Debt Renegotiation and Investment Decisions Across Countries*

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Abstract

We show that the prospect of a successful debt renegotiation in default reduces debt overhang and induces shareholders of distressed firms to underinvest less, dismiss less assets, and take on less risk. We identify these effects in the data via the exogeneous variation in debt renegotiation procedures prescribed by bankruptcy codes across 41 countries. Consistent with our theory, we find that the effects of debt renegotiation frictions operate through their interactions with the expected creditors' recovery conditional on default. These effects are large, statistically significant, and point to beneficial ex-post implications of weaker debt enforcement procedures.

Keywords: Debt renegotiation; Debt Overhang; Investment decisions; Asset sales; Risk-taking.

JEL Classification Numbers: D83; G24; G31; G32; G35.

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1. Introduction

A central result in corporate finance theory is that, as a firm approaches financial distress, key corporate decisions such as investment and risk-taking get distorted by conflicts of interests between shareholders and creditors. Notably, the expectation of a low shareholder recovery in distress due to debt overhang leads shareholders to underinvest in positive net present value (NPV) projects or to sell assets in place – the underinvestment effect of Myers (1977) – and to take on too much risk – the risk-shifting effect of Jensen and Meckling (1976). The goal of this paper is to examine whether a bankruptcy code that favors debt renegotiations over asset liquidations mitigates underinvestment and risk-shifting distortions caused by debt overhang and shareholder-debtholder conflicts.

To illustrate the effects of a possible debt renegotiation on corporate choices, we develop a parsimonious, two-period model that endogenizes a levered firm's decisions with respect to investment, asset sales, and risk-taking. The model considers a firm that operates a risky project and has risky, long-term debt outstanding. Management maximizes shareholder value and can make three types of decisions. First, it can increase the scale of the project by investing in new assets. Second, it can reduce the scale of the project by selling assets before debt maturity. Third, it can change the risk of the existing project by engaging in asset substitution.

In this model, we show that debt overhang and risky debt (*i*) reduce the value of new investments to shareholders by truncating their cash flows in default, (*ii*) foster asset sales before debt maturity, and (*iii*) encourage shareholders to increase risk by giving them an option to default. In this model, bankruptcy rules that favor debt renegotiations increase shareholders' expected recovery in default and decrease the convexity of their claims. As a result, debt overhang has muted effects on investment, asset sales, and risk taking incentives.

The main benefit of the model is that all the predictions regarding its three outcome variables relate to the same country- and firm-specific characteristics. Investment, asset sales,

and asset risk all depend on the same provisions in the bankruptcy code that add frictions to a successful renegotiation of debt, and on the degree of firm-specific debt overhang.

To test the predictions of the model, we use a panel of 19,466 firms across 41 countries with heterogeneous bankruptcy codes. The core of our identification strategy consists in exploiting the exogenous variation in the characteristics of the debt renegotiation procedure documented in the survey by Djankov, Hart, McLeish, and Shleifer (DHMS, 2008). The DHMS survey shows that bankruptcy codes vary substantially across countries and that one important source of heterogeneity is the amount of provisions against the renegotiation of debt contracts. In our empirical analysis, we employ the index of debt renegotiation frictions proposed by Favara, Schroth and Valta (2012). This index averages characteristics from the DHMS survey that add frictions to debt renegotiations, and hence provides the main source of cross-country variation of shareholders' expected recovery during financial distress. Our empirical tests relate each outcome variable, i.e. investment, asset sales, and risk-taking, to the interaction between this measure of renegotiation failure and firm-specific measures of debt overhang.

The empirical analysis delivers three main results. First, we find that distressed firms in countries favoring debt renegotiation do not cut back on investment as much as equally debt-overhung firms in countries that limit the scope of debt renegotiation. For instance, relatively distressed firms (i.e., with a default probability larger than 50%) in countries where debt is most likely to be renegotiated have an investment to capital ratio that is 20% larger than otherwise identical firms in countries where debt is least likely to be renegotiated. Second, we find that distressed firms are significantly less likely to sell assets in countries where they expect to successfully renegotiate their debt, and their PPE growth rate is larger by 56% compared to the average distressed firm in a country that limits debt renegotiation. Finally, we find that distressed firms in countries that favor debt renegotiations take 12% less risk, measured by the EBITDA volatility, than their counterparts in countries where

debt renegotiation is difficult.

A further implication of the model is that, holding the bankruptcy code constant, firm-specific characteristics related to shareholders' bargaining position in a debt renegotiation also affect the shareholders' recovery rate and, therefore, have an influence on investment, asset sales and risk-taking. Our model predicts that debt overhang will have weaker effects on investment, asset sales, and risk-taking for firms with higher asset liquidation costs and shareholders' bargaining power in default. Our empirical analysis confirms these predictions, giving further evidence that debt renegotiation and expected shareholder recovery are key determinants of real corporate decisions close to distress.

A series of robustness checks support the main results. First, we show that the results are not an artifact of sample selection of firms across countries. In our international panel, it is possible that differences in debt renegotiation provisions bias the selection of firms in countries with weak debt enforcement towards firms that are unlikely to default. We test our hypotheses using a subsample of firms that are matched across countries based on observable dimensions that are likely to affect investment and risk-taking decisions. Our results are almost identical.

Second, we rule out that the correlation between investment and debt renegotiation frictions is driven by financing constraints, whereby firms invest less because weak enforcement of debt contracts limits the firm's ability to borrow ex ante: We show that the correlation is present even for financially unconstrained firms. Third, we use instrumental variables regressions with the country's statutory tax rate and the firm's initial leverage as instruments for debt overhang to address the concern that the demand and supply for credit, and therefore, the firms' leverage, may be simultaneously determined with investment and risk-taking. Our results continue to hold. Finally, we show that our results are robust to the use of alternative measures of the default probability, implied asset volatility, or conditional creditors' recovery rates.

Overall, our paper makes three contributions. The first contribution is to the literature on the real effects of debt renegotiation. A recent strand of this literature shows that bankruptcy codes with fewer debt renegotiation frictions lead to larger debt reductions and, therefore, reduce equity risk.[1] Consistent with this view, deviations from absolute priority caused by debtor friendly bankruptcy laws have been shown to have important effects on equity returns both in the U.S. (see Garlappi, Shu and Yan (2007), and Hackbarth, Haselmann and Schoenherr (2013)) and outside the U.S. (see Favara, Schroth and Valta (2012)). While these studies assume that asset risk is given and independent of bankruptcy laws, we show that fewer debt renegotiation frictions *reduce* asset risk. Therefore, our analysis suggests that the equity risk effects found in prior studies may not only be due to a leverage effect but also to a risk-shifting effect.

Our paper also contributes to the literature examining the relation between creditor rights and firm decisions. In this literature, stronger creditor rights appear to decrease risk-taking (Acharya, Amihud and Litov (2011)) and innovation (Acharya and Subramanian (2009)). We argue that one reason for the apparent inconsistency between these results and ours is that we do not use an index of creditor rights but rather use an index that is specifically designed to account for frictions in the bankruptcy code that make debt renegotiations less likely. Moreover, we show that the positive effect of debt renegotiation frictions on risk-taking is conditional on the firm being sufficiently close to default.

The paper closest to ours in this literature is the paper by Becker and Stromberg (2012). They show that a strengthening of managerial fiduciary duties to creditors mitigates underinvestment and risk-shifting incentives for a firm near insolvency. In contrast, we find that underinvestment and risk-shifting distortions are mitigated with higher shareholders' (or lower creditors') expected recovery in default. That is, we show that debt overhang distortions can also be resolved by leaving debtors in control while increasing their expected claim on the

[1] See, e.g. Fan and Sundaresan (2000), François and Morellec (2004), or Davydenko and Strebulaev (2007).

assets in renegotiation. Together, these two sets of results show that the bankruptcy code can improve efficiency near insolvency by giving control to whoever (creditors or debtors) expects a higher recovery in bankruptcy.[2]

Finally, our paper relates to the literature on investment and debt overhang. This literature has provided evidence of a negative relation between investment and creditors' expected recovery (see Hennessy (2004), Hennessy, Levy, and Whited (2007), or Alanis and Chava (2013)). We advance this literature in three ways. First, we show that debt renegotiation frictions are an important component of the debt overhang channel and that the strength of the shareholders' bargaining advantage in distress depends on the bankruptcy code. Second, we demonstrate that debt overhang and debt renegotiation failure in default have large effects on other corporate decisions, such as asset sales and risk-taking. Third, we provide international evidence for these effects using a large international cross-section of firms.

The remainder of the paper is organized as follows. Section 2 outlines the model and derives testable predictions. Section 3 describes the data and discusses our measures of renegotiation frictions, corporate investment, asset sales, and risk-taking. Section 4 presents our main empirical results. Section 5 presents robustness tests. Section 6 concludes.

2. Model

In this section, we construct a two-period model that illustrates the interplay between debt renegotiation frictions, shareholder-debtholder conflicts, and corporate investment and risk-taking. This model allows us to derive testable hypotheses that we take to the data in the following sections.

[2]While the strengthening of creditor rights or the increase of the shareholders claims via debt renegotiation have similar positive effects on efficiency once the firm is in distress, it is not clear they have the same effects away from distress. Understanding the ex ante incentives provided by different bankruptcy regimes is beyond the scope of this paper and its predecessors, but remains a crucial goal for future research.

Throughout the model, markets are complete and arbitrage-free, and equilibrium interest rates are zero. There are three dates: $t = 0$, $t = 1$, and $t = 2$. At time $t = 0$, a firm operates assets with unlevered value $v > 0$. The return on these assets is governed by a binomial process, so that in each period the asset value can increase by a factor $z > 1$ with (risk-neutral) probability $p = \frac{1-z^{-1}}{z-z^{-1}}$ or decrease by a factor $z^{-1} < 1$ with probability $(1 - p)$. At time $t = 1$, the firm can increase its assets by a factor θ for a unit price of Θ. Alternatively, it has the option to sell a fraction λ of its assets for that same unit price Θ, in which case the proceeds from the asset sale are stored within the firm (we show in footnote 3 below that our results are robust to relaxing this assumption). At time $t = 2$, and if the firm does not purchase or sell assets at $t = 1$, the firm's assets in place can therefore take three values: $z^2 v$, v, or $z^{-2} v$.

To examine the effects of risky debt and renegotiation frictions on corporate investment and risk-taking, we assume that the firm has zero-coupon debt with face value F, with $z^{-2} v (1 + \theta) < F < z^{-1} v$, due at time $t = 2$. The assumption that $z^{-2} v (1 + \theta) < F$ ensures that default occurs with positive probability, even if investment is undertaken at time $t = 1$. Therefore, debt is risky and corporate decisions will reflect shareholder-debtholder conflicts. The assumption that $F < z^{-1} v$ implies that default only occurs in the lowest node at time $t = 2$ if there are no asset sales at $t = 1$.

We assume that in default a fraction α of asset value is lost. Because liquidation is costly, there exists a surplus associated with renegotiation in default. Following Fan and Sundaresan (2000), Garlappi and Yan (2011), and Favara, Schroth and Valta (2012), we consider that Nash bargaining in renegotiation allows shareholders to get a fraction η of the renegotiation surplus. Finally, to account for renegotiation frictions, we follow Davydenko and Strebulaev (2007) and consider that debt renegotiation can fail with probability f.

We solve the model using backward induction, starting with the effects of risky debt and renegotiation frictions on decisions at time $t = 1$. Consider first asset sales. Provided that

$\Theta \geq 1$, asset sales are always optimal for shareholders in the up node at time $t = 1$ since debt is risk-free in that node and asset sales do not change the value of corporate debt. In the down node, the probability of default is positive absent asset sales and debt is risky. Suppose that asset sales satisfy the condition $(1-\lambda)\, vz^{-2} + \lambda\Theta vz^{-1} > F$. Then, there is no default at time $t = 2$ with the asset sale. In this case, the value of equity with the asset sale in the down node at time $t = 1$ is

$$E_1(vz^{-1}; F) = p\,(v - F) + (1-p)\left(vz^{-2} - F\right) + \lambda\,(\Theta - 1)\, vz^{-1},$$

while the value of equity without the asset sale is

$$E_1(vz^{-1}; F) = p\,(v - F) + (1-p)\,\eta\alpha\,(1-f)\, z^{-2}v.$$

Therefore, shareholders find it optimal to sell a fraction λ of the firm's assets in the down node at time $t = 1$ if the selling price of assets Θ is such that:

$$\underbrace{\lambda\,(\Theta - 1)\, vz^{-1} + (1-p)\left(vz^{-2} - F\right)}_{\text{PV of asset sales to shareholders}} > \underbrace{(1-p)\,\eta\alpha\,(1-f)\, z^{-2}v}_{\text{Expected value in default}}.$$

This inequality shows that, when making decisions with respect to assets sales, shareholders balance the potential surplus they can get by selling the assets and the value they get in default if there is no asset sale. By selling assets and keeping the proceeds from asset sales as cash in the firm, shareholders reduce the risk of corporate debt when the probability of default is positive and transfer wealth to debtholders. As a result, the NPV of the asset sale to shareholders is equal to the NPV of the asset sale to the firm net of the wealth transfer to debtholders in the low cash flow state.

Similarly, because debt is risk-free in the up node at $t = 1$, shareholders always invest in new assets provided that $\Theta < 1$. In the down node, the probability of default is strictly positive and debt is risky. As a result, shareholders find it optimal to invest in the down

node at $t = 1$ if the purchasing price of assets Θ is such that:

$$\underbrace{p\theta v + (1-p)\,\theta\eta\alpha\,(1-f)\,z^{-2}v}_{\text{Benefits from investment}} > \underbrace{\theta z^{-1}v\Theta}_{\text{Cost of investment}}.$$

When making decisions with respect to assets purchases, shareholders balance the potential surplus from investment against the cost of investment. Simple algebraic manipulations of the above relation yield the following result:

Proposition 1 *Shareholders invest in new assets at time $t = 1$ if the unit asset price satisfies*

$$\Theta < 1 - \frac{1-z^{-1}}{z-z^{-1}}\left[1-\eta\alpha\,(1-f)\right] \equiv \Theta^{\max} < 1.$$

Shareholders sell a fraction λ of their assets if the unit asset price at time $t = 1$ satisfies

$$\Theta > 1 + \frac{\eta\alpha\,(1-f)\,vz^{-2} + (F - vz^{-2})}{\lambda v z^{-2}\,(1+z)} \equiv \Theta^{\min} > 1.$$

The equations for $\Theta^{\min}$ and $\Theta^{\max}$ show that since asset sales and purchases lead to wealth transfers to risky debtholders, the net present values of these transactions need to be sufficiently high for shareholders to proceed with these actions. That is, the selling price of assets need to be strictly higher than one while the purchasing price of assets needs to be strictly lower than one. As shown below, the treatment of shareholders in default affects their investment and disinvestment incentives at time $t = 1$, as illustrated by the effects of f, η and α on the cutoff levels $\Theta^{\min}$ and $\Theta^{\max}$. Using the expressions for $\Theta^{\min}$ and $\Theta^{\max}$, we immediately get the following Corollary:

Corollary 1 *Shareholders' incentives to sell assets increase with renegotiation frictions f and decrease with shareholder bargaining power η and liquidation costs α in that $\frac{\partial\Theta^{\min}}{\partial f} < 0$, $\frac{\partial\Theta^{\min}}{\partial\eta} > 0$, and $\frac{\partial\Theta^{\min}}{\partial\alpha} > 0$. Shareholders incentives to invest decrease with f and increase with η and α in that $\frac{\partial\Theta^{\max}}{\partial f} < 0$, $\frac{\partial\Theta^{\max}}{\partial\eta} > 0$, and $\frac{\partial\Theta^{\max}}{\partial\alpha} > 0$.*

Proposition 1 shows that risky debt in the firm's capital structure reduces the benefits of investment to shareholders and leads to underinvestment, a result first uncovered by Myers (1977). Corollary 1 shows that underinvestment depends also on renegotiation frictions: Given two firms with identical assets and liquidation costs, the firm facing more renegotiation frictions ex post should have a lower propensity to invest ex ante.[3] Our results on asset sales provide an additional illustration of the distortions introduced by debt risky in corporate policies. In the model, shareholders' incentives to sell assets are distorted by risky debt because of the value transfer that goes to debtholders in the low cash flow state where the firm is insolvent. This is another form of underinvestment.

The next question we are interested in is that of the effects of debt renegotiation frictions on risk-taking. To address this question, we assume that the price offered to the firm for its assets at time $t = 1$ is a random variable that can take two possible values $\overline{\Theta} > 1 > \underline{\Theta}$ with equal probability, so that the probability of an asset sale or purchase in the absence of conflicts of interest within the firm at time $t = 1$ is $\frac{1}{2}$. When shareholders have the option to sell and purchase assets at time $t = 1$, equity value at time $t = 0$ is given by

$$\begin{aligned} E_0(v;F) &= p^2\left(z^2 v - F\right) + 2p\left(1-p\right)\left(v - F\right) \\ &\quad + \frac{1}{2}\left(1-p\right)^2\left[\eta\alpha\left(1-f\right)z^{-2}v\left(1 + \mathbf{1}_{\{\overline{\Theta}<\Theta^{\min}\}}\right) + \left(z^{-2}v - F\right)\times \mathbf{1}_{\{\overline{\Theta}>\Theta^{min}\}}\right] \\ &\quad + \frac{1}{2}\left[pzv + \left(1-p\right)z^{-1}v\right]\left[\lambda\left(\overline{\Theta} - 1\right)\times \mathbf{1}_{\{\overline{\Theta}>\Theta^{\min}\}} + \theta\left(1-\underline{\Theta}\right)\times \mathbf{1}_{\{\underline{\Theta}<\Theta^{\max}\}}\right]. \end{aligned}$$

This equation reflects the fact that the firm defaults on the debt contract at time $t = 2$ with probability $(1-p)^2$ if the selling price of assets is below $\Theta^{\min}$, which occurs with probability

[3] Alternatively, suppose that shareholders can sell part of the firm's assets at time $t = 1$ and distribute the proceeds as a dividend. They will do so in the down node if

$$\Theta > \frac{\eta\alpha\left(1-f\right)v + z\left(v-F\right)}{v\left(1+z\right)} \equiv \Theta^{\min}.$$

Again, shareholders' incentives to sell assets increase with renegotiation frictions f in that $\frac{\partial\Theta^{\min}}{\partial f} < 0$ and decrease with shareholder bargaining power η and liquidation costs α in that $\frac{\partial\Theta^{\min}}{\partial\eta} > 0$ and $\frac{\partial\Theta^{\min}}{\partial\alpha} > 0$.

$\frac{1}{2}$. In default, outstanding claims are renegotiated. Renegotiation succeeds with probability $1-f$, in which case shareholders appropriate a fraction $\alpha\eta$ of the value of the firm $z^{-2}v$.

Suppose that shareholders can increase risk just after investing in the project (i.e. engage in asset substitution). In the model, an increase in z corresponds to an increase in the possible spread of values for the project and, therefore, in project risk. Using the definition of equity, the fact that the risk-neutral probability of an increase in asset value is $p = \frac{1-z^{-1}}{z-z^{-1}}$, and simple algebraic manipulations, we get that the effect of an increase in z on equity value is:

$$\frac{\partial E_0(v;F)}{\partial z} = \frac{2\left[v\left(1-\eta\alpha\left(1-f\right)\right)+Fz\right]}{\left(1+z\right)^3} > 0,$$

so that:

$$\begin{aligned}
\frac{\partial^2 E_0(v;F)}{\partial z \partial f} &= \frac{2\eta\alpha v}{\left(1+z\right)^3} > 0, \\
\frac{\partial^2 E_0(v;F)}{\partial z \partial \eta} &= \frac{-2v\alpha\left(1-f\right)}{\left(1+z\right)^3} < 0, \\
\frac{\partial^2 E_0(v;F)}{\partial z \partial \alpha} &= \frac{-v\eta\left(1-f\right)}{\left(1+z\right)^3} < 0.
\end{aligned}$$

The following Proposition summarizes our results on the effects of renegotiation frictions and shareholder-debtholder conflicts on risk-taking:

Proposition 2 *Shareholders' have incentives to increase risk after debt has been issued in that* $\frac{\partial E_0(v;F)}{\partial z} > 0$. *Shareholders risk-taking incentives increase with renegotiation frictions* f *and decrease with shareholders' bargaining power in default* η *and liquidation costs* α *in that* $\frac{\partial^2 E_0(v;F)}{\partial z \partial f} > 0$, $\frac{\partial^2 E_0(v;F)}{\partial z \partial \eta} < 0$, *and* $\frac{\partial^2 E_0(v;F)}{\partial z \partial \alpha} < 0$.

The above derivations show that shareholders' have incentives to increase risk after debt has been issued, a result first uncovered by Jensen and Meckling (1976). This is simply due to the fact that shareholders own an option to default and that the value of this option

increases with uncertainty.[4] The derivations also show that the propensity to increase risk increases with renegotiation frictions. Indeed, by reducing the value of shareholders' claim in default, renegotiation frictions increase the convexity of equity value and make it more attractive for shareholders to increase risk. Conversely, when debt renegotiation is possible in default in that $f < 1$, an increase in shareholders' bargaining power or in default costs increases the payoff to shareholders in default and reduces the convexity of their claim.

Note that in the model, as in all models where shareholders and creditors bargain over the renegotiation surplus, the shareholders' bargaining advantage and the probability of renegotiation failure affect the investment, asset sales, and risk-taking incentives via the same term, i.e., the expected payoff in the down node. Therefore, the model not only has testable implications about the unconditional effects of α, η, and f, but also about the interaction between these parameters. Before turning to the empirical analysis, where we develop the model's empirical implications, we summarize below our testable hypothesis:

HYPOTHESIS 1: *Corporate investment decreases with renegotiation frictions in default f and increases with shareholders' bargaining power in default η and liquidation costs α.*

HYPOTHESIS 2: *Assets sales increase with renegotiation frictions in default f and decrease with shareholders' bargaining power in default η and liquidation costs α.*

[4]It is easy to see that shareholders' risk-taking incentives increase with default risk. For example, shortening the maturity of corporate debt to $t = 1$ increases the default probability from $(1-p)^2$ to $1-p$ and chages equity value to $E_0(v; F, 1) = p(vz - F) + (1-p)\eta\alpha(1-f)z^{-1}v$ (even though book leverage is held constant at F/v). We then have

$$\frac{\partial E_0(v; F, 1)}{\partial z} - \frac{\partial E_0(v; F)}{\partial z} = \frac{vz(1 - \eta\alpha(1-f)) + F}{(1+z)^3} > 0,$$

showing that risk-shifting incentives increase with the probability of default. Similarly, changing the debt contract to increase its face value from $F < v$ to $F + \Delta F > v$ (while keeping the maturity at $t = 2$) also leads to an increase in default risk and in risk-taking incentives.

HYPOTHESIS 3: *Corporate risk-taking increases with renegotiation frictions in default f and decreases with shareholders' bargaining power in default η and liquidation costs α.*

3. Data and empirical method

3.1. Data

Our data include all the countries in the Worldscope data base whose bankruptcy code is described in the Djankov, Hart, McLeish, and Shleifer (DHMS, 2008) survey. The sample covers 41 countries for the period 1993-2010. We collect accounting data in U.S. Dollars from Worldscope and stock price data in U.S. Dollars from CRSP (for U.S. firms) and Datastream (for the rest of the world).

Our panel is unbalanced because we do not require that the firms exist for the whole sample period. We exclude financial services firms (first SIC code digit equal to six), utility firms (first two SIC code digits equal to 49), and government related firms (first SIC code digit equal to 9). We also drop firm-years with negative or zero total assets or sales, and firm-years for which the (absolute value of) negative EBITDA is larger than total assets, as in Bris, Koskinen, and Nilsson (2009).[5] We winsorize the variables in our sample at the 1st and 99th percentile to minimize the effects of outliers or coding errors in Worldscope. The final sample consists of 19,466 firms.

Data on debt renegotiation frictions come from the DHMS survey. We collect other country-level variables, such as the origin of the legal system (see La Porta, López de Silanes, Shleifer, and Vishny (1997)), and data on GDP growth and GDP per capita from the Worldbank. Finally, we obtain average creditors' recovery rates at the three-digit SIC code industry level from Altman and Kishore (1996). Table 1 contains the definitions of the main variables

[5]The results do not depend on this exclusion because it involves very few firm-years.

in our data set.

Insert Table 1 Here

3.1.1. Debt renegotiation frictions

In the model, a high value of f indicates that any attempt by shareholders to renegotiate the debt is likely to fail. Therefore, a higher f reflects a stricter enforcement of debt contracts via provisions in the bankruptcy code that add frictions to a successful debt renegotiation.

We measure renegotiation frictions using the data from the DHMS international survey on debt enforcement procedures. In this survey, attorneys and judges who practice bankruptcy law in 88 countries are asked to describe how an identical case of a firm defaulting on its debt is treated. Based on these responses, DHMS report country-specific measures of the quality of debt enforcement, some of which form the basis of our analysis.

In our empirical analysis, we follow Favara, Schroth and Valta (2012) and define *Renegotiation failure* as the average of several different binary indicators in DHMS. The chosen indicators are those that objectively characterize the debt renegotiation procedure, and include the rights of creditors to seize and sell debt collateral without court approval; to enforce their claims in an out-of-court procedure; to approve the appointment of an insolvency administrator and dismiss it; and to vote directly on the reorganization plan of a defaulting firm. The index also includes information on whether an insolvency procedure cannot be appealed, and whether management is automatically dismissed during the resolution of the insolvency procedure.[6] As a result, this index captures impediments to shareholders' ability to renege on outstanding debt, whether through a formal insolvency procedure or outside of court. By construction, the *Renegotiation failure* index ranges from zero to one: the

[6]The DHMS survey also includes a few other characteristics of the bankruptcy code that do not relate directly to frictions in the debt renegotiation procedure, e.g., expected costs and time to payment.

higher the score, the less likely that shareholders will recover anything in default. A detailed description of the construction of this index can be found in the Appendix.

As in Favara, Schroth and Valta (2012), we have imputed the DHMS survey results from 2005 to all the years in our sample, assuming that the survey captures the essence of each country's approach to insolvency, which is deeply rooted in persistent economical, political, and societal values. Indeed, major changes to each country's bankruptcy code between 1978 and 2004, which are tracked by Djankov, McLiesh, and Shleifer (2007), have been rare. Within our sample, the only instances of changes in the bankruptcy code are in Israel (1995), Russia (1994, 1998, and 2004), Spain (2004), Sweden (1995), and Thailand (1993).[7] Our main results are the same whether we include or exclude these few countries from the sample.[8]

Insert Table 2 Here

Table 2 shows that the average value of the *Renegotiation failure* index in our sample is 0.56, with a standard deviation of 0.24. The bankruptcy codes of common law countries, such as Australia, Great Britain, Hong Kong, New Zealand and Singapore include a large number of provisions that add frictions to the debt renegotiation process. In fact, these countries have the maximum score of one. On the other side of the spectrum, China and Chile score zero. The majority of countries in the sample are concentrated around values of 0.45 and 0.58, including Japan and the US. According to this measure, debt renegotiations are expected to succeed with relatively high probability in countries with a French origin to the legal system, e.g., France, Italy, and the Netherlands. Conversely, debt renegotiations

[7] Japan also changed its bankruptcy code in 2000, but the changes were undone in 2002.

[8] The fact that bankruptcy codes are stable over time for the majority of countries in our sample, and that the few bankruptcy reforms identified by Djankov, McLeish, and Shleifer (2007) occurred close to the beginning of our sample period, imply that there is little time variation to perform a differences-in-differences analysis.

are relatively unlikely in, e.g., Austria, Finland, or Hungary, as well as Thailand or Turkey.

Table 2 also shows that the number of firms varies substantially across countries, with the U.S. and Japanese firms respectively accounting for 19.33% and 16.42% of the sample observations. We show below that the results continue to hold when we exclude both U.S. and Japanese firms from the sample.

3.1.2. Debt overhang

An important determinant of shareholder behavior in the model is the expected creditor recovery in default, or debt overhang. In our empirical analysis, we use the same definition of debt overhang as Hennessy (2004): the dollar value of the expected creditors' recovery conditional on default, normalized by the total value of assets. As in Hennessy (2004), *Overhang* is calculated as the product of leverage (debt-to-assets), the estimated probability of default, and the creditor's expected recovery ratio conditional on default (see also Hennessy, Levy, and Whited (2007) and Alanis and Chava (2012)). To adapt this measure to our international panel of firms, we amend it in two ways. First, whereas Hennessy (2004) uses Moody's default rates implied by the bond's credit rating class, we estimate the default probability based on Bharath and Shumway's (2008) approximation of the Merton distance-to-default. The main reason for this alternative measure of the default probability is the lack of credit rating data for our international sample of firms. Second, the creditors' expected recovery rate is constructed using industry-specific recovery rates for the U.S. only. These industry recovery ratios are then imputed to the rest of countries in our panel on the premise that international differences in recovery rates in the same industry are homogeneous across countries, and only depend on technological characteristics.[9] Table 2 shows that *Overhang* varies significantly both within and across countries.

[9]As a robustness check, we show below that our results obtain also if we omit the US industries' creditor recovery rates from the overhang measure.

3.1.3. Investment, asset sales, and risk-taking

We study the effects of the interaction between debt overhang and renegotiation frictions on three main outcome variables: investment, asset sales, and risk-taking. We measure *Investment* as capital expenditures in year t divided by gross property, plant, and equipment (PPE) in year $t-1$. The average investment rate is rather stable across countries, despite the remarkable heterogeneity in our sample. The average investment rate is 0.12 with a standard deviation of 0.16.

As capital expenditures are truncated at zero, they are not informative about whether the firm is selling or buying assets. Therefore, we use *PPE growth* and *Asset growth* as indicators of asset sales. *PPE growth* is the growth in net PPE from year $t-1$ to year t. *Asset growth* is the growth in total assets from year $t-1$ to year t. Additionally, we follow Atanassov and Kim (2009) and identify asset sales as the years with large negative changes in net PPE or total assets. Specifically, the binary variables *PPE sales* and *Asset sales* equal one if *PPE growth* and *Asset growth* are less than -10%, respectively, and 0 otherwise.[10] The results are robust to alternative cutoff levels (-15% and -20%). Table 2 shows that *PPE sales* exhibits relatively more variation than *Investment*, both within and across countries.

To measure asset risk, we follow John, Litov, and Yeung (2008) and compute the volatility of the ratio of EBITDA to assets over eight years, between years t and $t-7$, requiring at least five available observations. While *EBITDA-to-assets vol* is a widely used measure of asset risk, by construction, it may not immediately capture the risk-taking effects of unexpected shocks to creditors' recovery rates. Therefore, we use two other measures of risk-

[10] Alternative approaches to measure asset sales in the literature include the uses of keyword searches for 'asset', 'sale', and 'divestiture' within 8K filings with the SEC (Lang, Poulsen and Stulz (1995)), reductions in the number of industry segments per firm reported in Compustat (Schlingemann, Stulz and Walkling (2002)), diverstiture data from SDC (Schlingemann, Stulz and Walkling (2002)) and plant-level data (Yang (2008)). The data required to implement these approaches in our international cross-section are unavailable.

taking that are based on market prices of equity and, as a consequence, should incorporate these effects more readily due to their forward-looking nature.[11] Specifically, we follow Bartram, Brown and Stulz (2012) and use the *Equity returns vol*, which equals the annualized standard deviation of weekly stock returns (Friday-to-Friday).[12] Finally, we follow Bharath and Shumway (2008) and compute the *Implied asset vol* as the average of the annual equity and debt volatilities, weighted by the market equity and debt face values.

3.1.4. Other firm and country level controls

We summarize all the other controls used in the analysis in Table 3. For the majority of the variables in the data set, the variation is mostly between rather than within firms. This feature of the data is not surprising for some variables, such as leverage, which are known to have large permanent components (Lemmon, Roberts and Zender (2008)). One notable exception is *Default probability*, which exhibits relatively more within firm variation. As a result, *Overhang* also has a relatively high within firm variation. Another exception are the first-difference variables, such as *PPE growth*, and the assets sales variables.

Insert Table 3 Here

Some of our tests also include firm-specific proxies of shareholders' bargaining power in default. Building on previous literature (e.g. Davydenko and Strebulaev (2007), Garlappi, Shu, and Yan, (2008), Favara, Schroth and Valta (2012)), we use the proportion of non-fixed

[11] As an additional check, we verify that our results hold also if we use up to fourth lead values of the dependent variable, *EBITDA-to-assets vol*$_{t+4}$.

[12] Some stocks in our sample are not frequently traded. Hence, by computing returns based on weekly data, these stocks have zero returns. This could bias downward our volatility estimates. To address this issue, we exclude from the sample all firms with very high proportions of zero stock returns. The current sample uses a cutoff of 90%, but the results are robust to lower cutoff levels. The results are also robust to using returns and volatilities based on daily stock prices.

to total assets (*Intangibility*) and the proportion of shares held by the firm's insiders to total shares outstanding (*Insiders' share*) to proxy for the shareholder's ability to extract rents in default.[13] *Intangibility* is used as a measure of the model's parameter α because the creditors' threat to liquidate the assets becomes weaker as intangible assets are expected to be more heavily discounted. *Insiders' share* proxies for the model's η because holding a larger share increases the insiders' incentives to work in the interest of *all* shareholders and therefore improves their coordination in bargaining with creditors. Following our model, we create the new variable *Shareholders' advantage* as the product of *Intangibility* and *Insiders' share*.

We also control for growth opportunities with the market-to-book ratio (*Market-to-book ratio*), which is the total book value of assets plus market capitalization minus book equity, divided by total assets (Tobin's average Q), and for the available cash flow (*Cash flow-to-capital ratio*) on the account that investment is sensitive to cash flow for firms facing financial constraints. Other control variables include the logarithm of total assets (log(*Total assets*)), the level of *EBITDA-to-assets*, and the proportion of long-term debt, i.e., *LT-debt-to-assets*.

Finally, we use country-level variables to account for additional variation in the countries' legal institutions, creditor rights, and economic growth. Notably, we control for the origin of the country's legal system to control for unobservable characteristics of the insolvency code. The categories for the origins of legal system can be French, German, Scandinavian, Socialist or Common law. The log of *GDP per capita* and *GDP growth* are also included to control for other cyclical factors influencing firms' investment and growth opportunities.

[13]These holdings include shares owned by officers, directors, their immediate families, and shares held in trust by pension programs.

3.2. Empirical method

In the classic debt overhang problem of Myers (1977), shareholders of a levered firm underinvest in positive NPV projects because the value created by new investment is mostly captured by creditors. Hennessy (2004) uses a dynamic investment model with adjustment costs to show that, empirically, the debt overhang effect produces a negative relation between investment rates and the expected creditor recovery in default.

Our model captures the same dependency between investment and creditors' recovery, but makes explicit the link between the creditors' recovery in default and the probability of a successful debt renegotiation. As such, we map the predictions of our model to the following empirical specification for the investment rate of firm i in year $t+1$:

$$\begin{aligned} \textit{Investment}_{i,t+1} = \beta_j + \beta_t + \beta_Q \times \textit{Market-to-book ratio}_{i,t} + \beta_{CF} \times \textit{Cash flow-to-capital}_{i,t} \\ + \beta_O \times \textit{Overhang}_{i,t} + \beta_f \times \textit{Renegotiation failure}_c \\ + \beta_{Of} \times \textit{Overhang}_{i,t} \times \textit{Renegotiation failure}_c + u_{i,t}. \end{aligned} \tag{4}$$

This specification is identical to Hennessy (2004) except for the additional variable *Renegotiation failure*$_c$, which is specific to country c, and its interaction with *Overhang*$_{i,t}$, which is firm-year specific. Our model predicts that β_{Of} is negative. We will estimate the parameters of this regression model using industry ($\beta_j = \beta_{IND}$), country-industry ($\beta_j = \beta_{IND,c}$), industry-year ($\beta_j = \beta_{IND,t}$), or firm fixed effects estimators ($\beta_j = \beta_i$). The parameter β_t captures year fixed effects. Given that β_{Of} is identified using country-firm variation, we compute standard errors adjusted for heteroskedasticity and within error correlation at a higher level of aggregation: country-industry. In additional tests, we show that our results are robust to Erickson and Whited's (2002) higher order GMM estimator, which corrects for measurement error in Tobin's Q.

For PPE or asset growth, we use the same linear specification but replace the dependent

variable in equation (4) by either *PPE growth* or *Asset growth*. That is, we specify

$$\begin{aligned} \textit{PPE growth}_{i,t+1} = \gamma_j + \gamma_t + \gamma_Q \times \textit{Market-to-book ratio}_{i,t} + \gamma_{CF} \times \textit{Cash flow-to-capital}_{i,t} \\ + \gamma_O \times \textit{Overhang}_{i,t} + \gamma_f \times \textit{Renegotiation failure}_c \\ + \gamma_{Of} \times \textit{Overhang}_{i,t} \times \textit{Renegotiation failure}_c + u_{i,t}. \end{aligned} \tag{5}$$

Our model predicts that $\gamma_{Of} < 0$. For PPE sales, we use the following probabilistic model

$$\begin{aligned} Pr[\mathbf{1}_{\{\textit{PPE sale in } t+1?\}} = 1] = \ & \Phi(\delta_Q \times \textit{Market-to-book ratio}_{i,t} + \delta_{CF} \times \textit{Cash flow-to-capital}_{i,t} \\ & + \ \delta_O \times \textit{Overhang}_{i,t} + \delta_R \times \textit{Renegotiation failure}_c \\ & + \ \delta_{Of} \times \textit{Overhang}_{i,t} \times \textit{Renegotiation failure}_c), \end{aligned} \tag{6}$$

where $\Phi(.)$ is the cumulative normal density function and $\mathbf{1}_{\{\text{assets sale in } t+1?\}}$ is an indicator function for either *Asset sales* or *PPE sales*. For this specification, our model predicts that the difference between the probability of an asset sale between otherwise identical firms in countries with different values of f is increasing in *Overhang*.[14]

While the literature testing investment regressions is well developed, there is a paucity of studies that provide guidance to specify risk-taking regression models. We employ the following very parsimonious specification to analyze risk-taking:

$$\begin{aligned} \textit{Risk}_{i,t+1} = \psi_j + \psi_t + \psi_O \times \textit{Overhang}_{i,t} + \psi_R \times \textit{Renegotiation failure}_c \\ + \psi_{Of} \times \textit{Overhang}_{i,t} \times \textit{Renegotiation failure}_c + \text{controls} + \nu_{i,t}, \end{aligned} \tag{7}$$

where the model predicts that firms with higher overhang in countries where debt renegotiations are unlikely would take more risk than firms with equal overhang in countries that favor debt renegotiations, i.e., $\psi_{Of} > 0$.

[14]The signs of the coefficients β_{Of}, γ_{Of}, and ψ_{Of} in the linear specifications (4), (5), and (7), respectively, are sufficient to test our theoretical predictions with respect to f. However, the sign of the coefficient δ_{Of} in the probit specification is not a sufficient test for our predictions. Therefore, we compute the change in the probability of an asset sale with respect to changes in f, implied by the estimates of δ_{Of} conditional on different levels of debt overhang.

Besides time and industry (or industry-country, industry-year, or firm) fixed effects, we include some of the control variables used by the previous literature. We control for the origins of the country's legal system, which has been found to capture large differences in average risk levels across countries by Acharya, Amihud, and Litov (2011). We include firm size to account for risk differences across firms that may simply be due to age differences. Similarly, we control for the country's economic development, the country's log(*GDP per capita*) and *GDP growth*. Further risk-taking tests also include a host of firm-specific controls found in the literature: the *Market-to-book ratio*, the level of *EBITDA-to-assets*, and the proportion of long-term debt, i.e., *LT-debt-to-assets* (see Becker and Stromberg (2012), Eisdorfer (2008) and Gilje (2013)).

3.3. Matching firms across countries

Standard OLS or fixed effects estimates of the models above could be biased by the fact that the selection of firms into each country may not be random. In particular, creditors could anticipate future debt concessions in countries favoring debt renegotiations. Therefore, debt may be too expensive in such countries or credit may be rationed for riskier firms. As a result, the Worldscope sample may be biased towards safer and less financially constrained firms in countries where debt is easily renegotiable, which would bias β_{Of} and γ_{Of} downwards and ψ_{Of} upwards. To address this concern, we re-estimate equations (4), (5), and (7) using a matching procedure. The aim is to identify firms that are similar on observable dimensions that likely affect investment and risk-taking decisions.

We define firms that operate in countries with high debt renegotiation frictions (i.e., with an index of renegotiation failure above the sample median) as 'treated' firms. From the set of non-treated firms, we construct a sample of 'matched' firms that are similar to the treated firms except for the fact they are in countries where the bankruptcy code entails less debt renegotiation frictions. Prior work has documented that corporate risk-taking varies

across industries and with firms' growth opportunities, cash flow, leverage and size (see, e.g., Eisdorfer (2008) or Becker and Stromberg (2012)). Accordingly, in each year, we match treated and non-treated firms that are close to each other on all these dimensions using the Mahalanobis metric, which weights the distance between two firms by the inverse covariance matrix of each matching dimension. This matching procedure ensures that we compare firms with statistically indistinguishable growth opportunities, cash flow, leverage, and firm size, even though they operate under different bankruptcy regimes.[15]

4. Results

This section presents the results of our tests for investment, asset sales, and risk-taking. The next section presents robustness tests.

4.1. Investment

Table 4 presents the main results for corporate investment. Column (1) shows the estimates of a standard Hennessy (2004) investment regression applied to a world wide sample of firms. The results are by and large consistent with Hennessy (2004), except for one expected difference: The R^2 is lower in the international cross section. Otherwise, Tobin's Q is also positively related to investment. The cash flow ratio is also positively related to investment, suggesting that financing constraints affect investment too. Finally, like Henessy's (2004) result for the U.S., the debt overhang measure has a negative effect on investment in the international cross section.

Insert Table 4 Here

Column (2) reports the estimates for the specification (equation (4)) that accounts for cross-country differences in the probability of renegotiation failure. The results are remark-

[15] In a robustness test we also use a propensity score matching estimator and obtain very similar results.

able: the *Overhang* measure has a quantitatively smaller and statistically insignificant effect on investment, whereas its interaction with *Renegotiation failure* has the predicted negative and statistically significant effect. Moreover, *Renegotiation failure* does not affect investment directly, but only via its interaction with the expected market value of debt recovered by creditors. This result validates the use of *Renegotiation failure* as a proxy for renegotiation frictions given that its effect seems to be precisely one of debt overhang.

To evaluate the economic significance of these estimates, we compute the implied difference between the expected investment rates of two firms that are otherwise identical but operate in two countries with different renegotiation frictions. We evaluate the statistic

$$\begin{aligned}\Delta E(Investment) &\equiv E(Investment|f_0,.) - E(Investment|f_1,.) \\ &= \hat{\beta}_{Of} \times \overline{Overhang} \times (f_0 - f_1),\end{aligned}$$

where $(f_0 - f_1)$ denotes the difference in the *Renegotiation failure* index between two selected countries, and $\overline{Overhang}$ denotes a given level of the normalized expected creditors' recovery on debt conditional on renegotiation failure. Table 4 reports this statistic evaluated at the average recovery for firms with a default probability larger than 0.5, and for the comparison between the same such firm in a country where debt renegotiation is very likely ($f_0 = 0$, say Chile or China) vs. very unlikely ($f_1 = 1$, say Australia or Singapore). For column (2), the difference is two percentage points in the investment ratio, i.e., 19% of the average investment ratio among such firms.

Becker and Stromberg (2012) estimate that a 1991 Delaware bankruptcy ruling, which established stronger managerial fiduciary duties towards creditors, increased investment for firms close to insolvency.[16] They interpret this finding as evidence that an earlier transfer of control rights from debtors to creditors mitigates the distortions due to debt overhang. Our results show that keeping shareholders in control, and *increasing* their expected recovery rate on the assets, also mitigates debt overhang. Together, these two sets of results show that

[16] *Credit Lyonnais v. Pathe Communications*, Delaware Civ A 12150. (Del. 1991).

the bankruptcy code can improve efficiency near insolvency by giving control to whoever (creditors or debtors) expects a higher recovery in bankruptcy.

Columns (3), (4), and (5) of Table 4 show the results of using industry, industry-year and country, and firm fixed effects estimators, respectively. These estimators account for the unobservable industry, industry-year and country, or firm-specific differences in investment rates. Hence, controlling for these effects makes it extremely unlikely that the estimated correlation between *Renegotiation failure* and investment is due to other unobservable country differences unrelated to debt overhang. Note, however, that columns (4) and (5) require that the direct effect of *Renegotiation failure* be excluded from the specification, because this measure does not vary within country nor within firm.

Column (6) shows that our results are robust to the use of the matching estimator. The estimates remain virtually unchanged not only for the reported industry fixed effects specification, but also for the unreported OLS or various fixed effects specifications. Remarkably, the matching estimator, which is based on a substantially smaller subsample of firms comparable across countries, provides *quantitatively* similar results.[17]

Finally, our results are robust to correcting for measurement error in Tobin's Q. Using Erickson and Whited's (2002) third-, fourth- and fifth-order GMM estimator, we still identify a negative statistically and economically significant effect of debt renegotiation frictions on investment via the debt overhang channel. The estimates are included in the Appendix.

Overall our results show that, controlling for Tobin's Q and cash flow, investment ratios among the relatively more distressed firms are significantly higher in countries where the

[17]While useful, our matching procedure may also have limitations. It only controls for selection based on observable characteristics. If unobservable differences among firms are correlated with the observable characteristics, the selection into treated and matched firms could be biased. However, the t-statistics for the difference of means of all matching variables in the treated and matched groups, both before and after matching, suggest that our matching procedure successfully homogenizes firm groups.

bankruptcy code favors debt renegotiations over liquidations.

4.2. Asset sales

Given that the distribution of *Investment* is heavily skewed to the right, with a disproportionate amount of observations close to 0, it is remarkable that we are able to identify large differences in investment rates due to differences in *Overhang* and *Renegotiation failure*. In our model, distressed firms in countries with high renegotiation frictions not only cut back on investment but also have the option to sell assets. Given this additional flexibility, and the fact that the actual variable is a growth rate not bounded below by zero, we expect to find larger differences in PPE or asset growth rates due to differences in *Renegotiation failure*.

Insert Table 5 Here

This intuition is confirmed in Table 5, where the dependent variable is either *PPE growth* (all columns except (5)) or *PPE sales* (column (5)). The results using total instead of fixed assets only (*Asset growth* and *Asset sales*) are indentical and therefore not shown. Column (1) shows that, in the international cross-section, PPE growth is negatively correlated with debt overhang without controlling for differences in debt enforcement. Column (2), which includes the interaction between *Overhang* and *Renegotiation failure*, shows that, as predicted by the model, PPE growth is significantly lower for otherwise identical, distressed firms in countries where debt renegotiations are unlikely.

Economically, the growth rate differences in PPE between identical firms in countries with likely vs. unlikely debt renegotiations can be as high as 74% of the average PPE growth rate across all countries. Note too that *Renegotiation failure* does not affect *PPE growth* for firms where creditor recovery is expected to be low. Again, this result provides additional support to our claim that our measure of debt renegotiation frictions does not

capture additional characteristics of bankruptcy laws that may affect firms' decisions away from financial distress. Column (3) and (4) show that the estimated coefficient for *Overhang* is not affected by the inclusion of industry or industry-year and country fixed effects.

Column (5) in Table 5 also shows that the less likely a debt renegotiation, the more likely the firm will be to sell assets as it becomes more distressed. As shown in the table, given comparable levels of overhang, the difference between the probabilities of asset sales by the average firm in countries with $f = 0$ and $f = 1$ is positive. Moreover, this difference is increasing in the level of overhang, from a difference of 10 percentage points for all firms, to 12 percentage points for firms with a default probability exceeding 0.5, and to 14 percentage points for firms with a default probability in excess of 0.75.

Finally, column (6) shows that our results are even stronger if we use the matching estimator. Again, the results hold for all other unreported specifications (OLS, industry-country, industry-year and country, or firm fixed effects).

4.3. Risk-taking

Table 6 shows the estimates of our risk-taking specification in (7). Controlling for firm size, the country's economic development, the origins of the legal system, and either industry-year and country, or firm fixed effects, we find that *Overhang* has a positive and significant effect on the volatility of EBITDA-to-assets (column (1)). Columns (2) to (6) show that the interaction between *Overhang* and *Renegotiation failure* has a positive, relatively larger and statistically significant coefficient, implying that the differences in risk-taking explained by differences in *Overhang* are not merely due to differences in firm-specific leverage or industry-specific recovery, but in fact largely due to the differences in *Renegotiation failure*. Therefore, asset risk is higher for firms in countries that favor liquidations. Moreover, the higher the expected creditors' recovery conditional on renegotiation failure, the larger the

differences in risk across such countries.

Insert Table 6 Here

These results seem at odds with prior literature where stronger creditor rights are associated with lower risk-taking (for example, Acharya, Amihud and Litov (2011)). As argued above, our measure of debt renegotiation failure isolates the effect of a lower expected creditors' recovery in default so that the reduction in risk-taking is due to the reduction in the convexity of the shareholders' claim on the asset once the firm is sufficiently levered. The negative effect of stronger creditor rights on risk-taking showed by the prior literature is more likely to be reflecting the effects of increased creditor control of corporate policies. Section 5 includes additional tests that reconcile these seemingly different findings.

In terms of economic significance, the difference between the average *EBITDA-to-assets vol* of a firm with a default probability higher than 0.5 in a country where *Renegotiation failure* equals one and the *EBITDA-to-assets vol* of an otherwise equal firm in a country where *Renegotiation failure* equals zero ranges between 4% and 12% of the average *EBITDA-to-assets vol*.

Columns (3) to (5) show that our results are not affected by the inclusion of additional firm-specific controls used in the literature. Column (5) shows that these results still obtain after controlling for firm fixed effects. This implies that there is evidence of risk-taking differences *within* the firm. That is, for a given firm in a given country with high renegotiation frictions, asset risk increases with the creditors expected recovery. Therefore, identification in our study is not only provided by the large variation in debt enforcement across countries, but also by the relatively long time series of our panel (18 years).

As with our previous results, the economic results strengthen if we use the matching estimator for the reported fixed effects estimator at the industry level (column (6)), as well as for unreported OLS, industry-year and country, or firm-level effects.

4.4. Shareholders' bargaining advantage

Our tests so far only exploit the variation in bankruptcy procedures across countries in order to identify its effect on corporate investment and risk-taking decisions. But our model also predicts that, in countries where debt is more easily renegotiable, shareholders' decisions are affected by their bargaining advantage in the renegotiation process, which in the model is given by the product of shareholders' bargaining power in default and liquidation costs, η and α, respectively. To test these additional predictions, we augment the specifications in equations (4), (5), and (7) to include the terms

$$\beta_S \times \textit{Shareholders' advantage} + \beta_{SO} \times \textit{Shareholders' advantage} \times \textit{Overhang}_{i,t}$$
$$+ \beta_{Sf} \times \textit{Shareholders' advantage} \times \textit{Renegotiation failure}$$
$$+ \beta_{SOf} \times \textit{Shareholders' advantage} \times \textit{Overhang}_{i,t} \times \textit{Renegotiation failure}_c.$$

Our model predicts that *Overhang* will have weaker effects on investment, asset sales, and risk-taking for firms where the expected creditors' recovery is lower, because liquidation costs are higher or because shareholder bargaining power is higher. That is, we predict that β_{SOf} is positive in the investment and PPE growth regressions, but negative in the risk regressions. The remaining terms are used to check whether the proxies used for the components of the shareholders' advantage, i.e., *Intangibility* and *Insiders' share*, have effects on the dependent variables besides the debt overhang channel.

Table 7 shows the estimates. For all the reported specifications, as well as for unreported ones using various fixed effects estimators, the coefficients of the interactions between *Overhang*, *Renegotiation failure*, and *Shareholders' advantage* have the sign predicted by our model. In all but one case, they are statistically significant to the 99% level. Moreover, as in the previous tests, the coefficient of the interaction between *Overhang* and *Renegotiation failure* remains negative. Further, none of the other interaction terms in the specification, which are not part of our theory but are included to increase the power of our test, have an effect that is either consistent nor significant across specifications. Overall, firm-specific

bargaining variables have an economically significant effect on investment and PPE growth, as judged by the reported changes in either variable given a one-standard deviation change in *Shareholders' advantage*.

Insert Table 7 Here

Alanis and Chava (2012) show, using a Compustat sample of U.S. firms, that similar proxies of shareholder bargaining advantage reduce the sensitivity of investment to the expected creditors' recovery rate. We are unable to confirm their results in our international panel of firms: Controlling for *Renegotiation failure*, the estimated coefficient of the interaction term between *Overhang* and *Shareholders' advantage* has the opposite sign and is not statistically significant in the investment, PPE growth, and risk-taking regressions. Instead, we find that the role of shareholders' bargaining advantage for relatively distressed firms depends on the characteristics of the bankruptcy code as the triple interaction term between *Overhang*, *Shareholders' advantage*, and *Renegotiation failure* reveals.[18]

5. Robustness and other tests

5.1. Endogenous leverage

A potential concern with the inference so far is that our estimates may be biased if debt overhang is not an exogenous variable, as leverage may be jointly determined with investment, asset sales, and risk taking. Indeed, Bae and Goyal (2004) and Qian and Strahan (2007) argue that that credit supply must be higher in countries with stronger creditor rights because

[18]The main difference between Alanis and Chava (2013) and this study is not only that we use an international cross-section but that we use a measure of the shareholders' advantage that depends on shareholders' bargaining power *and* on the assets' liquidation costs. Indeed, most models of debt renegotiation show that the expected creditors' recovery increases with the *product* of α and η (see, for example, Davydenko and Strebulaev (2007), Garlappi, Shu, and Yan (2008), or Favara, Schroth, and Valta (2012)).

syndicated loan prices are lower. This section addresses the potential endogeneity of debt overhang, allowing also for heterogeneity in credit demand.

5.1.1. Financing constraints

The possibility to renegotiate a debt contract ex post may constrain the firm's ability to raise debt in the first place. If creditors limit the supply of credit in anticipation of low recovery rates, then the effects of *Renegotiation failure* on investment and risk-taking could be due to variation in firms' financing constraints across countries, instead of debt overhang.[19]

To address this issue, we estimate the parameters of the regression models for each outcome variable (equations (4), (6), and (7)) in the subsamples of firms that are financially unconstrained, i.e., where the value of a given firm-specific measure of financing constraints is below each country's median value. Our goal is to show that there is an effect of *Overhang* and *Renegotiation failure* for firms that are least likely to be financially constrainted in the first place, so that any correlation cannot be attributed to such channel.

We sort firms using four standard measures of financing constraints: firm size (as in Hadlock and Pierce (2010)), the Whited and Wu (2006) index (WW), the Kaplan and Zingales (1997) index (KZ), and the payout ratio following Almeida, Campello, and Weisbach (2004). For parsimony, we omit the results sorting by the KZ index and the payout ratio, noting that they are consistent with the reported results.

Insert Table 8 Here

[19]Note that if *Renegotiation failure* were capturing credit rationing, i.e., a supply effect, then lower values of *Renegotiation failure* would imply tighter financing constraints and the correlation between investment and *Renegotiation failure* would be positive. Removing this positive bias would produce stronger negative estimates of β_{Of} compared to those shown in Table 4.

The results of these tests are reported in Table 8. Regardless of the sorting criterion, we find that the coefficient of the interaction between *Overhang* and *Renegotiation failure* has the expected sign: the estimates of β_{Of} and γ_{Of} are negative and statistically significant, and of ψ_{Of} are positive and statistically significant.

5.1.2. Intrumental Variables and Debt overhang

A valid instrument should have a significant effect on debt overhang (relevance restriction) and should have no effect on investment and risk-taking other than through debt overhang (exclusion restriction). We use the statutory tax rate at the country level as the main instrument for debt overhang.[20] This tax rate is likely to be a relevant determinant of firms' demand for leverage and thus overhang through the tax shield effect. As a second instrument, we use the firm's initial leverage. Lemmon, Roberts, and Zender (2008) show that, in the cross-section of firms, the variation in leverage is stable over time and largely explained by the initial level of leverage. This instrument captures the predetermined variation in the permanent component of the firms equilibrium leverage. We then include all interaction terms between these two variables and *Renegotiation failure* as instruments for *Overhang* $\times$ *Renegotiation failure*. Table 9 displays the results.

Insert Table 9 Here

Column (1) presents the first stage coefficients. Both the tax rate and initial leverage are positively and significantly related to *Overhang*, supporting the relevance restriction. Columns (2), (3), and (4) present the second stage regression coefficients for investment, PPE growth, and risk-taking, respectively. The results corroborate our previous findings. The coefficient of the interaction term between *Overhang* and *Renegotiation failure* is significantly negative for investment and PPE growth, and significantly positive for risk-taking.

[20]The statutory tax rate is the the rate for the highest bracket of all taxes on corporate income.

Importantly, the economic magnitudes are similar for investment and PPE growth, and slightly larger for risk-taking. Moreover the F-test indicates that our instruments pass the test of weak instruments. Overall, the results using instrumental variable regressions provide further support for the model's predictions and the main results.

Note that creditors could alternatively protect their security using covenants on investment and risk-taking conditional on financial distress. Our empirical findings could be potentially reflecting the exercise of covenants written ex ante in countries where debt is easily renegotiable, as opposed to the shareholders' optimal reaction ex post. But our theory suggests that such covenants would be unnecessary because the expectation of a successful debt renegotiation incentivizes shareholders to take *more* positive NPV projects and choose *less* asset risk anyway. Moreover, if covenants were used effectively as a substitute to shareholder behavior close to distress, then loans would be *more* likely to include covenants in countries where debt would be more likely to be renegotiated. While there is little evidence to date on the use of debt covenants across countries, some preliminary findings point in the opposite direction: Hong, Hung and Zhang (2011) find that loans are less likely to include covenants in countries with weaker contract enforcement.

To summarize, these additional tests and some recent empirical evidence confirm that the effect of debt overhang on our main variables of interest is related to the ability to renegotiate debt, and the shareholders' optimal response, regardless of the firms' capacity to raise external financing or, more generally, to the creditors' actions ex ante.

5.2. Creditor rights and Renegotiation failure

Acharya, Amihud and Litov (2011) argue that risk-taking at the firm level is decreasing in the strength of creditor rights. We find that risk-taking *increases* with debt renegotiation frictions. Given that more debt renegotiation frictions could be interpreted as stronger creditor rights, the two sets of results seem to be contradictory. However, there are two

important differences between the tests conducted in both studies. First, Acharya, Amihud and Litov (2011) estimate the *unconditional* effect of creditor rights whereas this paper estimates the effect of debt renegotiation frictions *conditional* on the distance to default and the expected creditors' recovery in default. Second, our *Renegotiation failure* measure isolates the effects of debt overhang via the creditors' expected recovery channel in default. In contrast, the broader concept of creditor rights used in Acharya, Amihud and Litov (2011) may also include the ability of creditors to influence management *away* from default.

To illustrate the difference between both studies, we re-estimate equation (7), including also the creditor right index of Djankov, McLiesh, and Shleifer (2007) (*Creditor rights*) which Acharya, Amihud and Litov (2011) use in their study and its interaction with *Overhang*.[21] These two variables capture the unconditional effects of creditors rights and the effect conditional on the distance to default and the expected creditors' recovery in default.

Insert Table 10 Here

Columns (1) and (2) of Table 10 report the results. As in Acharya, Amihud, and Litov (2011), the creditor rights index has a negative and statistically significant direct effect on risk-taking. However, the coefficient of the interaction between *Creditor rights* and *Overhang* is not significantly different from zero. Moreover, the interaction between *Overhang* and *Renegotiation failure* continues to have a positive and significant effect on risk-taking. These results suggest that stronger creditor rights reduce risk-taking only when the firm is away

[21]The creditor rights index varies from 0 (weakest creditor rights) to 4 (strongest creditor rights) and aggregates four binary indicators of the powers of secured lenders to (*i*) approve a debtor's filing for reorganization; (*ii*) seize collateral after a reorganization petition is approved; (*iii*) be paid first out of the proceeds of liquidating a bankrupt firm; and (*iv*) replace the incumbent manager with an administrator who runs the business during the reorganization. The creditor rights index of Djankov, McLiesh and Shleifer (2007) is constructed using the actual written bankruptcy laws whereas our *Renegotiation failure* index is based on the data in Djankov, Hart, McLiesh and Shleifer (2008), which depicts the bankruptcy process expected in *the practice* by the expert judges and attorneys.

from default. Moreover, the risk-taking incentives of firms with large debt overhang are best captured by our specific measure of renegotiation failure, as opposed to the more generic measure of ex ante creditor rights.

5.3. Alternative measures of risk

In this section, we verify that our results hold for alternative measures of asset risk. We estimate the relation between risk, *Overhang*, and our *Renegotiation failure* measure in equation (7) using volatility measures based on current equity prices as dependent variables. These measures are more likely to be forward-looking and reflect the changes in the shareholders' expectations about risk-taking. We use the *Equity returns vol*, which equals the annualized standard deviation of weekly stock returns (Friday-to-Friday) and the *Implied assets vol*, which is the average of the annual equity and debt volatilities, weighted by the market equity and debt face values.

The results are shown in columns (3) to (6) of Table 10. The estimated coefficients for the *Equity return vol* or *Implied assets vol* models have the same signs as those for *EBITDA-to-assets vol*. But the economic effects of *Renegotiation failure* on risk-taking appear now much larger than those in Table 6. For equally overhung firms with a default probability over 0.5, the difference in equity volatility between countries with the highest and lowest *Renegotiation failure* indexes is at least 1.3 times the sample mean of equity volatility and the difference in *Implied asset vol* is almost 40% of its sample mean.

The higher sensitivities of equity volatility can be explained by the fact that equity is a levered claim on the firm's assets. Also, as shown by Favara, Schroth, and Valta (2012), *Renegotiation failure* has an additional positive effect via the stock's market beta.

5.4. Other robustness checks

Table 11 shows the results of additional robustness tests. First, we ask whether firms from the U.S. and Japan, which represent a large fraction (30%) of the sampled firms, drive our results. Columns (1), (3) and (5) of Table 11 show the estimates of our benchmark investment, PPE growth and risk-taking regressions, respectively, using a subsample that excludes U.S. and Japanese firms. The results are not at all affected by such exclusion.

Insert Table 11 Here

Columns (2), (4) and (6) use *Overhang_Z*, which is based on an alternative measure of creditors' expected recovery in default. Namely, it replaces the firm default probability based on Bharath and Shumway's (2008) approximation of the Merton distance-to-default model with a firm default probability based on Altman's Z-score. We find that our results do not depend on the way we measure firms' default probabilities.

Insert Table 12 Here

Our measure of *Overhang* is constructed using industry-specific recovery rates for the U.S. which are then imputed to other countries on the account that international differences in recovery rates within the same industry are only due to differences in the bankruptcy code. To check whether this assumption drives our results, we have re-estimated all benchmark specifications for investment, asset sales, and risk-taking excluding the U.S. industry-specific recovery rates from the definition of *Overhang*. This new measure therefore depends only on firm-specific leverage and default probability. The results remain the same (Table 12), suggesting that our estimates are driven mostly by the cross-country variation in the *Renegotiation failure* index.

6. Conclusion

We have shown that the prospect of a successful debt renegotiation induces shareholders to underinvest less, dismiss less assets, and take on less risk. We have identified these effects via the exogeneous variation in debt renegotiation procedures prescribed by the bankruptcy codes across 41 countries. The effects of debt renegotiation frictions operate through their interactions with the expected creditors' recovery conditional on default. The results strongly suggest that the possibility of debt renegotiation decreases the underinvestment and asset substitution distortions caused by debt overhang.

Previous literature has shown that stronger ex ante creditor rights minimize debt overhang distortions. In the present study, these distortions are mitigated via a *weakening* of ex post creditor rights, i.e., allowing for the renegotiation of debt, when firms are sufficiently close to distress. The relative benefits and costs of these two approaches to bankruptcy regulation, and their effects on the ex ante efficiency of investment policy, should be studied in detail in future research.

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Appendix A. Data set

We start with all the countries in the paper by Djankov, Hart, McLiesh, and Shleifer (2008) that are also covered by Worldscope and Datastream. For every firm in each country, we download annual accounting variables, in USD, from Worldscope, and weekly and daily price data, in USD, from Datastream. For U.S. firms, we download price data from CRSP. We match the firm-level data with several country-specific institutional variables that come from the World Bank. We drop some countries because of the low number of observations (Colombia, Czech Republic, Egypt, and Venezuela), and because the institutional variables are not available (India, Pakistan, and Zimbabwe). We end up with a sample of firms from 41 countries, including all OECD, some Latin American, Middle Eastern, and Asian countries.

Appendix B: *Renegotiation failure* index

The construction of the *Renegotiation failure* index follows the paper by Favara, Schroth, and Valta (2012) and is based on the survey data from Djankov, Hart, McLiesh, and Shleifer (2008). The individual data items are available on Andrei Shleifer's web page. The index measures the probability that shareholders fail to force a renegotiation of debt with creditors, and is based on 12 broad categories and 16 individual indicators. Specifically, the index is the average of the following non-missing binary (0 if no, 1 if yes) indicators (variable names in parentheses correspond to the names in the data set for the paper by DHMS (2008)):

1. secured creditors may seize and sell their collateral without court approval (ooc);
2. secured creditors may enforce their security either in or out of court (sumjud);
3. the entire business's assets can be pledged as collateral (floating);
4. an insolvency or liquidation order cannot be appealed at all (apporde, appsal);
5. an insolvency case is suspended until the resolution of the appeal (1-disclai);
6. the firm may enter liquidation without attempting reorganization ((1-attemreo), trigliq);
7. secured creditors may enforce their security upon commencement of the insolvency proceedings ((1-scstay), (1-lawsc));
8. a defaulting firm must cease operations upon commencement of insolvency proceedings (opceas);
9. management does not remain in control of decisions during insolvency proceedings (1-mancont);
10. secured creditors have the right to approve the appointment of the insolvency administrator (whoapp);
11. secured creditors may dismiss the insolvency administrator (dismiss);
12. secured creditors vote directly on the reorganization plan (scvotdir, proofreo).

Table 1
Definitions of variables

Variable name	Variable definition	Source
Investment	Capital expenditures in year t / Gross PPE in year $t-1$	Worldscope
Asset growth	Growth in total assets from year $t-1$ to year t	Worldscope
Asset sales	Equals 1 if *Assets growth* $< -15\%$, and 0 otherwise	Worldscope
PPE growth	Growth in net PPE from year $t-1$ to year t	Worldscope
PPE sales	Equals 1 if *PPE growth* $< -15\%$, and 0 otherwise	Worldscope
EBITDA-to-assets	Ratio of EBITDA to total assets	Worldscope
EBITDA-to-assets vol	Standard deviation of the ratio of EBITDA to assets between the years $t-7$ and t, as in John, Litov and Yeung (2008).	Worldscope
Leverage	Total debt / Total assets	Worldscope
LT-debt-to-assets	Total long-term debt / Total assets	Worldscope
Equity returns vol	Annualized standard deviation of weekly stock returns (Friday-to-Friday), as in Bartram, Brown and Stulz (2012).	Worldscope / Datastream
Implied asset vol	Average of equity and debt yearly volatilities (% per year) from weekly stock prices, weighted by debt face values and market equity values, as in Bharath and Shumway (2008)	Worldscope / Datastream
Default probability (DP)	Default probability estimate, using Bharath and Shumway's (2008) approximation of the Merton DD model	Worldscope / Datastream
Renegotiation failure (f)	Favara, Schroth, and Valta's (2012) estimate of the probability of debt renegotiation failure, using the survey data in Djankov et al. (2008)	Djankov et al. (2008)
Recovery rate	Industry average creditors' recovery rate, at the three-digit SIC code level	Altman & Kishore (1996)
Overhang	$Leverage_{t-1} \times DP_{t-1} \times$ *Recovery rate*	All above
Market-to-book ratio	(Total assets + market cap - book equity) / Total assets	Worldscope
Cash flow-to-capital	(Net income + Depreciation & Amortization) / Gross PPE	Worldscope
Insiders' share	Numbers of shares held by officers, directors, their immediate families or in trust / Total shares outstanding	Worldscope
Intangibility	1 - (Net PPE / Total assets)	Worldscope
Shareholders' advantage	*Insiders' share* $\times$ *Intangibility*	See above
Creditor rights	Djankov et al.'s (2007) country-specific index of creditors' rights	Djankov et al. (2007)
Tax rate	The tax rate for the highest bracket of all taxes on corporate income.	Djankov et al. (2010)

Table 2: Descriptive statistics by country

This table presents a within-country summary (number of firms per country, N; mean; and standard deviation, sd) of *Renegotiation failure*, and *Overhang*, *Investment*, *PPE sales*, and *EBITDA-to-assets vol.* The sample contains firm-year observations from the Worldscope data base between 1993-2010 that could be matched to the countries surveyed by Djankov et al. (2008). Please refer to Table 1 for a definition of these variables.

	Renegotiation failure		*Overhang*		*Investment*		*PPE sales*		*EBITDA-to-assets vol*	
Country	N	mean	mean	sd	mean	sd	mean	sd	mean	sd
Argentina	53	0.308	0.050	0.070	0.076	0.115	0.259	0.439	0.091	0.070
Australia	677	1.000	0.033	0.050	0.161	0.206	0.270	0.444	0.086	0.085
Austria	60	0.667	0.047	0.061	0.098	0.114	0.216	0.412	0.049	0.059
Belgium	85	0.615	0.043	0.059	0.107	0.129	0.198	0.399	0.054	0.055
Brazil	195	0.417	0.051	0.070	0.122	0.129	0.268	0.443	0.078	0.055
Canada	907	0.667	0.040	0.057	0.150	0.182	0.214	0.410	0.081	0.070
Chile	91	0.000	0.037	0.051	0.109	0.144	0.143	0.351	0.047	0.043
China	1,428	0.000	0.068	0.074	0.155	0.188	0.114	0.318	0.048	0.045
Denmark	90	0.500	0.041	0.060	0.113	0.120	0.241	0.428	0.057	0.054
Finland	108	0.692	0.040	0.060	0.131	0.155	0.247	0.431	0.059	0.048
France	609	0.231	0.035	0.051	0.168	0.223	0.225	0.417	0.056	0.054
Germany	612	0.455	0.043	0.062	0.126	0.179	0.257	0.437	0.075	0.070
Great Britian	1,023	1.000	0.030	0.049	0.130	0.154	0.265	0.441	0.077	0.071
Greece	205	0.417	0.055	0.070	0.124	0.214	0.145	0.352	0.049	0.035
Hong Kong	681	1.000	0.041	0.056	0.125	0.180	0.269	0.443	0.083	0.076
Hungary	26	0.667	0.032	0.045	0.169	0.225	0.244	0.431	0.052	0.030
Indonesia	182	0.500	0.066	0.079	0.136	0.153	0.240	0.427	0.066	0.046
Ireland	50	0.615	0.043	0.067	0.134	0.126	0.169	0.375	0.067	0.067
Israel	309	0.556	0.051	0.072	0.099	0.132	0.223	0.416	0.074	0.065
Italy	182	0.231	0.052	0.062	0.105	0.144	0.226	0.419	0.048	0.041
Japan	2,248	0.538	0.055	0.067	0.073	0.113	0.192	0.394	0.037	0.041
Malaysia	698	0.583	0.043	0.059	0.095	0.146	0.210	0.408	0.058	0.055
Mexico	83	0.273	0.044	0.056	0.076	0.075	0.138	0.345	0.050	0.032
Netherlands	115	0.250	0.043	0.059	0.117	0.120	0.242	0.428	0.058	0.061
New Zealand	77	1.000	0.037	0.056	0.133	0.147	0.244	0.430	0.062	0.052
Norway	109	0.385	0.048	0.064	0.189	0.215	0.233	0.423	0.078	0.072

(Continues)

Table 2: continued

Country	*Renegotiation failure* N	mean	*Overhang* mean	sd	*Investment* mean	sd	*PPE sales* mean	sd	*EBITDA-to-assets vol* mean	sd
Peru	71	0.538	0.037	0.061	0.089	0.128	0.118	0.323	0.081	0.077
Philippines	102	0.538	0.048	0.062	0.102	0.144	0.244	0.430	0.070	0.065
Poland	231	0.417	0.030	0.049	0.158	0.212	0.223	0.417	0.073	0.061
Portugal	45	0.538	0.062	0.070	0.090	0.136	0.219	0.414	0.058	0.062
Russia	129	0.250	0.055	0.082	0.108	0.101	0.164	0.371	0.075	0.041
Singapore	488	1.000	0.040	0.057	0.126	0.193	0.240	0.427	0.065	0.061
South Africa	215	0.455	0.032	0.049	0.181	0.157	0.230	0.421	0.075	0.070
South Korea	1,261	0.538	0.061	0.074	0.125	0.173	0.200	0.400	0.066	0.059
Spain	84	0.462	0.045	0.062	0.085	0.096	0.191	0.393	0.056	0.053
Sweden	282	0.667	0.033	0.051	0.121	0.155	0.294	0.456	0.080	0.069
Switzerland	151	0.538	0.041	0.056	0.089	0.102	0.201	0.401	0.048	0.047
Taiwan	1,147	0.538	0.051	0.062	0.117	0.157	0.152	0.359	0.055	0.045
Thailand	364	0.692	0.060	0.087	0.096	0.133	0.199	0.399	0.060	0.041
Turkey	214	0.692	0.043	0.066	0.101	0.171	0.251	0.434	0.097	0.054
USA	3,779	0.538	0.048	0.062	0.135	0.146	0.189	0.392	0.074	0.066
Total	19,466	0.557	0.048	0.064	0.121	0.160	0.205	0.404	0.062	0.060

Table 3
Firm characteristics

This table presents descriptive statistics (number of firm-year observations, N; mean; standard deviation, decomposed into between-firm, sd_b, and within-firm, sd_w, variation; and the three quantiles: p25, p50 and p75) of the variables used in the analysis. The sample contains firm-year observations from the Worldscope data base between 1993-2010 that could be matched to the countries surveyed by Djankov et al. (2008). Please refer to Table 1 for a definition of these variables.

			Standard deviation					
	N	mean	Total	sd_b	sd_w	p25	p50	p75
Investment	141,256	0.123	0.164	0.147	0.125	0.036	0.076	0.145
Asset growth	150,757	0.088	0.259	0.180	0.230	−0.053	0.059	0.182
Asset sales	150,757	0.176	0.381	0.242	0.340	0.000	0.000	1.000
PPE growth	150,497	0.093	0.388	0.266	0.349	−0.074	0.035	0.171
PPE sales	150,497	0.205	0.404	0.263	0.358	0.000	0.000	0.000
EBITDA-to-assets vol	116,648	0.062	0.060	0.068	0.028	0.025	0.042	0.076
Overhang	150,757	0.048	0.064	0.049	0.050	0.001	0.020	0.074
Leverage	150,757	0.253	0.180	0.168	0.097	0.107	0.234	0.368
Default probability (DP)	150,757	0.360	0.344	0.228	0.297	0.009	0.271	0.681
Recovery rate	150,757	42.327	9.792	9.705	0.000	33.160	44.000	48.740
Equity returns vol	150,014	0.520	0.318	0.300	0.220	0.313	0.439	0.627
Implied asset vol	149,808	0.407	0.244	0.240	0.163	0.249	0.342	0.489
Market-to-book ratio	150,755	1.474	1.045	1.020	0.658	0.927	1.172	1.628
Cash flow-to-assets ratio	139,842	0.181	0.777	0.922	0.516	0.049	0.125	0.262
log(*Total assets*)	150,757	5.416	1.808	1.766	0.458	4.169	5.279	6.547
Insiders' shares	108,584	0.410	0.243	0.223	0.116	0.215	0.405	0.593
Intangibility	149,550	0.671	0.215	0.214	0.078	0.533	0.697	0.842
Shareholders' advantage	108,584	0.273	0.188	0.178	0.089	0.124	0.247	0.394
GDP growth	150,693	3.422	3.862	3.288	2.533	1.514	2.996	5.044
log(*GDP per capita*)	150,282	9.814	1.072	1.051	0.244	9.360	10.318	10.516

Table 4
Debt overhang, renegotiation failure, and capital investment

This table presents OLS, industry (IFE), industry-year and country (IYCFE), and firm fixed effects (FFE) estimates of investment regressions. The sample contains firm-year observations from the Worldscope data base between 1993-2010 that could be matched to the countries surveyed by Djankov et al. (2008). The dependent variable is yearly $Investment_{t+1}$. The specification in column 6 is estimated on subsamples of firms within each country, matched by *Market-to-book ratio*, *Cash flow-to-capital*, *Leverage*, and firm size, and controlling for industry fixed effects. All specifications include year fixed effects. Standard errors (in brackets under each estimate) are adjusted for heteroskedasticity and within industry-country clustering. Estimates followed by the symbols ***, ** or * are statistically significant at the 1%, 5%, or 10% levels, respectively. Please refer to Table 1 for a definition of all the variables.

	(1)	(2)	(3)	(4)	(5)	(6)
Specification	OLS	OLS	IFE	IYCFE	FFE	Matched
Market-to-book ratio	0.032***	0.032***	0.028***	0.027***	0.028***	0.027***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
Cash flow-to-capital	0.036***	0.036***	0.035***	0.034***	0.029***	0.028***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Overhang	−0.135***	−0.045	−0.032	−0.084***	−0.110***	−0.096**
	(0.011)	(0.030)	(0.027)	(0.023)	(0.025)	(0.04)
Overhang × *Renegotiation failure*		−0.177***	−0.185***	−0.085***	−0.150***	−0.124**
		(0.049)	(0.044)	(0.039)	(0.042)	(0.057)
Renegotiation failure (f)		−0.001	−0.010*			−0.001
		(0.007)	(0.006)			(0.007)
Constant	0.086***	0.087***	0.080***	0.053***	0.060***	0.086***
	(0.004)	(0.006)	(0.005)	(0.012)	(0.003)	(0.006)
Observations	134,954	134,954	134,954	134,954	134,954	65,810
Adjusted R^2	0.09	0.09	0.12	0.14	0.38	0.10
Economic significance : $\Delta E(y) \equiv E(y\|f=0,.) - E(y\|f=1,.)$						
$\Delta E(Investment)$		0.019***	0.020***	0.009***	0.016***	0.013**
Standard error		(0.005)	(0.005)	(0.004)	(0.005)	(0.006)
$\frac{\Delta E(Investment)}{\text{mean } Investment}$		0.186	0.192	0.088	0.155	0.124

Table 5
Debt overhang, renegotiation failure, and fixed assets sales (growth)

This table presents OLS, industry (IFE), and industry-year and country (IYCFE) fixed effects estimates of PPE growth regressions. The sample contains firm-year observations from the Worldscope data base between 1993-2010 that could be matched to the countries surveyed by Djankov et al. (2008). The dependent variables are either *PPE growth*$_{t+1}$ (all columns except column 5) or *PPE sales*$_{t+1}$ (column 5). The specification in column 6 is estimated on subsamples of firms within each country, matched by *Market-to-book ratio*, *Cash flow-to-capital*, *Leverage*, and firm size, and controlling for industry fixed effects. All specifications include year fixed effects. All specifications include year fixed effects. Standard errors (in brackets under each estimate) are adjusted for heteroskedasticity and within industry-country clustering. Estimates followed by the symbols ***, ** or * are statistically significant at the 1%, 5%, or 10% levels, respectively. Please refer to Table 1 for a definition of all the variables.

	(1)	(2)	(3)	(4)	(5)	(6)
Specification	OLS	OLS	IFE	IYCFE	Probit	Matched
Market-to-book ratio	0.041***	0.040***	0.042***	0.043***	−0.085***	0.043***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.007)	(0.003)
Cash flow-to-capital	0.068***	0.068***	0.069***	0.068***	−0.211***	0.065***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.014)	(0.004)
Overhang	−0.282***	−0.094**	−0.131***	−0.145***	0.610***	−0.122
	(0.021)	(0.045)	(0.043)	(0.045)	(0.227)	(0.077)
Overhang × *Renegotiation failure*		−0.377***	−0.350***	−0.336***	0.701***	−0.473***
		(0.076)	(0.073)	(0.077)	(0.345)	(0.111)
Renegotiation failure (f)		−0.009	−0.010		0.387***	−0.011
		(0.009)	(0.007)		(0.049)	(0.009)
Constant	0.089***	0.096***	0.058***	−0.051***	−1.108***	0.072***
	(0.007)	(0.009)	(0.007)	(0.019)	(0.043)	(0.009)
Observations	139,785	139,785	139,785	139,785	139,785	67,427
Adjusted R^2	0.05	0.05	0.07	0.07		0.05
Pseudo R^2					0.05	

(Continues)

Table 5: continued

Economic significance : $\Delta E(y) \equiv E(y|f=0,.) - E(y|f=1,.)$
or $\Delta Pr(y) \equiv Pr(y|f=1,.) - Pr(y|f=0,.)$

	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta E(PPE\ growth)$		0.049***	0.037***	0.036***		0.049***
Standard error		(0.008)	(0.008)	(0.008)		(0.011)
$\frac{\Delta E(PPE\ growth)}{\text{mean } PPE\ growth}$		0.736	0.561	0.538		0.728
$\Delta Pr(PPE\ sales)$					0.102***	
					(0.013)	
$\Delta Pr(PPE\ sales \vert DP > 0.5)$					0.118***	
					(0.013)	
$\Delta Pr(PPE\ sales \vert DP > 0.75)$					0.126***	
					(0.014)	

Table 6
Debt overhang, renegotiation failure, and risk-taking

This table presents OLS, industry (IFE), industry-year and country (IYCFE), and firm fixed effects (FFE) estimates of risk-taking regressions. The sample contains firm-year observations from the Worldscope data base between 1993-2010 matched to the countries surveyed by Djankov et al. (2008). The dependent variable is *EBITDA-to-assets vol*$_{t+1}$. The specification in column 6 is estimated on subsamples of firms within each country, matched by *Market-to-book ratio*, *Cash flow-to-capital*, *Leverage*, and firm size, and controlling for industry fixed effects. All specifications include year fixed effects. Additional firm-specific control variables include*Market-to-book ratio*, *EBITDA-to-assets*, and *LT-debt-to-assets*. All specifications include year fixed effects. Standard errors (in brackets under each estimate) are adjusted for heteroskedasticity and within industry-country clustering. Estimates followed by the symbols ***, ** or * are statistically significant at the 1%, 5%, or 10% levels, respectively. Please refer to Table 1 for a definition of all the variables.

	(1)	(2)	(3)	(4)	(5)	(6)
Specification	OLS	OLS	IFE	IYCFE	FFE	Matched
log(*Total assets*)	−0.011***	−0.011***	−0.010***	−0.010***	−0.019***	−0.011***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
GDP growth	0.000**	0.000**	0.000	−0.000**	0.000	0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
log(*GDP per capita*)	0.005***	0.005***	0.003***	−0.002	0.009***	0.004***
	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.001)
Overhang	0.090***	0.059***	0.050***	0.070***	0.016**	0.068***
	(0.006)	(0.012)	(0.010)	(0.010)	(0.007)	(0.018)
Overhang × *Renegotiation failure*		0.059***	0.066***	0.051***	0.050***	0.061**
		(0.022)	(0.017)	(0.018)	(0.013)	(0.027)
Renegotiation failure (f)		−0.004	0.007**			0.012***
		(0.005)	(0.003)			(0.003)
Constant	0.063***	0.066***	0.085***	0.148***	0.084***	0.069***
	(0.007)	(0.007)	(0.006)	(0.013)	(0.018)	(0.006)
Legal origin controls	Yes	Yes	Yes	No	No	Yes
Additional firm-specific controls	No	No	Yes	Yes	Yes	Yes
Observations	116,378	116,378	116,329	116,329	116,329	53,252
Adjusted R^2	0.16	0.16	0.32	0.35	0.77	0.34
Economic significance : $\Delta E(y) \equiv E(y\|f=0,.) - E(y\|f=1,.)$						
ΔE(*EBITDA-to-assets vol*)		−0.002	−0.007***	−0.006***	−0.005***	−0.006**
Standard error		(0.005)	(0.002)	(0.002)	(0.001)	(0.003)
$\frac{\Delta E(\textit{EBITDA-to-assets vol})}{\text{mean } \textit{EBITDA-to-assets vol}}$		−0.042	−0.118	−0.091	−0.089	−0.106

Table 7
Debt overhang and interactions between renegotiation failure and shareholders' advantage

This table presents OLS and industry fixed effects (IFE) estimates of investment, PPE growth, and risk-taking regressions. The sample contains firm-year observations from the Worldscope data base between 1993-2010 that could be matched to the countries surveyed by Djankov et al. (2008). The dependent variable in columns 1 and 2 is $Investment_{t+1}$, in columns 3 and 4 $PPE\ growth_{t+1}$, and in columns 5 and 6 $EBITDA\text{-}to\text{-}assets\ vol_{t+1}$. Columns 1 to 4 include *Market-to-book ratio* and *Cash flow-to-capital* as control variables. Columns 5 and 6 include *Market-to-book ratio*, log(*Total assets*), *EBITDA-to-assets*, *LT-debt-to-assets*, *GDP growth*, log(*GDP per capita*), and the legal origin as control variables. All specifications include year fixed effects. Standard errors (in brackets under each estimate) are adjusted for heteroskedasticity and within industry-country clustering. Estimates followed by the symbols ***, ** or * are statistically significant at the 1%, 5%, or 10% levels, respectively. Please refer to Table 1 for a definition of all the variables.

	Investment		PPE growth		Risk-taking	
	(1)	(2)	(3)	(4)	(5)	(6)
Specification	OLS	IFE	OLS	IFE	OLS	IFE
Overhang	−0.041	−0.034	0.073	0.001	−0.007	−0.012
	(0.058)	(0.05)	(0.101)	(0.095)	(0.028)	(0.026)
Overhang × *Renegotiation failure*	−0.217**	−0.204**	−0.762***	−0.660***	0.177***	0.187***
	(0.098)	(0.083)	(0.164)	(0.156)	(0.046)	(0.044)
Overhang × *Shareholders' advantage*	−0.091	−0.081	−0.601*	−0.494	0.190**	0.198***
	(0.171)	(0.157)	(0.324)	(0.317)	(0.078)	(0.075)
Overhang × *Shareholders' advantage* × *Renegotiation failure*	0.305	0.256	1.378**	1.167**	−0.395***	−0.394***
	(0.273)	(0.252)	(0.553)	(0.543)	(0.129)	(0.124)
Shareholders' advantage	0.043*	0.049***	0.060**	0.083***	−0.035***	−0.032***
	(0.022)	(0.016)	(0.031)	(0.025)	(0.008)	(0.006)
Shareholders' advantage × *Renegotiation failure*	−0.006	0.000	0.019	0.048	0.046***	0.043***
	(0.032)	(0.025)	(0.048)	(0.042)	(0.012)	(0.01)
Renegotiation failure (f)	0.005	−0.003	−0.016	−0.026*	−0.015**	−0.013***
	(0.013)	(0.009)	(0.017)	(0.014)	(0.006)	(0.004)
Constant	0.065***	0.058***	0.022	0.022**	0.082***	0.101***
	(0.009)	(0.006)	(0.014)	(0.01)	(0.008)	(0.007)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	99,993	99,993	103,704	103,704	87,092	87,092
Adjusted R^2	0.11	0.14	0.05	0.06	0.27	0.33

(Continues)

Table 7: continued

Economic significance : $\Delta E(y) \equiv E(y\|f=0,.) - E(y\|f=1,.)$						
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta E(\textit{Dependent variable})$	0.018^{**}	0.021^{**}	0.078^{***}	0.069^{***}	-0.017^{***}	-0.019^{***}
Standard error	(0.008)	(0.009)	(0.018)	(0.016)	(0.005)	(0.005)
$\frac{\Delta E(\textit{Dependent variable})}{\text{mean } \textit{Dependent variable}}$	0.170	0.205	1.171	1.029	−0.289	−0.326
Economic significance : $\Delta E(y) \equiv \frac{dE(y\|\text{median } f,.)}{d(\alpha\eta)} \times \text{Std. Dev.}(\alpha\eta)$						
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta E(\textit{Dependent variable})$	0.012^{***}	0.013^{***}	0.045^{***}	0.039^{***}	-0.004^{**}	-0.002^{*}
Standard error	(0.012)	(0.013)	(0.045)	(0.039)	(0.004)	(0.002)
$\frac{\Delta E(\textit{Dependent variable})}{\text{mean } \textit{Dependent variable}}$	0.113	0.126	0.669	0.586	−0.063	−0.041

Table 8
Robustness analysis:
Debt overhang and renegotiation failure for financially unconstrained firms

This table presents industry fixed effects estimates of investment, PPE growth, and risk-taking regressions. The sample contains firm-year observations of financially *unconstrained* firms from the Worldscope data base between 1993-2010 that could be matched to the countries surveyed by Djankov et al. (2008). In each country, firms are sorted into two groups based on median size (log(*Total assets*) or the Whited and Wu (2006) financing constraints index (WW-index). For the estimations in this table, we take all firm-year observations with above median size or below median WW-index to identify firms that are financially unconstrained. The dependent variable in columns 1 and 2 is $Investment_{t+1}$, in columns 3 and 4 *PPE growth*$_{t+1}$, and in columns 5 and 6 *EBITDA-to-assets vol*$_{t+1}$. Columns 1 to 4 include *Market-to-book ratio* and *Cash flow-to-capital* as control variables. Columns 5 and 6 include *Market-to-book ratio*, log(*Total assets*), *EBITDA-to-assets*, *LT-debt-to-assets*, *GDP growth*, log(*GDP per capita*), and the legal origin as control variables. All specifications include industry and year fixed effects. Standard errors (in brackets under each estimate) are adjusted for heteroskedasticity and within industry-country clustering. Estimates followed by the symbols ***, ** or * are statistically significant at the 1%, 5%, or 10% levels, respectively. Please refer to Table 1 for a definition of all the variables.

	Investment		PPE growth		Risk-taking	
	(1)	(2)	(3)	(4)	(5)	(6)
Financing constraints variables	Size	WW	Size	WW	Size	WW
Overhang	0.03	0.039	−0.109**	−0.058	0.011	0.025*
	(0.029)	(0.036)	(0.051)	(0.069)	(0.01)	(0.014)
Overhang × *Renegotiation failure*	−0.189***	−0.187***	−0.312***	−0.357***	0.081***	0.043*
	(0.048)	(0.06)	(0.086)	(0.118)	(0.018)	(0.025)
Renegotiation failure	−0.022***	0.001	−0.025***	0.002	0.005*	0.002
	(0.006)	(0.006)	(0.009)	(0.01)	(0.003)	(0.003)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	67,486	64,124	67,475	64,115	59,234	56,464
Adjusted R^2	0.18	0.18	0.06	0.06	0.19	0.17

Table 9
Robustness analysis:
Endogenous debt overhang

This table presents two-stage industry fixed effects regressions for investment, PPE growth, and risk-taking. The sample contains firm-year observations from the Worldscope data base between 1993-2010 matched to the countries surveyed by Djankov et al. (2008). Column 1 presents the first-stage estimates of the second-stage regressions in columns 2 to 4. The dependent variable is *Overhang* and the instruments are the statutory tax rate (*Tax rate*), initial leverage ($Leverage_{t0}$), and their interactions with *Renegotiation failure*. In column 2, the dependent variable is $Investment_{t+1}$, in column 3 $PPE\ growth_{t+1}$, and in column 4 $EBITDA\text{-}to\text{-}assets\ vol_{t+1}$. All columns control for *Market-to-book ratio*, *Cash flow-to-capital*, industry and year fixed effects. Column 4 also includes log(*Total assets*), *EBITDA-to-assets*, *GDP growth*, log(*GDP per capita*), and the legal origin. Standard errors (in brackets under each estimate) are adjusted for heteroskedasticity and within industry-country clustering. Estimates followed by ***, ** or * are statistically significant at the 1%, 5%, or 10% levels, respectively. Refer to Table 1 for a definition of all the variables.

	1st stage	2nd stage		
	Overhang	Investment	PPE growth	Risk-taking
	(1)	(2)	(3)	(4)
Overhang		0.325***	0.303	−0.068**
		(0.086)	(0.190)	(0.028)
Overhang × *Renegotiation failure*		−1.163***	−0.780**	0.288***
		(0.152)	(0.345)	(0.053)
Renegotiation failure (f)	0.025***	0.032***	0.014	−0.004
	(0.005)	(0.007)	(0.017)	(0.003)
Tax rate	0.001***			
	(0.000)			
Tax rate × *Renegotiation failure*	−0.001***			
	(0.000)			
$Leverage_{t0}$	0.085***			
	(0.014)			
Tax rate × $Leverage_{t0}$	0.001			
	(0.000)			
$Leverage_{t0}$ × *Renegotiation failure*	−0.008			
	(0.022)			
Tax rate × *Reneg. failure* × $Leverage_{t0}$	−0.001			
	(0.001)			
Controls	Yes	Yes	Yes	Yes
Observations	134,954	134,954	139,785	116,377
R^2	0.15	0.07	0.05	0.23
Kleinbergen-Paap F-statistic		285.53	288.67	349.58

(Continues)

Table 9: continued

Economic significance : $\Delta E(y) \equiv E(y\|f=0,.) - E(y\|f=1,.)$			
	(2)	(3)	(4)
$\Delta E(\textit{Dependent variable})$	0.037^{***}	0.032^{***}	-0.014^{***}
Standard error	(0.003)	(0.006)	(0.001)
$\frac{\Delta E(\textit{Dependent variable})}{\text{mean } \textit{Dependent variable}}$	0.358	0.479	-0.235

Table 10
Robustness analysis:
Creditor rights, risk-taking, and alternative asset risk measures

This table presents OLS and industry fixed effects (IFE) estimates of risk-taking regressions. The sample contains firm-year observations from the Worldscope data base between 1993-2010 that could be matched to the countries surveyed by Djankov et al. (2008). The dependent variable is *EBITDA-to-assets* vol_{t+1} in columns 1 and 2, *Equity return* vol_{t+1} in columns 3 and 4, and *Implied asset* vol_{t+1} in columns 5 and 6. All specifications include *Market-to-book ratio*, log(*Total assets*), *EBITDA-to-assets*, *LT-debt-to-assets*, *GDP growth*, log(*GDP per capita*), and the legal origin as control variables. All specifications include industry and year fixed effects. Standard errors (in brackets under each estimate) are adjusted for heteroskedasticity and within industry-country clustering. Estimates followed by the symbols ***, ** or * are statistically significant at the 1%, 5%, or 10% levels, respectively. Please refer to Table 1 for a definition of all the variables.

	EBITDA vol		Equity vol		Asset vol	
	(1)	(2)	(3)	(4)	(5)	(6)
Specification	OLS	IFE	OLS	IFE	OLS	IFE
Overhang	0.058***	0.062***	0.474***	0.503***	0.069**	0.066*
	(0.013)	(0.012)	(0.058)	(0.053)	(0.034)	(0.034)
Creditor rights	−0.003***	−0.002***				
	(0.001)	(0.001)				
Overhang × *Creditor rights*	−0.003	−0.005				
	(0.006)	(0.005)				
Renegotiation failure (f)	0.018***	0.013***	−0.051***	−0.053***	−0.062***	−0.060***
	(0.004)	(0.003)	(0.015)	(0.013)	(0.013)	(0.010)
Overhang × *Renegotiation failure*	0.061***	0.067***	0.793***	0.268***	0.267***	0.210***
	(0.021)	(0.018)	(0.100)	(0.090)	(0.062)	(0.059)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	116,329	116,329	115,755	115,755	115,603	115,603
Adjusted R^2	0.26	0.32	0.26	0.29	0.24	0.27
Economic significance : $\Delta E(y) \equiv E(y\|f=0,.) - E(y\|f=1,.)$						
ΔE(*Dependent variable*)	0.001	0.001	−0.084***	−0.081***	−0.029***	−0.029***
Standard error	(0.002)	(0.002)	(0.011)	(0.010)	(0.007)	(0.006)
$\frac{\Delta E(\textit{Dependent variable})}{\text{mean } \textit{Dependent variable}}$	0.025	0.036	−1.419	−1.364	−0.481	−0.478

Table 11
Robustness analysis:
Alternative subsamples and distance-to-default measure

This table shows the robustness of the results to different sub-samples and definitions of the overhang variable. The table presents industry fixed effects estimates of investment, PPE growth, and risk-taking regressions. The sample contains firm-year observations from the Worldscope data base between 1993-2010 that could be matched to the countries surveyed by Djankov et al. (2008). The dependent variable in columns 1 and 2 is $Investment_{t+1}$, in columns 3 and 4 $PPE\ growth_{t+1}$, and in columns 5 and 6 *EBITDA-to-assets* vol_{t+1}. Columns 1 to 4 include *Market-to-book ratio* and *Cash flow-to-capital* as control variables. Columns 5 and 6 include *Market-to-book ratio*, log(*Total assets*), *EBITDA-to-assets*, *LT-debt-to-assets*, *GDP growth*, log(*GDP per capita*), and the legal origin as control variables. In columns 1, 3, and 5, all firm-year observations belonging to the US or Japan are excluded. In columns 2, 4, and 6 *Overhang_Z* replaces the default probability *DP* for Altman's Z-score. All specifications include industry and year fixed effects. Standard errors (in brackets under each estimate) are adjusted for heteroskedasticity and within industry-country clustering. Estimates followed by the symbols ***, ** or * are statistically significant at the 1%, 5%, or 10% levels, respectively. Please refer to Table 1 for a definition of all the variables.

	Investment		PPE growth		Risk-taking	
	(1)	(2)	(3)	(4)	(5)	(6)
Overhang	−0.086***		−0.254***		0.063***	
	(0.027)		(0.044)		(0.01)	
Overhang × *Renegotiation failure*	−0.124***		−0.262***		0.072***	
	(0.042)		(0.073)		(0.018)	
Overhang_Z		0.000		−0.001		0.001***
		(0.007)		(0.001)		(0.000)
Overhang_Z × *Renegotiation failure*		−0.006***		−0.011***		0.001*
		(0.001)		(0.002)		(0.001)
Renegotiation failure (f)	−0.015***	0.002	−0.013*	0.008	0.024***	0.006*
	(0.005)	(0.007)	(0.007)	(0.009)	(0.003)	(0.003)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	86,633	126,562	88,299	131,117	73,465	109,188
Adjusted R^2	0.11	0.13	0.05	0.05	0.31	0.33
Economic significance : $\Delta E(y) \equiv E(y\|f=0,.) - E(y\|f=1,.)$						
ΔE(*Dependent variable*)	0.013***	0.025***	0.028***	0.048***	−0.008***	−0.005**
Standard error	(0.005)	(0.006)	(0.008)	(0.009)	(0.002)	(0.003)
$\frac{\Delta E(Dependent\ variable)}{\text{mean } Dependent\ variable}$	0.130	0.241	0.425	0.713	−0.131	−0.086

Table 12
Robustness analysis:
Alternative debt overhang measure

This table presents OLS and industry fixed effects (IFE) estimates of investment, PPE growth, and risk-taking regressions. The sample contains firm-year observations from the Worldscope data base between 1993-2010 that could be matched to the countries surveyed by Djankov et al. (2008). The dependent variable in columns 1 and 2 is $Investment_{t+1}$, in columns 3 and 4 $PPE\ growth_{t+1}$, and in columns 5 and 6 $EBITDA\text{-}to\text{-}assets\ vol_{t+1}$. Columns 1 to 4 include *Market-to-book ratio* and *Cash flow-to-capital* as control variables. Columns 5 and 6 include *Market-to-book ratio*, log(*Total assets*), *EBITDA-to-assets*, *LT-debt-to-assets*, *GDP growth*, log(*GDP per capita*), and the legal origin as control variables. In all columns, *Overhang_FCR* is calculated using the same formula as *Overhang* (see Table 1), except that the conditional recovery rate (*Recovery rate*) is always equal to one. All specifications include year fixed effects. Standard errors (in brackets under each estimate) are adjusted for heteroskedasticity and within industry-country clustering. Estimates followed by the symbols ***, ** or * are statistically significant at the 1%, 5%, or 10% levels, respectively. Please refer to Table 1 for a definition of all the variables.

	Investment		PPE growth		Risk-taking	
	(1)	(2)	(3)	(4)	(5)	(6)
Specification	OLS	IFE	OLS	IFE	OLS	IFE
Overhang_FCR	−0.025*	−0.022*	−0.054***	−0.073***	0.030***	0.024***
	(0.014)	(0.012)	(0.020)	(0.019)	(0.005)	(0.005)
Overhang_FCR ×	−0.065***	−0.073***	−0.134***	−0.129***	0.019**	0.025***
Renegotiation failure	(0.022)	(0.019)	(0.033)	(0.032)	(0.010)	(0.008)
Renegotiation failure (f)	−0.001	−0.010*	−0.010	−0.012*	−0.003	0.007***
	(0.007)	(0.006)	(0.009)	(0.007)	(0.005)	(0.003)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	134,954	134,954	139,785	139,785	116,329	116,329
Adjusted R^2	0.09	0.13	0.05	0.06	0.16	0.32
Economic significance : $\Delta E(y) \equiv E(y\|f=0,.) - E(y\|f=1,.)$						
$\Delta E(Dependent\ variable)$	0.017***	0.019***	0.045***	0.033***	−0.002	−0.006***
Standard error	(0.004)	(0.005)	(0.008)	(0.008)	(0.002)	(0.002)
$\frac{\Delta E(Dependent\ variable)}{\text{mean } Dependent\ variable}$	0.166	0.187	0.678	0.505	−0.039	−0.112

Table A.1
Robustness analysis: GMM estimates for capital investment

This table presents higher-order GMM estimates of investment regressions. The sample contains firm-year observations from the Worldscope data base between 1993-2010 that could be matched to the countries surveyed by Djankov et al. (2008). The dependent variable is yearly $Investment_{t+1}$. The specifications are estimated using the 3rd (GMM3), 4th (GMM4), or 5th-order (GMM5) GMM panel estimator, which corrects for measurement error in Tobin's average Q (Market-to-Book ratio). The specification in column 6 is estimated on subsamples of firms within each country, matched by *Market-to-book ratio*, *Cash flow-to-capital*, *Leverage*, and firm size, and using a GMM5 estimator. Estimates followed by the symbols ***, ** or * are statistically significant at the 1%, 5%, or 10% levels, respectively. Please refer to Table 1 for a definition of all the variables.

	(1)	(2)	(3)	(4)	(5)	(6)
Specification	GMM4	GMM5	GMM3	GMM4	GMM5	Matched
Market-to-book ratio	0.078***	0.070***	0.108***	0.077***	0.068***	0.057***
	(0.003)	(0.002)	(0.005)	(0.003)	(0.002)	(0.003)
Cash flow-to-capital ratio	0.028***	0.028***	0.027***	0.029***	0.029***	0.025***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Overhang	−0.028**	−0.026**	0.104***	0.072***	0.086***	−0.034
	(0.012)	(0.011)	(0.031)	(0.028)	(0.027)	(0.042)
Overhang × *Renegotiation failure*			−0.121**	−0.130***	−0.137***	−0.031
			(0.050)	(0.046)	(0.046)	(0.063)
Renegotiation failure (f)			−0.001	0.000	0.004	−0.006
			(0.005)	(0.005)	(0.005)	(0.006)
Constant	−0.007	0.003	−0.050***	−0.005	−0.006	0.006
	(0.005)	(0.004)	(0.009)	(0.006)	(0.005)	(0.007)
Observations	134,954	134,954	134,954	134,954	134,954	65,810
Economic significance : $\Delta E(y) \equiv E(y\|f=0,.) - E(y\|f=1,.)$						
$\Delta E(Investment)$			0.016**	0.017***	0.018***	0.004
Standard error			(0.007)	(0.006)	(0.006)	(0.008)
$\frac{\Delta E(Investment)}{\text{mean } Investment}$			0.152	0.164	0.172	0.038

Table A.2
Descriptive statistics for the Mahalanobis-metric matching procedure

This table presents descriptive statistics for the matching variables before and after the matching procedure. Treated firms are defined as those that operate in countries with an index of *Renegotiation failure* above the sample median. From the set of non-treated firms (firms in countries with a *Renegotiation failure* index below the sample median), matched firms are selected based on industry, year, *Market-to-book ratio*, *Cash flow-to-capital*, *Total debt-to-assets*, log(*Total assets*) using the Mahalanobis metric, which weights the distance between two firms by the inverse covariance matrix of each matching dimension. Panel A of the table shows the means and differences-of-means test (T statistics and p values) for the unmatched and matched sample across treated and control firms. Panel B of the table displays the summary statistics of the distribution of the absolute distances between treated and control firms before and after the matching procedure, as well as the likelihood-ratio test (LR statistic and p value) for the null hypothesis that the average distance is zero. Please refer to Table 1 for a definition of all the variables.

Panel A: Means of matching variables before and after the matching procedure

		Group mean (μ)		$H_0 : \mu_T - \mu_C = 0$	
Matching variable	Sample	Treated (T)	Control (C)	T statistic	p value
Market-to-book ratio	Unmatched	1.515	1.526	−1.590	0.111
	Matched	1.515	1.511	0.580	0.559
Cash flow-to-capital	Unmatched	0.209	0.209	0.040	0.966
	Matched	0.209	0.203	1.000	0.316
Total debt-to-assets	Unmatched	0.214	0.219	−4.410	0.000
	Matched	0.214	0.213	1.050	0.291
log(*Total assets*)	Unmatched	4.836	5.016	−16.270	0.000
	Matched	4.836	4.850	−1.460	0.145

Panel B: Distribution of distance between control and treated firms before and after the matching procedure

		Summary statistics		$H_0 : \mu_D = 0$	
	Sample	Mean (μ_D)	Std. Dev.	LR	p value
Absolute distance	Unmatched	3.388	4.468	279.520	0.000
	Matched	0.570	0.199	6.170	0.190