000
	240	649
2009	0.0349	0.0255
	-0.0043	0.0004
	401	494
2010	-0.0234	0.0508
	-0.0279	0.0129
	386	508
2011	0.0578	0.0418
	0.0111	-0.0040
	477	463
2012	0.0593	0.0285
	0.0015	-0.0004
	505	467
2013	0.0340	0.0378
	0.0000	0.0000
	475	525
2014	0.0457	0.0659
	0.0000	0.0000
	463	589
2015	0.0615	0.0387
	0.0000	0.0000
	514	572
2016	0.0384	0.0757
	-0.0036	0.0056
	517	615
2017	0.0230	0.0736
	-0.0223	0.0165
	479	684
Average	0.0321	0.0447
	0.0027	0.0016
Total	5203	11628

Table 4. This table presents Spearman rank correlations between the main variables of interest. Implied asset value and volatility are inferred from the KMV-Merton model. *DR* is a dummy variable equal to 1, if the firm in a given year is under a renegotiation process. *RAR* is the measure of firm's risk-shifting incentives, computed as asset volatility the following year divided by asset volatility the current year. *IRAR* is calculated by subtracting the median industry *RAR* in a given year, determined at the 2-digit SIC code, from the sample firm's *RAR*. *Debt ratio* is the ratio of long-term debt to total assets. *DLI* is the default likelihood indicator, computed from Equation (4). Bold values indicate significance at the 1% and 5% levels.

Variable	1	2	3	4	5	6	7	8	9
1. *RAR*	1.00								
2. *IRAR*	**0.6918**	1.00							
3. *DR*	**-0.0154**	**-0.0163**	1.00						
4. *DLI*	**-0.2604**	**-0.1321**	**0.0466**	1.00					
5. *Current asset volatility*	**-0.3852**	**-0.2592**	**-0.0717**	**0.4906**	1.00				
6. *Log(Implied asset value)*	**0.0288**	0.0009	**0.0425**	**-0.4251**	**-0.5064**	1.00			
7. *Debt ratio*	**0.0309**	**0.0231**	**0.1225**	**0.3350**	**-0.2996**	**0.1679**	1.00		
8. *EBITDA-to-total assets*	-0.0096	-0.0082	**-0.0657**	**-0.2976**	**-0.1927**	**0.2907**	**-0.0366**	1.00	
9. *Market-to-book ratio*	**0.0205**	**-0.0440**	**-0.0868**	**-0.3791**	-0.0046	**0.3454**	**-0.1081**	**0.4122**	1.00

Table 5. This table reports characteristic differences between highly distressed firms that renegotiate their debt service and firms that do not renegotiate their debt obligations. For each year from 1999 through 2017, we use the default likelihood indicator (DLI) of each firm to sort the sample into default risk deciles. High-risk firms are those in the upper default likelihood indicator decile. Implied asset value and volatility are inferred from the KMV-Merton model. DLI denotes the default likelihood indicator, computed from Equation (4). RAR is the measure of firm's risk-shifting incentives, computed as asset volatility the following year divided by asset volatility the current year. $IRAR$ is calculated by subtracting the median industry RAR in a given year, determined at the 2-digit SIC code, from the sample firm's RAR. $Size$ is the natural logarithm of the sum of market value of equity and book value of debt. *Debt ratio* is the ratio of long-term debt to total assets. T-test and Wilcoxon rank-sum test, are adopted to examine whether the means and medians of the two groups differ significantly.

(A) Means of firm's key variables

	$NBOS$	DLI	RAR	$IRAR$	*Asset volatility*	$Size$	*Implied asset value*	*Debt ratio*
High-risk/ Renegotiation	652	0.253	0.990	0.006	0.457	2690.242	1457.727	0.395
No-renegotiation	11628	0.029	1.050	0.045	0.397	9642.375	9324.372	0.212
Difference		0.224	-0.060	-0.039	0.060	-6952.133	-7866.645	0.183
P-value		0	0	0.009	0	0	0	0

(B) Medians of firm's key variables

	$NBOS$	DLI	RAR	$IRAR$	*Asset volatility*	$Size$	*Implied asset value*	*Debt ratio*
High-risk/ Renegotiation	652	0.091	0.896	-0.047	0.403	839.804	459.062	0.354
No-renegotiation	11628	0.000	0.975	0	0.340	1357.264	1284.952	0.185
Difference		0.091	-0.079	-0.047	0.063	-517.460	-825.890	0.169
P-value		0	0	0	0	0	0	0

Table 6. This table reports the results of Fama-MacBeth regressions, performed on $IRAR$. $IRAR$ is calculated by subtracting the median industry RAR in a given year, determined at the 2-digit SIC code, from the sample firm's RAR. RAR is the measure of firm's risk-shifting incentives, computed as asset volatility the following year divided by asset volatility the current year. DR is a dummy variable equal to 1, if the firm in a given year is under a renegotiation process. $DLI(H)$ is a dummy variable that takes the value of 1, if the firm in a given year is in the highest default likelihood indicator decile. DLI denotes the default likelihood indicator, computed from Equation (4). High-risk firms are those in the upper default likelihood indicator decile, while the rest firms constitute the low-risk group. Implied asset value and volatility are inferred from the KMV-Merton model. *Debt ratio* is the ratio of long-term debt to total assets. Additional control variables include *EBITDA-to-total assets* and *Market-to-book ratio*. The t-statistics are corrected for serial correlation and heteroskedasticity according to Newey and West (1987), and are shown in parantheses. ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively.

Independent variable	(1)	(2)	High-risk (3)	Low-risk (4)	(5)	(6)	High-risk (7)	Low-risk (8)
DR	-0.0244**	-0.0120*	-0.1111**	-0.0110	-0.0186**	-0.0054	-0.1035**	-0.0048
	(-2.85)	(-1.82)	(-2.83)	(-1.65)	(-2.27)	(-0.79)	(-2.51)	(-0.70)
$DLI(H)$		0.0447				0.0484*		
		(1.76)				(1.88)		
DR*$DLI(H)$		-0.0893***				-0.0904***		
		(-3.56)				(-3.22)		
Current asset vol.	-0.7344***	-0.7485***	-0.8646***	-0.7228***	-0.8229***	-0.8389***	-0.9723***	-0.8157***
	(-8.06)	(-8.38)	(-15.23)	(-6.65)	(-9.25)	(-9.65)	(-14.50)	(-7.69)
Log(Implied asset value)	-0.0349***	-0.0343***	-0.0669***	-0.0306***	-0.0353***	-0.0347***	-0.0664***	-0.0315***
	(-8.47)	(-8.23)	(-7.42)	(-6.84)	(-9.25)	(-8.90)	(-7.44)	(-7.58)
Debt ratio	-0.0228	-0.0297	-0.0454	-0.0216	-0.0481	-0.0581**	-0.0821	-0.0451
	(-0.71)	(-1.12)	(-0.47)	(-0.75)	(-1.59)	(-2.37)	(-0.74)	(-1.63)
EBITDA-to-total assets					-0.2001***	-0.1985***	-0.3829***	-0.1962***
					(-8.48)	(-8.38)	(-5.84)	(-7.45)
Market-to-book ratio					0.0086***	0.0089***	0.0001	0.0092***
					(3.56)	(3.87)	(0.01)	(4.01)
Intercept	0.5687***	0.5676***	0.8668***	0.5281***	0.6155***	0.6146***	0.9464***	0.5769***
	(11.80)	(11.65)	(10.85)	(8.58)	(13.77)	(13.57)	(10.07)	(10.01)
Avr. Adj. R^2	0.1141	0.1177	0.1767	0.1121	0.1247	0.1283	0.1908	0.1231

Table 7. This table shows the distribution of RAR and $IRAR$ across sample subgroups. RAR is the measure of firm's risk-shifting incentives, computed as asset volatility the following year divided by asset volatility the current year. $IRAR$ is calculated by subtracting the median industry RAR in a given year, determined at the 2-digit SIC code, from the sample firm's RAR. Each year, firms are classified according to whether they were renegotiating their debt obligations or not. DR is a dummy variable equal to 1, if the firm in a given year is under a renegotiation process. In addition, firms are classified according to the type of amended loan terms thus, $DR(AM)$, $DR(DE)$, $DR(MA)$, $DR(PR)$, $DR(CF)$ and $DR(CNF)$ are dummy variables equal to 1, if the firm in a given year is renegotiating the following loan characteristics: amount, definition, maturity, pricing, covenants financial and covenants non financial, respectively. The average mean values of RAR and $IRAR$ across all years are reported in the first line, while the average median and number of firm-years are reported in the second and third line, respectively.

Subgroup	RAR	$IRAR$
DR	1.0368	0.0321
	0.9963	0.0027
	5203	5203
$DR(AM)$	1.0145	0.0159
	0.9763	-0.0113
	2924	2924
$DR(DE)$	1.0367	0.0298
	0.9984	-0.0003
	4136	4136
$DR(MA)$	1.0158	0.0040
	0.9816	-0.0179
	2445	2445
$DR(PR)$	1.0345	0.0374
	1.0039	0.0053
	2273	2273
$DR(CF)$	1.0320	0.0348
	1.0000	-0.0005
	1901	1901
$DR(CNF)$	1.0236	0.0325
	0.9817	-0.0062
	2012	2012
$Non\text{-}renegotiating\ firms$	1.0483	0.0447
	0.9994	0.0016
	11628	11628

Table 8. This table reports the results of Fama-MacBeth regressions, performed on $IRAR$. $IRAR$ is calculated by subtracting the median industry RAR in a given year, determined at the 2-digit SIC code, from the sample firm's RAR. RAR is the measure of firm's risk-shifting incentives, computed as asset volatility the following year divided by asset volatility the current year. DR is a dummy variable equal to 1, if the firm in a given year is under a renegotiation process. $DR(AM)$, $DR(DE)$, $DR(MA)$, $DR(PR)$, $DR(CF)$ and $DR(CNF)$ are dummy variables equal to 1, if the firm in a given year is renegotiating the following loan characteristics: amount, definition, maturity, pricing, covenants financial and covenants non financial, respectively. Implied asset value and volatility are inferred from the KMV-Merton model. *Debt ratio* is the ratio of long-term debt to total assets. The t-statistics are corrected for serial correlation and heteroskedasticity according to Newey and West (1987), and are shown in parantheses. ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively.

Independent Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)
DR	-0.0244**						
	(-2.85)						
$DR(AM)$		-0.0418**					
		(-2.39)					
$DR(DE)$			-0.0225*				
			(-1.99)				
$DR(MA)$				-0.0528**			
				(-2.34)			
$DR(PR)$					-0.0165*		
					(-2.01)		
$DR(CF)$						-0.0218**	
						(-2.81)	
$DR(CNF)$							0.0006
							(0.05)
Current asset vol.	-0.7344***	-0.7320***	-0.7338***	-0.7335***	-0.7334***	-0.7329***	-0.7492***
	(-8.06)	(-8.08)	(-8.08)	(-8.11)	(-8.12)	(-8.11)	(-8.45)
Log(Implied asset value)	-0.0349***	-0.0348***	-0.0349***	-0.0348***	-0.0347***	-0.0348***	-0.0370***
	(-8.47)	(-8.47)	(-8.51)	(-8.43)	(-8.42)	(-8.49)	(-12.00)
Debt ratio	-0.0228	-0.0233	-0.0235	-0.0263	-0.0253	-0.0252	-0.0285
	(-0.71)	(-0.71)	(-0.73)	(-0.81)	(-0.78)	(-0.79)	(-0.83)
Intercept	0.5687***	0.5656***	0.5663***	0.5660***	0.5648***	0.5651***	0.5837***
	(11.80)	(11.93)	(11.81)	(11.88)	(11.96)	(11.86)	(15.03)
Avr. Adj. R^2	0.1141	0.1140	0.1141	0.1135	0.1138	0.1136	0.1160

Table 9. This table reports the results of Fama-MacBeth regressions, performed on $IRAR$. $IRAR$ is calculated by subtracting the median industry RAR in a given year, determined at the 2-digit SIC code, from the sample firm's RAR. RAR is the measure of firm's risk-shifting incentives, computed as asset volatility the following year divided by asset volatility the current year. DR is a dummy variable equal to 1, if the firm in a given year is under a renegotiation process. $DR(AM)$, $DR(DE)$, $DR(MA)$, $DR(PR)$, $DR(CF)$ and $DR(CNF)$ are dummy variables equal to 1, if the firm in a given year is renegotiating the following loan characteristics: amount, definition, maturity, pricing, covenants financial and covenants non financial, respectively. Implied asset value and volatility are inferred from the KMV-Merton model. *Debt ratio* is the ratio of long-term debt to total assets. Additional control variables include *EBITDA-to-total assets* and *Market-to-book ratio*. The t-statistics are corrected for serial correlation and heteroskedasticity according to Newey and West (1987), and are shown in parantheses. ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively.

Independent Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)
DR	-0.0186**						
	(-2.27)						
$DR(AM)$		-0.0354*					
		(-2.11)					
$DR(DE)$			-0.0168				
			(-1.58)				
$DR(MA)$				-0.0484*			
				(-2.11)			
$DR(PR)$					-0.0107		
					(-1.25)		
$DR(CF)$						-0.0168**	
						(-2.35)	
$DR(CNF)$							0.0074
							(0.57)
Current asset vol.	-0.8229***	-0.8209***	-0.8229***	-0.8223***	-0.8226***	-0.8222***	-0.8380***
	(-9.25)	(-9.25)	(-9.28)	(-9.29)	(-9.31)	(-9.28)	(-9.57)
Log(Implied asset value)	-0.0353***	-0.0353***	-0.0354***	-0.0353***	-0.0352***	-0.0353***	-0.0371***
	(-9.25)	(-9.25)	(-9.32)	(-9.21)	(-9.16)	(-9.31)	(-11.29)
Debt ratio	-0.0481	-0.0483	-0.0489	-0.0505	-0.0501	-0.0500	-0.0529
	(-1.59)	(-1.56)	(-1.62)	(-1.64)	(-1.63)	(-1.66)	(-1.64)
EBITDA-to-total assets	-0.2001***	-0.2011***	-0.2009***	-0.2006***	-0.2019***	-0.2019***	-0.2062***
	(-8.48)	(-8.33)	(-8.44)	(-8.42)	(-8.35)	(-8.30)	(-8.23)
Market-to-book ratio	0.0086***	0.0087***	0.0088***	0.0088***	0.0089***	0.0088***	0.0080***
	(3.56)	(3.58)	(3.65)	(3.67)	(3.72)	(3.66)	(3.73)
Intercept	0.6155***	0.6133***	0.6139***	0.6135***	0.6125***	0.6130***	0.6298***
	(13.77)	(13.90)	(13.77)	(13.87)	(13.89)	(13.80)	(16.89)
Avr. Adj. R^2	0.1247	0.1245	0.1247	0.1240	0.1244	0.1242	0.1259

Table 10. Robustness tests. This table presents Spearman rank correlation coefficients for default likelihood indicator, Altman's (1968) Z-score and Ohlson's (1980) O-score. Default likelihood indicator (DLI) is based on Merton's (1974) model and computed from Equation (4). *** indicates a $P - value < 0.001$.

	DLI	*Altman's Z-score*	*Ohlson's O-score*
DLI	1.00		
Altman's Z-score	-0.5074***	1.00	
Ohlson's O-score	0.4228***	-0.5389***	1.00

Table 11. Robustness tests. This table reports the results of Fama-MacBeth regressions, performed on $IRAR$. $IRAR$ is calculated by subtracting the median industry RAR in a given year, determined at the 2-digit SIC code, from the sample firm's RAR. RAR is the measure of firm's risk-shifting incentives, computed as asset volatility the following year divided by asset volatility the current year. DR is a dummy variable equal to 1, if the firm in a given year is under a renegotiation process. $ZSCORE(H)$ is a dummy variable that takes the value of 1, if the firm in a given year is in the highest default risk decile, where default risk is measured by the Altman's (1968) Z-score. High-risk firms are those in the upper default risk decile, while the rest firms constitute the low-risk group. Implied asset value and volatility are inferred from the KMV-Merton model. *Debt ratio* is the ratio of long-term debt to total assets. Additional control variables include *EBITDA-to-total assets* and *Market-to-book ratio*. The t-statistics are corrected for serial correlation and heteroskedasticity according to Newey and West (1987), and are shown in parantheses. ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively.

Independent Variable	(1)	High-risk (2)	Low-risk (3)	(4)	High-risk (5)	Low-risk (6)
DR	-0.0169*	-0.0913***	-0.0164*	-0.0122	-0.0865**	-0.0115
	(-2.05)	(-3.27)	(-1.95)	(-1.60)	(-3.01)	(-1.44)
ZSCORE(H)	0.0940***			0.0718***		
	(5.65)			(4.86)		
*DR*ZSCORE(H)*	-0.0645***			-0.0559**		
	(-3.23)			(-2.93)		
Current asset vol.	-0.7553***	-0.7913***	-0.7544***	-0.8304***	-0.9174***	-0.8308***
	(-8.15)	(-10.03)	(-7.48)	(-9.30)	(-10.93)	(-8.44)
Log(Implied asset value)	-0.0336***	-0.0495***	-0.0320***	-0.0349***	-0.0492***	-0.0335***
	(-8.04)	(-3.85)	(-7.49)	(-9.01)	(-3.61)	(-8.48)
Debt ratio	-0.0786**	-0.0521	-0.0828**	-0.0865**	-0.1314	-0.0765**
	(-2.28)	(-0.85)	(-2.55)	(-2.71)	(-1.45)	(-2.49)
EBITDA-to-total assets				-0.1709***	-0.2002***	-0.2273***
				(-8.24)	(-7.08)	(-6.17)
Market-to-book ratio				0.0097***	0.0154	0.0121***
				(4.10)	(0.99)	(4.90)
Intercept	0.5692***	0.7689***	0.5572***	0.6107***	0.8311***	0.5992***
	(11.74)	(6.74)	(10.05)	(13.57)	(6.55)	(11.51)
Avr. Adj. R^2	0.1188	0.0941	0.1296	0.1273	0.0966	0.1393

Table 12. Robustness tests. This table reports the results of Fama-MacBeth regressions, performed on $IRAR$. $IRAR$ is calculated by subtracting the median industry RAR in a given year, determined at the 2-digit SIC code, from the sample firm's RAR. RAR is the measure of firm's risk-shifting incentives, computed as asset volatility the following year divided by asset volatility the current year. DR is a dummy variable equal to 1, if the firm in a given year is under a renegotiation process. $OSCORE(H)$ is a dummy variable that takes the value of 1, if the firm in a given year is in the highest default risk decile, where default risk is measured by the Ohlson's (1980) O-score. High-risk firms are those in the upper default risk decile, while the rest firms constitute the low-risk group. Implied asset value and volatility are inferred from the KMV-Merton model. *Debt ratio* is the ratio of long-term debt to total assets. Additional control variables include *EBITDA-to-total assets* and *Market-to-book ratio*. The t-statistics are corrected for serial correlation and heteroskedasticity according to Newey and West (1987), and are shown in parantheses. ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively.

Independent		High-risk	Low-risk		High-risk	Low-risk
Variable	(1)	(2)	(3)	(4)	(5)	(6)
DR	-0.0073	-0.1049**	-0.0120	-0.0049	-0.1036**	-0.0086
	(-0.93)	(-2.90)	(-1.37)	(-0.59)	(-2.77)	(-0.94)
OSCORE(H)	0.1307***			0.1012***		
	(7.24)			(5.46)		
*DR*OSCORE(H)*	-0.0735***			-0.0584**		
	(-3.47)			(-2.53)		
Current asset vol.	-0.7962***	-0.8464***	-0.7827***	-0.8579***	-0.9667***	-0.8576***
	(-8.77)	(-11.17)	(-7.28)	(-9.81)	(-10.95)	(-8.47)
Log(Implied asset value)	-0.0336***	-0.0652***	-0.0294***	-0.0341***	-0.0669***	-0.0305***
	(-10.18)	(-7.12)	(-7.24)	(-10.02)	(-7.00)	(-8.69)
Debt ratio	-0.0806**	0.0248	-0.1116***	-0.0862**	0.0097	-0.1088***
	(-2.35)	(0.43)	(-4.03)	(-2.67)	(0.16)	(-3.91)
EBITDA-to-total assets				-0.1702***	-0.1326***	-0.3189***
				(-8.31)	(-5.77)	(-12.24)
Market-to-book ratio				0.0057**	0.0072	0.0143***
				(2.44)	(1.35)	(4.35)
Intercept	0.5797***	0.8885***	0.5505***	0.6184***	0.9418***	0.5996***
	(14.38)	(9.84)	(10.42)	(16.02)	(9.40)	(12.77)
Avr. Adj. R^2	0.1265	0.1418	0.1244	0.1330	0.1445	0.1349

Table 13. Robustness tests. This table reports the results of Fama-MacBeth regressions, performed on $IRAR$. $IRAR$ is calculated by subtracting the median industry RAR in a given year, determined at the 2-digit SIC code, from the sample firm's RAR. RAR is the measure of firm's risk-shifting incentives, computed as asset volatility the following year divided by asset volatility the current year. DR is a dummy variable equal to 1, if the firm in a given year is under a renegotiation process. $DLI(H)$ is a dummy variable that takes the value of 1, if the firm in a given year is in the highest default likelihood indicator decile. DLI denotes the default likelihood indicator, computed from Equation (4). High-risk firms are those in the upper default likelihood indicator decile, while the rest firms constitute the low-risk group. Implied asset volatility is inferred from the KMV-Merton model. *Size* is the natural logarithm of the sum of market value of equity and book value of debt. *Debt ratio* is the ratio of long-term debt to total assets. Additional control variables include *EBITDA-to-total assets* and *Market-to-book ratio*. The t-statistics are corrected for serial correlation and heteroskedasticity according to Newey and West (1987), and are shown in parantheses. ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively.

Independent			High-risk	Low-risk			High-risk	Low-risk
Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
DR	-0.0243**	-0.0117	-0.1118**	-0.0107	-0.0185*	-0.0050	-0.1026**	-0.0043
	(-2.62)	(-1.76)	(-2.86)	(-1.58)	(-2.09)	(-0.72)	(-2.52)	(-0.61)
$DLI(H)$		0.0654**				0.0699**		
		(2.53)				(2.70)		
DR*$DLI(H)$		-0.0917***				-0.0931***		
		(-3.52)				(-3.16)		
Current asset vol.	-0.7443***	-0.7697***	-0.8616***	-0.7497***	-0.8330***	-0.8622***	-0.9782***	-0.8456***
	(-7.81)	(-8.25)	(-14.12)	(-6.57)	(-9.01)	(-9.57)	(-13.98)	(-7.61)
Size	-0.0362***	-0.0357***	-0.0633***	-0.0322***	-0.0367***	-0.0364***	-0.0636***	-0.0334***
	(-9.39)	(-9.11)	(-6.87)	(-7.44)	(-10.16)	(-9.81)	(-8.42)	(-7.58)
Debt ratio	-0.0098	-0.0271	-0.0562	-0.0190	-0.0343	-0.0553*	-0.0996	-0.0420
	(-0.30)	(-1.00)	(-0.60)	(-0.65)	(-1.13)	(-2.18)	(-0.93)	(-1.49)
EBITDA-to-total assets					-0.2015***	-0.1977***	-0.3827***	-0.1963***
					(-8.50)	(-8.28)	(-6.01)	(-7.31)
Market-to-book ratio					0.0087***	0.0098***	0.0060	0.0100***
					(3.20)	(3.82)	(0.35)	(3.92)
Intercept	0.5799***	0.5838***	0.8849***	0.5477***	0.6266***	0.6317***	0.9681***	0.5980***
	(11.82)	(11.95)	(10.35)	(8.62)	(13.75)	(13.92)	(9.61)	(10.13)
Avr. Adj. R^2	0.1136	0.1181	0.1750	0.1118	0.1247	0.1293	0.1900	0.1235

Table 14. Robustness tests. This table reports the results of Fama-MacBeth regressions, performed on $IRAR$. $IRAR$ is calculated by subtracting the median industry RAR in a given year, determined at the 2-digit SIC code, from the sample firm's RAR. RAR is the measure of firm's risk-shifting incentives, computed as asset volatility the following year divided by asset volatility the current year. DR is a dummy variable equal to 1, if the firm in a given year is under a renegotiation process. $DR(AM)$, $DR(DE)$, $DR(MA)$, $DR(PR)$, $DR(CF)$ and $DR(CNF)$ are dummy variables equal to 1, if the firm in a given year is renegotiating the following loan characteristics: amount, definition, maturity, pricing, covenants financial and covenants non financial, respectively. Implied asset volatility is inferred from the KMV-Merton model. *Size* is the natural logarithm of the sum of market value of equity and book value of debt. *Debt ratio* is the ratio of long-term debt to total assets. The t-statistics are corrected for serial correlation and heteroskedasticity according to Newey and West (1987), and are shown in parantheses. ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively.

Independent Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)
DR	-0.0243**						
	(-2.62)						
$DR(AM)$		-0.0429**					
		(-2.37)					
$DR(DE)$			-0.0223*				
			(-1.89)				
$DR(MA)$				-0.0549**			
				(-2.29)			
$DR(PR)$					-0.0158*		
					(-1.84)		
$DR(CF)$						-0.0204**	
						(-2.67)	
$DR(CNF)$							0.0006
							(0.05)
Current asset vol.	-0.7443***	-0.7420***	-0.7437***	-0.7435***	-0.7434***	-0.7428***	-0.7576***
	(-7.81)	(-7.83)	(-7.83)	(-7.85)	(-7.87)	(-7.86)	(-8.07)
Size	-0.0362***	-0.0361***	-0.0362***	-0.0361***	-0.0360***	-0.0361***	-0.0378***
	(-9.39)	(-9.42)	(-9.46)	(-9.35)	(-9.36)	(-9.43)	(-11.76)
Debt ratio	-0.0098	-0.0103	-0.0105	-0.0132	-0.0122	-0.0122	-0.0146
	(-0.30)	(-0.31)	(-0.32)	(-0.40)	(-0.38)	(-0.38)	(-0.42)
Intercept	0.5799***	0.5773***	0.5776***	0.5777***	0.5762***	0.5761***	0.5909***
	(11.82)	(11.96)	(11.85)	(11.91)	(12.01)	(11.91)	(13.66)
Avr. Adj. R^2	0.1136	0.1134	0.1135	0.1129	0.1133	0.1129	0.1153

Table 15. Robustness tests. This table reports the results of Fama-MacBeth regressions, performed on $IRAR$. $IRAR$ is calculated by subtracting the median industry RAR in a given year, determined at the 2-digit SIC code, from the sample firm's RAR. RAR is the measure of firm's risk-shifting incentives, computed as asset volatility the following year divided by asset volatility the current year. DR is a dummy variable equal to 1, if the firm in a given year is under a renegotiation process. $DR(AM)$, $DR(DE)$, $DR(MA)$, $DR(PR)$, $DR(CF)$ and $DR(CNF)$ are dummy variables equal to 1, if the firm in a given year is renegotiating the following loan characteristics: amount, definition, maturity, pricing, covenants financial and covenants non financial, respectively. Implied asset volatility is inferred from the KMV-Merton model. *Size* is the natural logarithm of the sum of market value of equity and book value of debt. *Debt ratio* is the ratio of long-term debt to total assets. Additional control variables include *EBITDA-to-total assets* and *Market-to-book ratio*. The t-statistics are corrected for serial correlation and heteroskedasticity according to Newey and West (1987), and are shown in parantheses. ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively.

Independent Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)
DR	-0.0185*						
	(-2.09)						
DR(AM)		-0.0365*					
		(-2.09)					
DR(DE)			-0.0165				
			(-1.50)				
DR(MA)				-0.0504*			
				(-2.08)			
DR(PR)					-0.0101		
					(-1.14)		
DR(CF)						-0.0152**	
						(-2.19)	
DR(CNF)							0.0073
							(0.59)
Current asset vol.	-0.8330***	-0.8310***	-0.8330***	-0.8324***	-0.8326***	-0.8323***	-0.8458***
	(-9.01)	(-9.00)	(-9.03)	(-9.04)	(-9.06)	(-9.04)	(-9.16)
Size	-0.0367***	-0.0366***	-0.0367***	-0.0366***	-0.0365***	-0.0366***	-0.0377***
	(-10.16)	(-10.16)	(-10.27)	(-10.08)	(-10.07)	(-10.24)	(-10.94)
Debt ratio	-0.0343	-0.0345	-0.0351	-0.0365	-0.0363	-0.0363	-0.0389
	(-1.13)	(-1.11)	(-1.16)	(-1.18)	(-1.17)	(-1.20)	(-1.20)
EBITDA-to-total assets	-0.2015***	-0.2025***	-0.2023***	-0.2019***	-0.2032***	-0.2034***	-0.2090***
	(-8.50)	(-8.36)	(-8.45)	(-8.45)	(-8.38)	(-8.32)	(-8.50)
Market-to-book ratio	0.0087***	0.0088***	0.0088***	0.0089***	0.0090***	0.0089***	0.0078***
	(3.20)	(3.20)	(3.27)	(3.29)	(3.34)	(3.29)	(3.42)
Intercept	0.6266***	0.6246***	0.6249***	0.6248***	0.6237***	0.6239***	0.6365***
	(13.75)	(13.90)	(13.79)	(13.86)	(13.92)	(13.82)	(15.31)
Avr. Adj. R^2	0.1247	0.1245	0.1248	0.1241	0.1246	0.1243	0.1256