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Corporate leverage and employees' rights in bankruptcy

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ABSTRACT

Corporate leverage responds differently to employees' rights in bankruptcy depending on whether it is driven by strategic concerns in wage bargaining or by credit constraints. Using novel data on employees' rights in bankruptcy, we estimate their impact on leverage, exploiting time-series, cross-country, and firm-level variation in the data. For financially unconstrained firms, results accord with the strategic debt model: leverage increases more in response to rises in corporate property values or profitability if employees have strong seniority in liquidation and weak rights in restructuring. Instead, in financially constrained firms leverage responds less to these shocks if employees have stronger seniority.

1. Introduction

Most research on corporate capital structure assumes that firms' main liabilities are debt and equity. In fact, liabilities to employees are typically of comparable magnitude. Between 1992 and 2005, wages were 34% of total assets of bankrupt US firms (Graham et al., 2016; Table 1). Pension entitlements are also sizable: the off-balance sheet pension liabilities of the S&P 500 firms stood at $1.25 trillion in 2005, and between 1991 and 2003, a fourth of Compustat companies had defined-benefit pension plans, which, when consolidated with financial debt, raised their leverage by about one-third (Shidvasani and Stefanescu, 2010). The figures for other countries are similar: consolidating off-balance sheet pension plans raises leverage by 32%, on average, and for some firms by as much as 70% (Bartram, 2016).

While the recent literature has increasingly recognized that relations with employees influence leverage decisions, it has overlooked that these decisions can be affected by the balance of power between workers and creditors in bankruptcy proceedings. In this paper we show for the first time, both theoretically and empirically, that corporate leverage depends on the protection afforded under bankruptcy law to employees' versus creditors' claims and specifically on their relative seniority in liquidation and the balance of their rights in restructuring.

Our first contribution is to show that the balance between workers' rights and those of creditors in bankruptcy varies greatly from country to country. This is illustrated by Fig. 1, which displays the seniority of employees' claims, separately for unpaid salaries, severance pay, and

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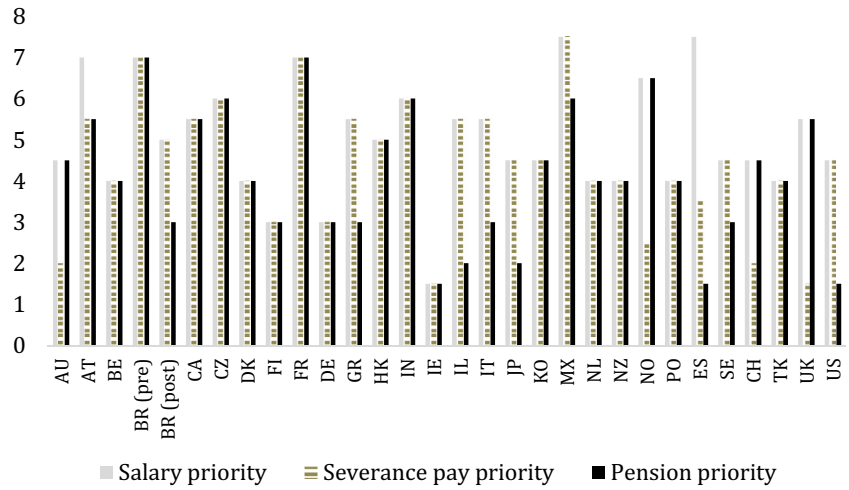

Fig. 1. Seniority of employees' claims in insolvent firms' liquidation.
The figure shows the seniority of employees' claims, separately for (unpaid) salaries, severance pay, and pension contributions in 29 countries. The bars indicate the ranking of these claims in each country relative to competing claimants in bankruptcy on a scale from one for the most junior to eight for the most senior.

pension contributions in 29 countries.[1] The bars indicate the ranking of these claims in each country relative to competing claimants in bankruptcy. For instance, employees' seniority is much higher in Argentina, Belgium, France, Hungary, India, Mexico, and Singapore than in Australia, Denmark, Finland, Germany, Slovakia, Turkey, and the US. In some countries (like France) employees are senior to most other claimants, whereas in others (like Germany) their claims are the most junior.

The paper's second contribution is to show that these substantial differences in the protection of employees relative to other creditors have different effects on firms' capital structure depending on whether leverage is aimed at curtailing employees' bargaining power or is driven by credit constraints. Hence its effects help to discriminate empirically between these two hypotheses.

Specifically, if firms have unused debt capacity, they are free to increase debt so as to reduce the money at stake in wage negotiations and thus curtail the wage demands of their employees. We show analytically that firms tend to be more aggressive in this strategic use of leverage if their employees enjoy stronger legal protection in bankruptcy: in particular, when their assets' value or revenue rises, firms will increase leverage more if their employees have greater seniority in bankruptcy so as to prevent a surge in wage demands. This response of corporate leverage is akin to that elicited by an increase in workers' bargaining power, for instance owing to union-friendly legislation (Baldwin, 1983; Bronars and Deere, 1991; Dasgupta and Sengupta, 1993; Perotti and Spier, 1993; Matsa, 2010). The rise in leverage is mitigated by bankruptcy costs and can indeed be reversed if these are sufficiently high: if so, firms may prefer to accommodate workers' demands and thus choose low leverage even if their employees have high seniority.

If firms are financially constrained instead, their leverage should respond differently to employee protection in bankruptcy. As such protection tends to increase labor costs, it eats into the future cash flow that can be pledged to creditors, tightening financial constraints and thus reducing leverage: the greater operating leverage due to higher labor costs crowds out financial leverage (Simintzi et al., 2015). In this case, the stronger employees' seniority, the more muted the response of leverage to an increase in the firm's surplus: intuitively, if employees are well protected in bankruptcy, they are entitled to a large fraction of any increase in the firm's resources in case of bankruptcy; anticipating that their claims will take a back seat in liquidation, creditors will provide less additional credit when the firm's assets appreciate or its prospects brighten.

These predictions allow a test of the strategic debt model against the model with financial constraints: while both predict that leverage increases in response to higher cash flows and collateral values, employees' seniority can amplify this response in the strategic debt model, whereas it attenuates it under binding credit constraints.[2]

However, seniority captures only one aspect of employees' legal protection in bankruptcy: distressed firms are often restructured rather than liquidated. If workers and creditors can renegotiate their respective claims so as to avoid liquidation, workers' rights in the restructuring process become relevant. In the strategic debt model, these

[1] See Section 3 for a detailed description of this measure of employee seniority.

[2] Interestingly, while the two models yield different predictions about the effect of workers' seniority on leverage, they both predict a negative relationship between wages and leverage: an increase in leverage dictated by strategic concerns reduces wages, and an increase in wages reduces leverage in credit-constrained firms. This explains why wage bargaining and financial frictions reinforce each other in generating a negative correlation between leverage and wages in Michaels, Page, and Whited (2019).

rights invariably reduce optimal leverage: the stronger employees' protection in debt renegotiation, the smaller the fraction of the firm's continuation payoff accruing to creditors, hence the greater their loss from insolvency; anticipating this, shareholders will choose lower leverage. So while employees' seniority in liquidation may call for more leverage, their protection in restructuring calls for less. This yields another testable prediction linking leverage to employees' rights in bankruptcy.

A key requirement for testing these hypotheses is a consistent measure of employees' rights in bankruptcy. To this end, we collect data on workers' rights in liquidation and reorganization in 29 countries via a questionnaire (described in Section 4 and reproduced in Section A of the Internet Appendix) addressed to law firms in each country participating in the Lex Mundi project and to other legal experts. Specifically, we gather information on the seniority of employees' pension entitlements, unpaid salaries, and severance pay relative to other claims under liquidation and on worker rights during reorganization.

We merge these novel legal indicators with firm-level data from Worldscope and Osiris (for non-US firms) and Compustat (for US firms) in 1988–2015. Testing the contrasting predictions of the two models requires identifying an exogenous source of variation in firms' resources: we exploit changes in real estate and commodity prices. First, we analyze the response of firms' change in leverage to changes in the value of their real estate assets, exploiting three sources of variation—time-series, firm-level, and cross-country: the coefficients of interest are those of the interaction between real estate price changes (that vary over time and across countries), firms' initial real estate holdings (that differ across firms), and workers' rights in bankruptcy (that differ across countries).

Second, we focus on another source of variation of corporate leverage, namely profits. Using a strategy reminiscent of Bertrand and Mullainathan (2001), we deal with the potential endogeneity of changes in profits by instrumenting them with changes in the prices of commodities used as inputs or produced by firms. The profitability of each industry is likely to respond differently to commodity prices, depending on its revenue and cost structure. In the first stage of our instrumental variables (IV) estimation, we estimate the response of firms' profit growth to commodity price changes, allowing the coefficients to reflect the industry's exposure to those price changes. In the second stage, we estimate the response of the change in firm leverage to changes in its profitability and to its interactions with employees' rights in bankruptcy. Taking as an example a rise in oil prices, the identification strategy aims at determining whether the resulting profit changes lead companies to change their leverage differently depending on the rights of their employees in bankruptcy. Each industry has different exposure to oil price changes, generating within-country, industry-level variation in the response to the same oil shock. So also this approach, like that based on real estate shocks, relies on a triple-diff specification: we exploit the interaction between time variation in commodity price changes, industry-level variation in exposures to them (as captured by first-stage coefficients), and cross-country variation in workers' rights.

The coexistence of time, firm, and country-level variation enables us to saturate our specifications by including country-industry-time effects (not firm-level effects as our specification is in first differences). These filter out the influence of time-varying country and industry characteristics that could affect the response of leverage to changes in real estate valuations and profitability. These effects also absorb the time-series variation in real estate price (or profit) changes at country level and that of their interaction with bankruptcy law indicators. The within-country variation of firm-level exposures still enables us to identify the coefficients of interest.

When we do not distinguish between financially constrained and unconstrained firms, our empirical results are as follows. First, in countries where workers are more senior or better protected by government insurance in bankruptcy, firms increase leverage more in response to real estate appreciation or a profit increase than firms whose employees are less protected. Second, the opposite holds for national differences in employees' rights in debt restructuring: here the firms whose employees are better protected increase leverage less in response to an appreciation of real estate holdings or a rise in profits. Third, firms increase leverage more in countries where workers have stronger bargaining power and greater public insurance coverage. All three results are consistent with the strategic debt model, while the first and the third conflict with the credit-constraint model.

Interestingly, the results become more nuanced upon distinguishing between firms that are likely to be financially constrained and those that are not, as one would expect considering that the strategic debt model requires firms to be free to increase leverage in response to shocks. Since identifying financially constrained firms is notoriously difficult, we use several methods to estimate separate leverage regressions for the two types of firms. First, we estimate an endogenous switching regression model with unknown sample separation, where the probability of financial constraints being binding is estimated jointly with the parameters of the leverage regressions for each group of firms. Second, for robustness, we resort to simpler sample separation rules based on firm size or age to identify unconstrained and constrained firms. Irrespective of the methodology used, we find that the results accord with the strategic debt model only for unconstrained firms: their leverage increases more in response to rises in corporate property values or profitability if employees have strong seniority in liquidation and weak rights in restructuring. Instead, in constrained firms leverage responds less to these shocks if employees have stronger seniority.

The paper is organized as follows. Section 2 places our contribution against the backdrop of the literature. Section 3 presents the two models whose different predictions guide our empirical analysis. Section 4 develops the key predictions offered by these models into testable hypotheses and lays out our empirical strategy. Section 5 describes the data, Section 6 presents the estimates, Section 7 describes extensions and robustness checks, and Section 8 concludes.

2. Literature review

Most of the US firm-level evidence is consistent with the strategic use of debt: controlling for corporate performance, more highly leveraged US firms pay lower wages and fund their pension plans less generously (Hanka, 1998); US airlines in distress obtain wage concessions from workers with underfunded pension plans (Benmelech et al., 2012); and unions are more likely to strike and "win" in wage negotiations if the firm's debt has been decreasing (Myers and Saretto, 2016). Michaels et al. (2019), who provide the most comprehensive analysis of the US data, find a strong inverse correlation between labor earnings and leverage, both between firms and over time. They interpret this finding via a model that combines the strategic use of debt in wage bargaining with financing frictions: by their estimates, both are factors in the inverse correlation between wages and leverage.[3]

Moreover, for the US there is evidence that firms choose higher leverage when workers are protected by better unemployment insurance or are more unionized. Matsa (2010) finds that collective bargaining coverage and pro-union changes to state labor laws increase corporations' leverage in the US—a result replicated for Sweden by Cronqvist et al. (2009). Consistently, US firms facing more serious threats of unionization have higher leverage (Bronars and Deere, 1991), while those rated as "employee-friendly" keep their leverage low (Bae et al., 2011).

This evidence contrasts with Simintzi et al. (2015) who, using firm-level data from 21 countries, find that leverage is inversely correlated with job security law and interpret this finding as a sign that leverage is determined by credit constraints rather than strategic concerns. They argue that since employment protection enhances workers' bargaining power, it increases wages and thus reduces employers' capacity to borrow.[4]

While our own baseline estimates square with the predictions of the strategic debt model, our results differ considerably when separate leverage regressions are estimated for financially unconstrained and constrained firms: the predictions of the strategic leverage model apply only to unconstrained firms, while for constrained ones, the evidence aligns with the idea that employees' bargaining power and seniority rights lead to lower leverage, in line with Simintzi et al. (2015). Hence, allowing for differences in financial constraints reconciles the conflicting results in the literature so far.

[3] This finding contrasts with Berk et al. (2010), in whose model risk-averse employees require higher wages from more highly leveraged employers as compensation for greater bankruptcy risk. Chemmanur et al. (2013) produce US evidence consistent with this hypothesis, but their sample includes annual observations for only 10% of the companies present in Compustat and reporting wage data. By contrast, Michaels et al. (2019) merge Compustat balance sheet data with wage data drawn from the Longitudinal Database of Establishments of the Bureau of Labor Statistics (BLS), which provides quarterly observations on establishments' total wage bill and employment.

[4] Serfling (2016) reports a similar finding for the US, showing that the adoption of state-level labor protection laws is associated with a reduction in firms' debt ratios.

3. Theory

As observed in the introduction, previous work on corporate leverage has neglected the possible role of employee protection in case of bankruptcy; i.e., the extent to which workers' wage and pension claims are protected by (i) seniority in liquidation procedures, (ii) rights in corporate restructuring, and (iii) government insurance schemes.

To guide the empirical analysis, here we present two simple models that yield different predictions on how these forms of employee protection affect optimal leverage. Section 3.1 lays out a model of strategic debt choice, where the firm uses leverage to improve its bargaining position vis-à-vis employees. Section 3.2 contrasts its predictions with those that follow if leverage is instead determined by a binding credit constraint.

3.1. The strategic debt model

Our strategic debt model posits, as is common in this literature, that firms can use leverage to push money off the bargaining table and so lower wages. But it also recognizes that leverage increases the likelihood of insolvency, depriving the firm of future profits and inducing workers to demand a wage premium to compensate for periods of unemployment. These costs tend to act as counterweights to the strategic gains from debt, generating an optimal level of leverage.

Section 3.1.1 describes our setting. Section 3.1.2 characterizes the equilibrium leverage in bankruptcy, assuming that the firm is liquidated and workers' claims are protected by their seniority. Section 3.1.3 replicates the analysis for corporate restructuring, assuming that workers' claims are renegotiated.

3.1.1. The setting

The firm bargains with its employees to determine the wage W and hence the division of its surplus (after deducting nonlabor costs) between shareholders and workers. Management runs the firm in the shareholders' interest, setting its wage policy and leverage so as to maximize the firm's value V, which is determined by risk-neutral investors. To generate revenue, the firm combines its initial assets with labor. Workers have reservation wage W_0. With no loss of generality, the number of workers hired by the firm is standardized to one and the risk-free interest rate to zero.

We refer to the sum of the firm's asset value and revenue as its "resources" $\tilde{R}$, which is assumed to be a uniformly distributed random variable with support $[0, \overline{R}]$. The firm is viable, in the sense that its expected resources exceed its labor costs if employees are paid their reservation wage W_0 and the firm incurs no bankruptcy costs: $\overline{R}/2 - W_0 > 0$. However, for low realizations of $\tilde{R}$, the firm may be insolvent: this occurs if such realized value falls short of the firm's debt D plus the agreed wage W; i.e., $R < D + W$. The realized value R is known to the firm and its creditors, not to employees (except in bankruptcy), but the firm may commit to communicate it credibly to employees.

Employees are interested not only in their expected income but also in the risk of job loss due to bankruptcy:

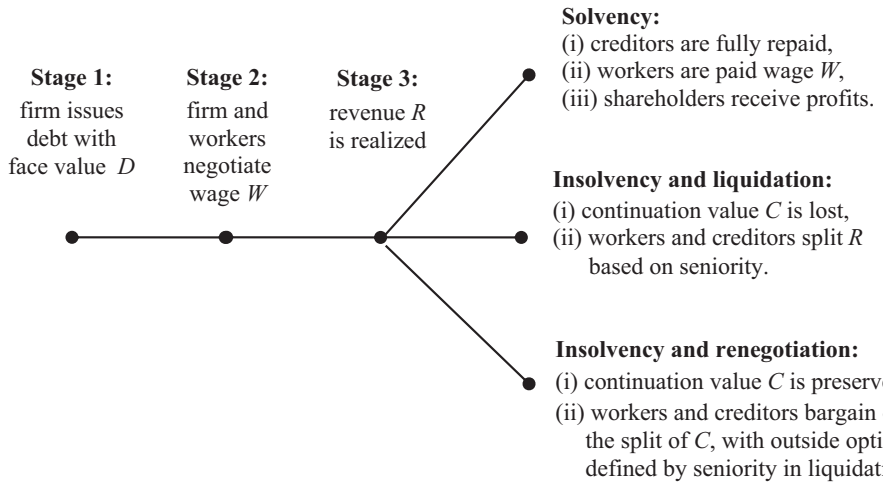

Fig. 2. Timeline of the strategic debt model.
The figure shows the timeline of strategic model of Section 3.1. In the final stage, the firm is either solvent or insolvent depending on the realized value of its resources, R. In insolvency states, either the firm is liquidated (Section 3.1.2) or its debt is renegotiated with the firm's creditors and employees (Section 3.1.3).

their utility U is the expected wage minus the expected loss from unemployment L, due to the destruction of firm-specific human capital. L is assumed to be greater in firms with more resources, which pay higher wages, as will be seen below: formally, $dL/d\overline{R} > 0$. The loss L from unemployment may be mitigated by public insurance: in several countries the government provides income support to the employees of bankrupt firms, repaying part or all of their claims; public unemployment insurance can play a further mitigating role. To capture their mitigating effect, public insurance mechanisms are assumed to absorb a fraction γ of the loss L so that workers' loss from unemployment in bankruptcy is $(1-\gamma)L$.[5] This loss weakens the union's wage demand, but is assumed not to reduce it to the reservation wage W_0, to focus on the interesting case where workers seek quasi-rents: the relevant condition is $(1-\gamma)L < \overline{R}/2$; i.e., the workers' loss from unemployment is less than the firm's expected resources.

Before bargaining with workers, shareholders issue debt with face value and pledged repayment D and collect the proceeds via a debt-for-equity swap. As Fig. 2 shows, the timeline has three stages.

At $t = 1$, the firm issues debt with face value D. Its equity is correspondingly reduced.

At $t = 2$, the firm bargains with workers over the wage W via the random proposer model of Binmore (1987): the union and management make take-it-or-leave-it offers with frequency α and $1-\alpha$, respectively, and the wage is set at the union's preferred level W_u with frequency α and at the firm's preferred level W_f with frequency $1-\alpha$, where α can be thought of as the union's bargaining power.

[5] The results would be qualitatively unchanged if under insolvency the government paid workers a fraction γ of their claims and workers bore the entire unemployment loss L. The assumption that the government absorbs a fraction γ of the loss L captures the same idea in a simpler way.

At $t = 3$ the realized value of the firm's resources, R, determines whether it is solvent or not. If the firm repays creditors and employees, it continues to operate and captures growth opportunities yielding a continuation payoff C, which is increasing in the firm's size, as measured by its maximal resources $\overline{R}$: $dC/d\overline{R} > 0$. If instead the firm is insolvent, it can be either liquidated or restructured. If it is liquidated, its resources R are shared between creditors and workers according to the seniority rules set by law, and its continuation value C is lost. This loss is avoided if creditors and employees accept a reduction of their claims so that the firm can remain a going concern. To achieve such a restructuring, creditors and employees bargain over the sharing of the continuation value, with their relative seniority in liquidation defining their respective outside options. In the following sections, we derive the equilibrium wage and leverage, first under the assumption that insolvency results in liquidation and then positing a restructuring.

Hence, the division of the firm's resources between the claimants depends not only on the terms of the debt contract signed by the firm and its creditors at $t = 1$ and the labor contract agreed at $t = 2$ but also on whether the firm is solvent at $t = 3$ and—in the event of insolvency—on the seniority of creditors' and workers' claims. We assume that in bankruptcy a fraction $1-\theta$ of the firm's debt D is senior to the workers' claim W, and the remaining fraction θ is junior. Hence, the parameter $\theta \in [0, 1]$ can be seen as a measure of the seniority rights of the employees of an insolvent company and therefore determines the balance between workers' and creditors' rights. In the extreme case where $\theta = 0$, workers are junior to all creditors; conversely, if $\theta = 1$, they are the most senior claimants.

Even if the agreed wage is a constant W, the worker's actual income $\tilde{Y}$ is stochastic, as in insolvency states (where $R < D + W$) it depends on the realized value R of

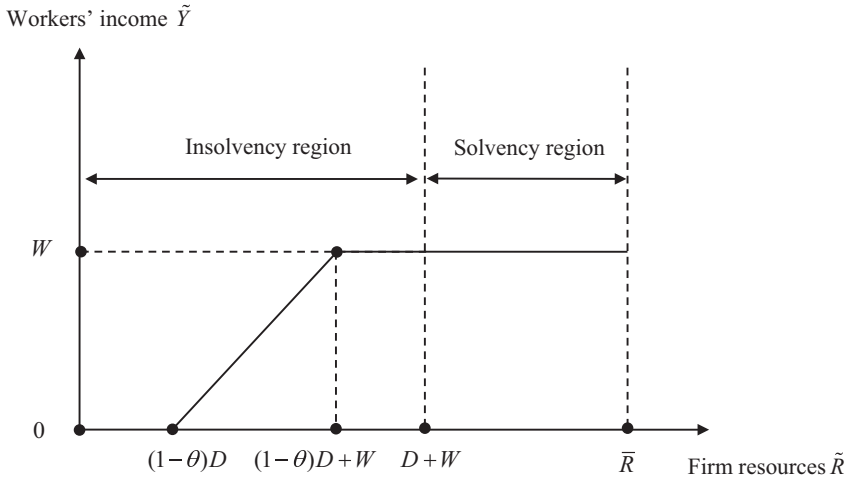

Fig. 3. Workers' income.
The figure shows workers' income $\tilde{Y}$ as a function of the firm's resources $\tilde{R}$, denoting the contractual wage by W, the face value of the firm's debt by D and employee seniority by $\theta \in [0, 1]$.

the firm's resources. The value of R determines one of four possible outcomes as shown in Fig. 3:

(i) default on senior debt: if R falls short even of the face value of senior debt $(1-\theta)D$, the firm defaults on all creditors and on workers, whose payoff in this region is zero;
(ii) default only on workers and junior debt: if R covers the senior debt $(1-\theta)D$ but not the entire workers' claim, i.e., if $R \in [(1-\theta)D, (1-\theta)D+W)$, the payment to workers is $Y = R-(1-\theta)D$ and that to junior creditors is zero;
(iii) default only on junior debt: if R covers both senior debt and the workers' claim W, but not all of junior debt θD, i.e., if $R \in [(1-\theta)D+W, D+W)$, workers receive $W$and junior creditors receive $R-(1-\theta)D-W$;
(iv) no default**:** if R covers both the workers' claim W and the face value of all debt D, i.e., if $R \in [W+D, \overline{R}]$, senior creditors, workers and junior creditors are repaid in full.

The wage W determined by bargaining at $t=2$ differs depending on whether it is set by the union or the firm, not only because they have different objectives but also because they may condition on different information. Even though the firm can commit to inform employees of the realized value of resources R, it has the incentive to do so only when it sets the wage itself because in this case it can lower its expected bankruptcy costs by indexing the wage to R rather than promising a fixed wage. When instead the union makes the take-or-leave-it offer, the firm has no incentive to reveal its resources R, as this would enable the union to appropriate them entirely.

Thus the union sets a fixed contractual wage W_u, but the actual income $\tilde{Y}_u$ of employees is a random variable taking different values in the different regions (i)–(iv). The union sets W_u so as to maximize workers' utility, i.e., their expected income minus the expected loss from unemployment, net of the fraction γ absorbed by public insurance:

$$U = E(\tilde{Y}_u) - \pi_u(1-\gamma)L, \tag{1}$$

where π_u is the probability of bankruptcy when the union sets the wage W_u. If instead the firm makes the take-it-or-leave-it offer, it will set the wage schedule $W_f(\tilde{R})$ so as to maximize its expected profits. Hence, this schedule (i) must induce employees to work at the lowest cost, meeting their participation constraint with equality:

$$\mathrm{E}\left[W_f(\tilde{R})\right] = W_0 + \pi_f(1-\gamma)L, \tag{2}$$

where π_f is the probability of bankruptcy when the firm sets the wage, and (ii) must minimize the likelihood of bankruptcy, as in this case bankruptcy costs are not offset by gains in wage bargaining, the firm already having all the bargaining power.

3.1.2. Equilibrium under liquidation in bankruptcy

Equilibrium wages and leverage are found by backward induction, deriving first the wages set at $t=2$ and then the value-maximizing debt chosen by shareholders at $t=1$, under the assumption that in insolvency the firm is liquidated.

When the union sets the wage (which happens with frequency α), it will choose the wage W_u that maximizes the workers' utility in Eq. (1), namely:

$$W_u^* = \overline{R} - (1-\theta)D - (1-\gamma)L, \tag{3}$$

which for an unlevered firm exceeds the reservation wage W_0, recalling that $W_0 < \overline{R}/2$ and $(1-\gamma)L < \overline{R}/2$ by assumption. The wage set by the union is increasing in the firm's maximal resources $\overline{R}$ (as well as their expected value $\overline{R}/2$). Intuitively, when the firm has abundant resources, employees know that it can accommodate aggressive wage demands, unless at $t=1$ it has issued a great deal of debt D. But this strategic value of leverage is diminished by the workers' seniority θ and eliminated altogether in the extreme case in which the workers' entire claim is senior to the firm's other debt ($\theta = 1$).

When instead the firm sets the wage (which happens with frequency $1-\alpha$), it chooses a wage schedule $W_f(\tilde{R})$ that (i) just meets the workers' participation constraint (2) and (ii) minimizes bankruptcy costs. As long as these conditions are met, the form of the wage schedule is irrelevant. To minimize the likelihood of bankruptcy, the firm will set the wage at zero in states in which it cannot fully repay its debt D and increasing in R in solvency states. Then, the firm will never default on its employees, as it pledges to pay them only in solvency states.[6] Hence, when the firm possesses all the bargaining power, it indexes wages to its performance and sets their expected value according to expression (2), where the default probability is simply $\pi_f = D/\overline{R}$.

Using the wages (2) and (3) to compute the firm's labor costs, probability of default and value as of $t=1$, one obtains the value-maximizing debt level (see Appendix A.1):

$$\hat{D}_l = \frac{\overline{R}}{1-\theta} - \frac{1-\alpha(1-\theta)}{\alpha(1-\theta)^2}C - \frac{1-\alpha}{\alpha(1-\theta)^2}(1-\gamma)L, \quad (4)$$

where the subscript l is a mnemonic for "liquidation" in insolvency states. Hence the optimal level of debt balances the benefit of lower wages from its strategic use in bargaining (the first term) against the costs of a more likely bankruptcy, which consist in the forgone continuation payoff C (the second term) and the loss L for employees (the third term). The optimality condition (4) is valid only if $\theta < 1$, i.e., if the employees' claims are not all senior to other debt, since only in this case leverage has strategic value.

Eq. (4) yields predictions concerning the response of the optimal level of debt to changes in employees' bargaining power and in their rights in case of liquidation:

Proposition 1 (optimal debt under liquidation). *The optimal debt level is (i) increasing in employees' bargaining power α and in public insurance coverage γ; (ii) increasing in employees' seniority θ if the bankruptcy cost is below a critical threshold, and decreasing otherwise; and (iii) positive only if employees are junior to some creditors' claims ($\theta < 1$).*

This proposition is proved in Appendix A (as are subsequent ones). The intuition regarding the effect of workers' bargaining power α and public insurance γ is straightforward: maximizing the firm's value requires high leverage to compress wage demands in situations where unions are strong and employees are well protected from unemployment risk. The first prediction is in line with the literature on strategic debt, the second with Agrawal and Matsa (2013).

The prediction regarding employees' seniority θ is novel: as their seniority reduces the strategic value of debt, in the presence of a higher θ more leverage is required to achieve the same deterrence of workers' demands. But this also increases the likelihood of bankruptcy so that beyond some critical level of bankruptcy cost, the firm will react to stronger worker seniority rights by scaling down leverage.

Finally, the firm will issue debt only if employees are junior to at least some creditors ($\theta < 1$): if they were senior to all other claimants ($\theta = 1$), leverage would have no strategic value, which in this model is its only benefit. Of course, leverage may still be positive if it were allowed to have other advantages, such as tax shield benefits.

The analysis so far neglects that debt D cannot induce the union to set a wage lower than workers' reservation utility, i.e., exceed the level that meets their participation constraint $\mathrm{E}(\tilde{Y}_u|W = W_u^*) \geq W_0 + \pi_u(1-\gamma)L$. If this constraint binds, leverage is unambiguously increasing in employee seniority θ, because seniority tends to raise employees' expected income, calling for more debt to drive their expected income down to its reservation level. In this case, leverage is increasing in public insurance γ, as in Proposition 1, but is invariant to workers' bargaining power, as workers are already at their reservation utility. (These comparative statics are proved in Appendix A.3).

While Proposition 1 focuses on the comparative statics of the level of debt, our empirical tests will focus on how the model parameters affect the change of debt in response to changes in firm resources. This will allow us to exploit not only country-level variation in employees' rights in bankruptcy but also firm-level variation in asset values and profitability. Thus, the predictions of the following proposition are central to our tests:

Proposition 2 (optimal debt response to changes in firm's resources under liquidation). *For $\theta \in [0,1)$, the change of the firm's optimal debt $\hat{D}_l$ in response to a change in its expected resources $\overline{R}/2$ is (i) increasing in employees' bargaining power α and public insurance coverage γ and (ii) increasing in their seniority θ if the implied increase in bankruptcy costs is below a critical threshold, and decreasing otherwise.*

The intuitive rationale for result (i) is that when the value of the firm's assets or its revenue are expected to increase, shareholders want to increase leverage more if unions are powerful and if employees are well insured against bankruptcy risk. To understand result (ii), consider first a situation where shareholders expect an increase in the firm's asset value or revenue (a larger $\overline{R}/2$) without any impact on its continuation payoff C: the stronger workers' seniority rights, the larger the increase in leverage required to deter workers from trying to appropriate the windfall. If instead shareholders expect a permanent increase in the firm's resources, i.e., also a greater continuation value C, they will be wary of issuing more debt if employees have strong seniority rights, for fear of compromising the firm's now brighter growth opportunities. In fact, if prospects have improved sufficiently, they will want to reduce corporate debt so as to offset the bankruptcy risk created by aggressive wage demands from employees with strong seniority protection. As in Proposition 1, these predictions are conditional on workers being junior to at

[6] The results would be qualitatively unchanged (at the cost of additional complexity) if the firm were to pledge a constant wage to its workers also when it is allowed to set the wage. In this case the firm might default on its employees as well as on its creditors. Hence, its shareholders would bear the costs associated with bankruptcy more often, without any countervailing labor cost savings. Moreover, since bankruptcy would occur more often, workers would have to be paid a higher expected income to compensate them for the greater expected unemployment loss.

least some other claims ($\theta < 1$), as otherwise debt has no strategic value.

3.1.3. Debt renegotiation in bankruptcy

So far, insolvency has been assumed to result in liquidation, with creditors and employees recovering what they can of their claims according to their seniority. This assumption is reasonable if corporate debt is hard to renegotiate, as when creditors are dispersed. If instead creditors are concentrated (just a few banks, say) and can thus coordinate, they have an incentive to renegotiate their debt with workers so as to adapt their claims to the firm's actual value and keep it operating as a going concern, thereby preserving its continuation value C, which would be lost under liquidation.

In this case, in the last stage of the model's timeline in Fig. 2, $t = 3$, renegotiation replaces liquidation, the lowest branch being the relevant one in case of insolvency: after the realization of the firm's resources R, creditors and workers bargain over the sharing of C. Their respective outside options are the payoffs that they could obtain if the firm were liquidated. Like wage bargaining between the firm and workers at $t = 2$, debt renegotiation between creditors and workers at $t = 3$ is formalized via the random proposer model, workers and creditors making take-or-leave-it offers with frequencies β and $1 - \beta$, respectively. Hence, the parameter β captures the bargaining power of workers vis-à-vis creditors in debt renegotiation, which may differ from their bargaining power α in wage negotiations because it does not depend just on union power but also on workers' rights in corporate restructurings. Depending on such rights, workers may be either more or less accommodating in debt renegotiation than they are in wage bargaining.

Thus, by comparison with liquidation, debt renegotiation generates an additional expected quasi-rent βC for workers and additional value $(1 - \beta)C$ for creditors.[7] The anticipation of these payoffs in insolvency affects both the wage chosen by workers at $t = 2$ and the firm's value and optimal leverage at $t = 1$ (see Appendix A.4). The prevalent effect of the parameter β on firm value turns out to be negative. Intuitively, renegotiation preserves the continuation payoff C in insolvency and enables creditors to appropriate a fraction $(1 - \beta)$ of it. Hence, it increases the firm's value V by $(1 - \beta)C$. The greater employees' rights in renegotiation β, the smaller this increase in firm value.

Through this channel, β lowers optimal leverage: the larger the portion of the continuation payoff eventually appropriated by employees rather than creditors, the higher the cost of bankruptcy to the firm. To see this, consider two limiting cases: if $\beta = 0$ (i.e., if creditors appropriate the entire continuation payoff), an insolvent firm bears no bankruptcy cost; at the other extreme, with $\beta = 1$ none of the continuation payoff goes to creditors so that bankruptcy costs are maximal, as high as under liquidation. Hence, if $\beta = 1$, maximizing the firm's value requires much less leverage than if $\beta = 0$. More generally, the higher β, the smaller the firm's incentive to issue debt, a negative effect that prevails over the ambiguous effect via average employee compensation, as shown by the following expression for optimal debt (derived in Appendix A):

$$\hat{D}_r = \frac{\overline{R}}{1-\theta} - \frac{\theta}{(1-\theta)^2}\beta C - \frac{1-\alpha}{\alpha(1-\theta)^2}(1-\gamma)L, \qquad (5)$$

where the subscript r stands for "renegotiation." The difference between the optimal debt under renegotiation $\hat{D}_r$ and its analogue under liquidation $\hat{D}_l$ in Eq. (4) lies in the second term, which captures the response of debt to continuation value: the greater the bargaining power of employees in renegotiation, the lower the initially chosen debt level. For the other parameters, the comparative statics of $\hat{D}_r$ are qualitatively similar to those of $\hat{D}_l$:

Proposition 3 (optimal debt under renegotiation). *The optimal debt level is decreasing in employee renegotiation rights β. Its responses to employees' wage bargaining power α, seniority θ, and public insurance γ have the same sign as under liquidation (Proposition 1).*

As already mentioned, the intuition for the first result is that workers' bargaining power β in debt renegotiation increases the firm's bankruptcy cost (when workers' participation constraint is slack), and this calls for lower debt $\hat{D}_r$ to reduce the likelihood of insolvency. Hence workers' bargaining power β vis-à-vis creditors at the renegotiation stage induces less issuance, while workers' bargaining power in wage negotiations, α, calls for greater debt issuance as a strategic device if the firm is liquidated in insolvency states. The prediction is that corporate debt should be lower where workers have better legal protection in the reorganization of insolvent firms and larger where workers have stronger bargaining power in wage negotiations.

Also if the debt of an insolvent firm is renegotiated, it cannot be so large as to violate the employees' participation constraint. Thus, as in Section 3.2, if the debt level $\hat{D}_r$ in Eq. (5) violates this constraint, the firm's leverage will be set at a lower level, $\overline{D}_r$, that leaves workers at their reservation utility. As shown in Appendix A.5, in this case an increase in the fraction β of the continuation payoff accruing to employees leads to an increase in leverage: intuitively, as a larger β would increase employees' expected payoff, the firm will want to reduce it down to its reservation level by issuing a larger debt $\overline{D}_r$.

The predictions on the level of the optimal debt $\overline{D}_r$ under renegotiation also extend to its response to changes in the firm's expected resources. Since the continuation payoff is assumed to be increasing in the value of the firm's expected resources $\overline{R}/2$, an increase in the latter calls for a reduction in leverage if employees can appropriate a comparatively large fraction β of the continuation payoff:

Proposition 4 (optimal debt response to changes in surplus under renegotiation). *For $\theta \in [0, 1)$, the change of the firm's optimal debt $\hat{D}_r$ in response to a change in its expected resources $\overline{R}/2$ is (i) decreasing in employee renegotiation rights β and (ii) is affected by employees' wage bargaining*

[7] This additional quasi-rent βC is assumed not to exceed the workers' loss from unemployment $(1 - \gamma)L$ so that, even when the firm's debt is renegotiated, bankruptcy inflicts a net loss $(1 - \gamma)L - \beta C > 0$ on its employees, over and above their expected loss of labor earnings.

power α, seniority θ, and public insurance coverage γ as under liquidation (Proposition 2).

3.2. Model with credit constraints and no strategic leverage

It is useful to compare the predictions of the strategic leverage model presented so far with those produced by a model in which corporate debt is determined by a binding credit constraint, i.e., cannot be set strategically to strengthen the firm in wage bargaining. Such an alternative model can be obtained with just two changes to the foregoing model.

The first change is a reversal of the timing of debt issuance and wage bargaining: the firm chooses its debt level after, rather than before, the wage bargaining stage as in the timeline of Fig. 2. Hence it can no longer precommit to a given debt level for wage bargaining purposes: at $t = 2$, when it chooses its debt, the wage has already been set. Conversely, workers, in bargaining with the firm at $t = 1$, set their wage demands in anticipation of the debt that will be issued at $t = 2$.

The second change is to introduce credit rationing: at the issuance stage the firm can undertake a profitable and scalable investment whose future cash flow, unlike its resources $\tilde{R}$, cannot be pledged to creditors due to moral hazard or noncontractibility.[8] By the same token, the continuation payoff C cannot be pledged to creditors.

Hence, the firm's investment is determined by its debt capacity, i.e., the resources $\tilde{R}$ that it can pledge to creditors. Under our assumptions of risk neutrality and no discounting, the funds that the firm can raise at $t = 2$ equal the market value of its debt:

$$V_D = \frac{D^2}{2\overline{R}} + D\frac{\overline{R} - D}{\overline{R}} - \alpha\theta D\frac{W_u}{\overline{R}}, \tag{7}$$

as shown in Appendix A.6. The sum of the first two terms would be the market value of debt if creditors were totally senior to workers; i.e., $\theta = 0$: specifically, the first term is the expected value of the payoff accruing to creditors in insolvency states, while the second is its expected value in solvency. The last term instead captures the reduction in the debt's value due to workers' seniority rights θ and their wage bargaining power α: intuitively, both parameters increase labor costs, and, insofar as workers are senior to creditors, these costs reduce the payoff that can be pledged to creditors in case of bankruptcy.

When issuing debt at $t = 2$, the firm exploits its debt capacity to the full. That is, it sets the face value D at $D_{\max}$, the level that maximizes V_D in expression (7):

$$D_{\max} = \overline{R} - \alpha\theta W_u. \tag{8}$$

This expression shows that the firm's debt is increasing in the maximal amount of resources that it can pledge to creditors ($\overline{R}$) and decreasing in the wage set by the union at $t = 1$, W_u, to an extent that depends both on workers' bargaining power α and seniority θ: the operating leverage due to labor costs tends to crowd out financial leverage, with both α and θ determining the extent of the crowding out.

Expression (8) still contains an endogenous variable, namely the contractual wage W_u. In setting this, the union allows for the fact that at $t = 2$ the firm will issue debt $D_{\max}$ so that W_u is obtained by combining expressions (3) and (8):

$$W_u^* = \overline{R} - (1-\theta)D_{\max} - (1-\gamma)L = \frac{\theta\overline{R} - (1-\gamma)L}{1 - \alpha\theta(1-\theta)}. \tag{9}$$

It is easy to see that the wage W_u^* chosen by the union is increasing in the workers' bargaining power α, their seniority θ, and in the public insurance coverage γ.

Substituting the optimal wage (9) into Eq. (8) yields the book value of debt at $t = 1$:

$$D_{\max} = \frac{(1-\alpha\theta)\overline{R} + \alpha\theta(1-\gamma)L}{1 - \alpha\theta(1-\theta)}, \tag{10}$$

which has the following comparative statics properties:

Proposition 5 (optimal debt with binding credit constraint).

(i) *If the firm is subject to a binding credit constraint, its debt is decreasing in the workers' bargaining power α, workers' seniority θ, and public insurance coverage γ.*

(ii) *The change in debt in response to a change in the firm's expected resources $\overline{R}/2$ is also decreasing in α, θ, and γ if the equilibrium wage is increasing in $\overline{R}$.*

Proposition 5 contrasts with Propositions 1 and 2 for the strategic leverage model. First, workers' seniority, bargaining power, and public insurance reduce rather than augment corporate debt: intuitively, they reduce the firm's debt capacity rather than prompting it to counteract workers' bargaining power with more debt. Here "operating leverage reduces financial leverage," as in Simintzi et al. (2015). Second, and importantly for our empirical tests, workers' seniority, bargaining power, and public insurance reduce the positive response of leverage to increases in the firm's resources. By contrast, in the strategic debt model such response is amplified by workers' bargaining power, public insurance, and workers' seniority unless the firm's continuation value is very high.

4. The empirical strategy

As illustrated in the previous section, the strategic debt model and the credit rationing model yield different predictions about the impact of employees' rights in bankruptcy on corporate leverage and its response to changes in asset value and profitability. This section describes our empirical strategy for taking these predictions to the data.

4.1. Baseline specification

The most complete specification of our leverage regression is

$$\Delta D_{ijct} = (\lambda_0 + \lambda_1\theta_c + \lambda_2\gamma_c + \lambda_3\alpha_c + \lambda_4\beta_c)\cdot S_{ijt-1} + \delta' X_{ijct-1} + \mu_{cjt} + \varepsilon_{ijct}, \tag{11}$$

where the subscripts i, j, c, and t index firms, industries, countries, and years. ΔD_{ijct} is the change in the leverage

[8] The analysis can easily be extended to the case where the cash flow from the new investment or the firm's continuation payoff C can be pledged partially to the firm's creditors.

ratio (defined as the book value of debt divided by lagged total assets) of firm i in industry j, country c, and year t. In some specifications, we estimate a linear probability model where the dependent variable equals one if firm i's debt issuance exceeds 1% of its lagged total assets, and zero otherwise, as in Leary and Roberts (2014). S_{ijct-1} measures the shock to firm i's resources, namely a change in the value of its real estate or in its profits as measured by earnings before interest, tax, depreciation and amortization (EBITDA) scaled by total assets in year $t-1$. θ_c, γ_c, α_c, and β_c are country-level characteristics: θ_c measures employees' seniority in firm liquidation, γ_c the public insurance coverage of their claims in bankruptcy, α_c their bargaining power in wage negotiations as proxied by union density, and β_c their rights in debt renegotiation.[9] X_{ijct-1} is a vector of company-specific controls measured in year $t-1$, namely the change in firm size (log of total assets), asset tangibility (ratio of plant, property, and equipment to total assets), growth opportunities (market-to-book ratio), and investment (capital expenditure scaled by lagged total assets).[10] Finally, μ_{cjt} is a country-industry-time effect and ε_{ijct} the error term. Being in first differences, the specification is similar to level specifications that include firm fixed effects. We also estimate more basic specifications that include country-industry effects μ_{cj} and year effects μ_t instead of their interaction μ_{cjt} and omit firm-level controls X_{ijct-1}.

The coefficient λ_0 measures the response of changes in leverage to a shock to firm i's resources S_{ijct-1}. The coefficients λ_1, λ_2, λ_3, and λ_4, respectively, measure how this response is affected by employee seniority in liquidation, public insurance coverage of their claims, their wage bargaining power, and their rights in debt renegotiation.

The coefficient λ_1 allows the leverage response to the shock to differ depending on workers' seniority in bankruptcy. Recall that in the strategic debt model a transitory shock S_{ijct-1}should be associated with a larger increase in leverage ($\lambda_1 > 0$) for a firm whose employees have high seniority than for an identical firm with lower-seniority employees. The coefficient can switch signs ($\lambda_1 < 0$) in the case of a permanent increase in firm resources. The credit rationing model instead unambiguously predicts $\lambda_1 < 0$, as employee seniority reduces the extent to which an increase in the firm's resources expands its debt capacity.

Moreover, if the firm uses debt strategically, its leverage should respond more to the shock S_{ijct-1} if its employees are well protected by public insurance coverage in bankruptcy ($\lambda_2 > 0$) and have strong bargaining power ($\lambda_3 > 0$). In these cases too, the credit rationing model predicts the opposite ($\lambda_2 < 0$ and $\lambda_3 < 0$). Finally, the strategic debt model predicts that the shock S_{ijct-1} should lead to a smaller increase in leverage if the firm's employees have strong rights in debt renegotiation ($\lambda_4 > 0$). Recall that, via this channel, a higher bargaining power of employees (at the renegotiation stage) can lead to a negative response of leverage, as in the credit-constraint model.

We use two different identification strategies, based on two different types of shocks S_{ijct-1} to firm resources: a change in the value of the firm's real estate, arising from changes in country-level real estate prices, and a change in profitability, arising from fluctuations in the prices of commodities.

4.2. Identification based on real estate prices

In the first identification strategy, the variable S_{ijct-1} in Eq. (11) is proxied by the percentage change in the market value of the firm's real estate holdings, defined as the product of the market price of real estate in country c where firm i is located and firm i's initial real estate holdings. This market value thus varies over time as well as between firms in each country.

Employees' rights in bankruptcy θ_c, γ_c, and β_c, are time-invariant country-level variables (see Section 4).[11] In specification (11), their impact on changes in leverage is identified by their respective interaction with the change in the value of the firm's real estate, which is a triple interaction between the change in the real estate index in country c in year t, the initial real estate holdings of firm i and workers' rights in bankruptcy. This interaction varies over time, across firms and countries, allowing our specification to include time and country-industry effects or country-industry-time effects. In the latter case, we control for any time-changing variable at the country and industry level.

This addresses one possible concern with our specification, namely that the coefficients could be biased by spurious correlations due to macroeconomic shocks that affect both property prices in country c and the leverage of firms in that country: such shocks may affect country-level investment opportunities and thereby both the demand for domestic real estate and the leverage choices of firms in that country. The inclusion of country-industry-time effects in our specification absorbs the country-level variation in real estate prices and in their interaction with bankruptcy law indicators. But the variation in firms' real estate holdings – i.e., in their exposure to property price shocks – within each country and industry still enables us to identify the coefficients of interest. Spurious correlation is not a problem if there are no omitted variables that correlate systematically both with firm-level exposures to real estate shocks and with changes in leverage within country-industry cells. The validity of our identification rests on this assumption.

It should also be recalled that our coefficients of interest are those of the interactions between real estate shocks and country-level indicators of workers' rights in bankruptcy. Hence, to invalidate the identification of these coefficients, firm-level omitted variables should correlate with the interaction between firm-level exposures to real

[9] As an alternative measure of the wage bargaining power, we use the degree of employment protection offered by national legislation: see Table B.2.4 of the Online Appendix. Moreover, in some specifications we measure γ_c also by the replacement rate of the public unemployment insurance system, which may contribute to protect the employees of bankrupt firms: see Table B.2.5 of the Online Appendix.

[10] In regressions where the shock is the change in the value of the firm's real estate assets, the controls X_{ijct-1} also include the change in profitability, as measured by EBITDA scaled by total assets.

[11] The only exception is Brazil, where a reform was enacted in 2005.

estate shocks and workers' rights, as well as with changes in leverage within country-industry cells.

To measure the market value of each firm's real estate assets, we multiply its holdings as given in the balance sheet at historical cost by country-level real estate indices. Property assets consist of land and buildings. To compute market values, we use only the land component as in Cvijanovic (2015). We want our measure to exclude the changes in firms' physical stock of land via acquisitions or sales during the sample period, to avoid problems of endogeneity. Accordingly, properties are valued at the historical cost in the year in which the relevant firm first appears in our data set.[12] This initial level is then inflated by the residential real estate price index of the corresponding country and scaled by the lagged book value of the firm's property, plant, and equipment (PPE).

4.3. Identification based on commodity prices

Our alternative identification strategy estimates the response of the change in firm's leverage to changes in profitability. An obvious concern is that profitability is likely to be affected by leverage. Therefore, we focus on changes in commodity prices as an exogenous source of variation in firm-level profitability, as in Bertrand and Muillanathan (2001), and use IV estimation to address this endogeneity issue: the change in profitability (i.e., change in EBITDA divided by total assets) is instrumented with the percentage changes in the price indices of crude oil, gold, iron ore, platinum, and copper. In the first-stage regressions, the coefficients of the change in these commodity prices are allowed to vary across 15 North American Industry Classification System (NAICS) industries since differences across industries' input and output compositions can generate different exposures to commodity prices. The second-stage estimates how the change in leverage responds to the exogenous shocks to profitability induced by commodity price changes.

This approach exploits variation over time, across countries and across industries to identify the impact of workers' rights in bankruptcy: in the second stage, the interaction term varies over time owing to fluctuations in commodity prices, across countries owing to differences in our indicators of employees' rights, and across industries owing to their differential exposures to commodity prices. In this case, the variation in exposures arises from the industry-specific first-stage coefficients, while in the approach based on real estate prices it derives from firm-level differences in holdings. Since the second-stage regressions include country-industry and time effects, biases in the estimates due to spurious correlation are not a concern if there are no omitted variables that correlate systematically over time both with the industry-level exposures to commodity price shocks and with industry-level changes in leverage within each country. The validity of this identification strategy rests on this assumption.

[12] Thus, for older firms that have been in our data set from the beginning, this year is 1988. For younger firms, which enter later in our sample, it is their initial public offering (IPO) year.

5. The data

To apply our empirical methodology, we collect data on employees' rights in bankruptcy in various countries and merge them with firm-level data and other national variables in the same countries. The variables are drawn from several sources (see Appendix B for details). Accounting and financial data for firms outside the US are from Worldscope and Osiris and for US firms from Compustat, resulting in a data set for listed corporations in 29 countries in the period 1988–2015. We screen out financial institutions and utilities, as well as firms with less than four years of data, and winsorize the data below the 1st and above the 99th percentile: the four-year cut-off trades off the need for enough observations per firm with the avoidance of survivorship bias. This leaves us with 22,592 firms and 291,428 firm-year observations. Table 1 shows the descriptive statistics of the firm variables in our sample, both in levels and in first differences.

Country-level data on workers' employment protection and union density are taken from the Organisation for Economic Co-operation and Development (OECD) data sets. Our real estate price data come from the Bank for International Settlement database, which contains national real estate price indices for all our sample countries. Commodity prices are drawn from Bloomberg.

5.1. Employee protection in bankruptcy

To quantify the legal rights of employees in bankruptcy procedures, we construct a novel data set, derived principally from a detailed questionnaire (shown in Section A of the Internet Appendix) submitted to law firms that are part of the Lex Mundi project and to expert legal scholars. We received one questionnaire per country. Table 2 shows the most important rights of employees in bankruptcy in each country for which we have data.

5.2.1. Employee claim seniority in liquidation

The first issue on which the questionnaires provide information is the seniority relative to the claims of other creditors, in the case of a company's liquidation, of employees' (i) unpaid salaries and wages, (ii) severance pay, and (iii) entitlements to employers' pension plan contributions. The questionnaires consider five types of creditors potentially competing with these employee claims: (a) those with liens on property (e.g., a real estate mortgage); (b) the bankruptcy trustee, for administrative expenses; (c) post petition creditor positions; (d) local or central government, for income and other tax liabilities; and (e) unsecured creditors. So altogether, each of the three types of employee claims sits in an eight-part seniority ranking, in which some claims may have the same seniority, i.e., may be "tied." Absent ties, we rank the claims on a scale from one for the most junior to eight for the most senior; in case of ties, we apply the average-rank method proposed by Kendall (1945), i.e., assign to all the tied claims the average of the ranks involved.

Hence the questionnaires enable us to establish the seniority of each of the three types of workers' claim (unpaid

Table 1
Descriptive statistics.
The table presents firm-level descriptive statistics of the variables used in the regressions. The sample contains firm-year observations of 22,592 firms incorporated in 29 countries, over the period 1988–2015. Variables are defined in Appendix B.

		Levels			First differences		
	No. of observations	Mean	Median	Standard deviation	Mean	Median	Standard deviation
Book leverage	291,418	0.2507	0.2192	0.28	0.003	0.000	0.11
Market leverage	291,418	0.2683	0.2245	0.26	0.004	0.000	0.13
Assets (in log)	291,418	9.52	9.36	3.32	0.124	0.098	0.58
Market-to-book ratio	291,418	1.6418	1.1702	6.14	−0.021	−0.008	0.71
Investments	291,418	0.0708	0.058	0.05	−0.001	0.000	0.09
Return on assets	291,418	0.0401	0.0548	0.14	0.002	0.000	0.08
PPE ratio	291,418	0.3229	0.3024	0.2001	−0.003	0.000	0.09

Table 2
Country-level descriptive statistics.
The table shows country-level descriptive statistics of indicators of employees' rights in bankruptcy, labor market, and creditors' rights. Variables are described in Appendix B.

	Workers' seniority (Pension) (1)	Workers' seniority (Wages) (2)	Worker rights in restructuring (3)	Government insurance coverage (4)	Union density (5)	Employment protection legislation (6)
Australia	4.5	4.5	1	0	34.49	1.11
Austria	5.5	7	4	1	43.68	2.12
Belgium	4	4	1	1	52.98	2.53
Brazil (before reform)	7	7	4	0	31.22	2.75
Brazil (after reform)	3	5	4	0	28.75	2.75
Canada	5.5	5.5	6	0	32.21	0.75
Czech Rep.	6	6	4	0	39.72	1.93
Denmark	4	4	4	1	75.59	1.74
Finland	3	3	6	2	73.73	2.09
France	7	7	2	1	10.76	3.01
Germany	3	3	1	2	29.29	2.55
Greece	3	5.5	4	0	33.24	3.26
Hong Kong	5	5	1	0	21.58	n.a.
India	6	6	2	0	21.92	2.77
Ireland	1.5	1.5	4	1	49.41	0.99
Israel	2	5.5	1	1	30.91	1.37
Italy	3	5.5	4	1	38.74	2.69
Japan	2	4.5	4	0	24.45	1.59
Mexico	6	7.5	1	0	18.26	3.13
Netherlands	4	4	4	2	25.31	2.40
New Zealand	4	4	4	0	38.37	1.15
Norway	6.5	6.5	4	1	56.48	2.70
Poland	4	4	4	2	33.02	1.53
South Korea	4.5	4.5	1	0	13.10	2.32
Spain	1.5	7.5	2	0	13.86	3.16
Sweden	3	4.5	4	1	79.90	2.47
Switzerland	4.5	4.5	4	0	22.86	1.14
Turkey	4	4	4	0	14.16	3.74
United Kingdom	5.5	5.5	5	1	37.05	0.66
United States	1.5	4.5	2	1	15.24	0.21

wages, severance pay, and employers' pension plan liabilities). In most of our regressions, however, we measure employee seniority—the empirical counterpart of parameter θ in our model—only by the seniority of the contributions owed by employers to pension plans, as this claim is likely to exceed unpaid wages or severance pay. In any case, the rankings of all three types of employee claim are closely correlated, as shown in Table B.1 of the Internet Appendix, which reports the correlations between the different measures of workers' rights in bankruptcy and between these and other country-level institutional features, such as employment protection and unemployment insurance.

Column 1 of Table 2 shows the rank of employers' contributions to employee pension plans. Where there are no ties, in countries where this is the most senior claim, it is ranked eight; where it is second most senior, seven; and so on. In case of ties with other claims, it gets the average rank. Column 1 shows that claim seniority differs very substantially from country to country. In Brazil (prior to the 2005 bankruptcy reform) and France, employees have the highest seniority in the liquidation of insolvent companies (a rank of 7), before all other creditors. In some other countries it is much lower: in Ireland, Spain, and the United States employee claims are ranked at the bottom (their pension claims score 1.5). Elsewhere employee claim

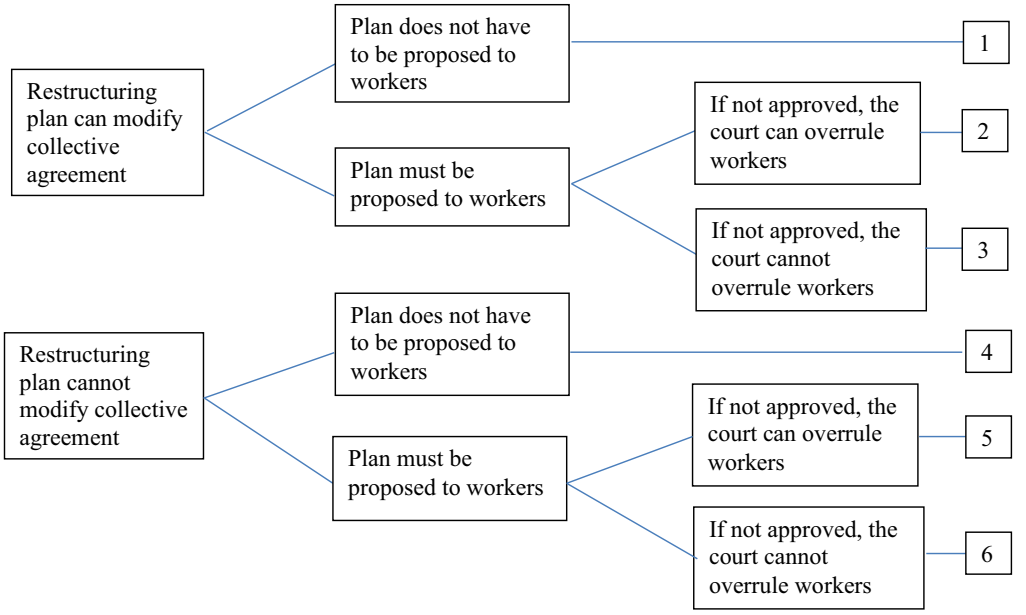

Fig. 4. Algorithm used to measure workers' rights in firm restructuring.
The figure illustrates the algorithm used to assign numerical values ranging from 1 to 6 to the replies to the questionnaire in the part where it investigates when the restructuring plan of an insolvent firm can impair workers' rights established by collective bargaining. Higher values of the resulting measure correspond to stronger workers' rights in firm restructuring.

seniority falls between these two extremes: it is low in Japan, Germany, Sweden, and Denmark and rather high in Norway, the Czech Republic, India, and Mexico. Column 2 shows, as noted above, that the seniority of employees' unpaid wages is closely correlated with that of their pension plan entitlements.[13]

5.2.2. Public insurance of employees of insolvent firms

Even if employees' seniority is low, the government can effectively secure their claims (wholly or partly) by a public insurance fund. Thus in countries where workers have low seniority, a government-mandated insurance fund can mitigate the cost of bankruptcy to workers by covering unpaid salaries, pension contributions, and/or severance pay, possibly capped at some fraction of the claims. Hence we class countries into three groups: (i) those with no public insurance fund, (ii) those with capped public insurance, and (iii) those with uncapped insurance funds. To measure the coverage of public insurance in bankruptcy, i.e., parameter γ in the model, we assign values zero, one, and two, respectively, to countries in these three groups.

Column 3 of Table 2 shows these national values for pension contributions. Most countries provide such insurance, but the amount covered varies significantly and is not systematically correlated with employee seniority. For example, in Brazil and Greece there is no government-mandated insurance, in Italy and Sweden insurance provision is capped, and in Germany it is uncapped, but pension contributions have the same seniority in all five countries (for Brazil, after the reform). Conversely, in Spain, Japan, Turkey, Australia, and Mexico, whose governments do not insure pension contribution liabilities, workers' seniority scores are 1.5, 2, 4, 4.5, and 6, respectively.

5.2.3. Employee rights in corporate restructuring

Our questionnaire also asks about workers' rights in corporate restructuring, specifically whether or not the restructuring plan can impair employee rights established by collective bargaining and whether their consent to the plan is required. The two points are not necessarily related: the law may require the consent of workers even for a restructuring plan that does not infringe collective bargaining agreements.

Column 4 of Table 2 shows a measure of workers' rights in restructuring—the empirical counterpart of parameter β in our model—which is obtained by ranking the relevant replies from 1 (greatest impairment, hence least protection of workers' rights) to 6 (least impairment, hence strongest protection). Fig. 4 shows how the relevant replies are mapped hierarchically onto these values: first, whether or not collective bargaining agreements can be modified by the plan; next, whether the plan must be presented to employees' representatives for approval; and finally, whether the plan can be carried out even without approval, if authorized by court (possibly in a modified version).

Again, there is significant international heterogeneity: in France and the United States, where our indicator is equal to two, and in Germany and Australia, where it is one, collective bargaining agreements can be altered easily, while in Canada and Finland (both with a value of six), or Austria, Denmark, Norway, and Turkey (with a value of

[13] It is worth noting that in some countries the seniority of employees' claims is capped; that is, it applies only to a part of their total claim. Here again our questionnaires reveal considerable cross-country differences, although for the sake of brevity we do not report these data.

four) it is quite difficult to alter a bargaining agreement or get the restructuring plan approved. Interestingly, there is significant variability even within groups of countries sharing the same type of legal system, i.e., common law or civil law. For example, within common law countries, employees enjoy strong rights in firm restructuring in the UK and Canada (scoring five and six respectively) but not in Australia or the US (one and two respectively).

Employees aside, implementing a restructuring plan obviously requires the consent of creditors: depending on what fraction is required to agree, bankruptcy law will make restructuring more or less likely. Our questionnaire also gives data on the minimum fraction required in each country. Insofar as this affects the probability that creditors will agree on restructuring in lieu of liquidation, it also affects the relevance of employees' rights under restructuring: for instance, if restructuring requires unanimity of creditors, employees' rights become practically irrelevant; conversely, if it does not require even a majority of creditors, and is thus more likely, employees' rights can be quite important.

To take this factor into account, we devise an alternative measure of workers' rights in firm restructuring (i.e., parameter β in the model), namely the interaction of the measure described above (Column 3 of Table 2) with a proxy of the likelihood of restructuring based on the fraction of creditors required to approve. This interacted variable serves as a probability-weighted measure of employees' rights, which we can call "effective rights in restructuring." We set four possible thresholds for creditor consent: (i) unanimity, (ii) qualified majority, (iii) simple majority, and (iv) no requirement. Since the likelihood of restructuring should be inversely related to the strictness of the threshold, we approximate it as follows: (i) 0.25 for creditor unanimity, (ii) 0.50 for qualified majority, (iii) 0.75 for simple majority, and (iv) 1 when no majority is required. Employees' effective rights in restructuring are then measured by applying these weights to the variable shown in Column 3. For example, while this has the same value (4) in Austria, Italy, Japan, Sweden, and Switzerland, its effective value differs since Austria and Switzerland require a qualified majority (0.5), Italy and Japan a simple majority (0.75), and Sweden no majority (1). Therefore, the variable "effective rights in restructuring" is equal to two in Austria and Switzerland, three in Italy and Japan, and four in Sweden.

5.2.4. Employees' bargaining power

Table 2 also provides information on the labor market variables that capture workers' bargaining power in our regressions: union density and employment protection legislation (EPL), both of which vary over time and across countries. Union density is our main measure of workers' bargaining power, as it appears to be the closest empirical counterpart of the parameter α in our firm-union bargaining model. It is defined as the fraction of unionized workers, and its country averages are shown in Column (5). Data on union density come from two sources: the OECD labor statistics database for most countries in our sample, and the International Labor Organization (ILO) for countries for which OECD data are not available.

Union density is not significantly correlated with our measures of workers' seniority, suggesting that seniority is an important dimension of workers' rights not captured by the level of unionization. Instead, union density is positively and significantly correlated with workers' rights in firm restructuring: hence, in countries where workers have stronger rights in the restructuring of distressed firms, they are also better equipped to exercise such rights via more representative trade unions.

We check the robustness of our results by using the EPL indicator (see Section 7.2), which measures the degree of difficulty of individual and collective dismissals of both regular and temporary workers in each country and ranges between a protection low of zero and a high of six.[14] The EPL country averages are shown in Column 6.

6. The empirical results

To determine how firms' capital structure is affected by workers' rights in bankruptcy, we estimate variants of the regression described in specification (11): the coefficients bear on the interactions between measures of employee rights in bankruptcy (or bargaining power) and the variables capturing changes in firms' real estate value or profitability. Recall that in the strategic debt model the coefficient of the interaction with employee seniority and λ_1 should be positive unless bankruptcy costs are high; those of the interactions with public insurance coverage and wage bargaining (λ_2 and λ_3) should also be positive, and that of the interaction with workers' rights in restructuring (λ_4) should be negative. In the credit-constraint model, by contrast, λ_1, λ_2, and λ_3 should be negative.

6.1. Regressions based on real estate valuations

We begin with the results stemming from the identification strategy based on real estate holdings. We start estimating baseline regressions where coefficients are constrained to be the same for all firms (Section 6.1.1), and then we explore how the results change when they are allowed to differ between financially constrained and unconstrained firms (Section 6.1.2).

6.1.1. Baseline regressions

Table 3 shows the estimates for various specifications of our baseline regression, progressively saturated with fixed effects. In the regressions shown in the first three columns the dependent variable is the change in book leverage. The specification in Column 1 includes country, industry, and year effects, that in Column 2 country-industry and year effects, and that in Column 3 country-industry-year effects and firm-level controls.[15] In the last two columns the dependent variable is an indicator variable for debt

[14] The indicator, produced by the OECD, has three distinct components: regular contracts, temporary contracts (for workers with fixed-term contracts), and collective dismissals. It is available for all countries in our sample except Hong Kong.

[15] Replacing the change in book leverage with its level as dependent variable (and including firm fixed effects) in these specifications yields results that are qualitatively similar to those shown in Columns 1–3.

Table 3
Employees' rights in bankruptcy, real estate shocks, and capital structure.

This table presents the coefficient estimates of a panel regression estimated for 22,592 firms from 29 countries over the period 1988–2015. The dependent variable in each specification is indicated at the top of the corresponding column. Debt issuance equals one if Net debt issuances normalized by lagged book assets exceed 1%, and zero otherwise. Real estate shock is the percent change of the value of the firm's real estate, defined as the historical cost of its land in the year in which the firm first appears in the data set, inflated by the real estate price index of the corresponding country and scaled by the lagged book value of the firm's PPE. Worker seniority, Government insurance coverage, Union density, and Worker rights in restructuring are defined in Appendix B. Firm control variables, used in the specifications of Columns 3 and 5, are the changes in total assets, asset tangibility, profitability (defined as EBITDA normalized by total assets), market-to-book ratio, and CapEx ratio, which are defined in Appendix B. All independent variables are lagged one year. *T*-statistics are reported in parenthesis. Standard errors are clustered at the country level. Asterisks (*, **, and ***) indicate statistical significance (at the 10%, 5%, and 1% level, respectively).

Dependent variable	(1) Δ Book leverage	(2) Δ Book leverage	(3) Δ Book leverage	(4) Debt issuance	(5) Debt issuance
Real estate shock ×	0.0083***	0.0078***	0.0074**	0.0041***	0.0038***
Worker seniority	(3.08)	(2.90)	(2.62)	(3.61)	(3.22)
Real estate shock ×	0.0054*	0.0051*	0.0046	0.0072**	0.0065*
Government insurance coverage	(1.89)	(1.77)	(1.63)	(2.08)	(1.90)
Real estate shock ×	0.0007**	0.0006**	0.0005*	0.0004**	0.0003**
Union density	(2.32)	(2.03)	(1.93)	(2.58)	(2.35)
Real estate shock ×	−0.0052**	−0.0049**	−0.0045*	−0.0039**	−0.0038**
Worker rights in restructuring	(−2.24)	(−2.10)	(−1.91)	(−2.47)	(−2.29)
Real estate shock	0.0322***	0.0301***	0.0292***	0.0209***	0.0194***
	(6.51)	(6.08)	(5.97)	(5.48)	(5.38)
Union density	0.0005	0.0005	–	0.0216	-
	(1.44)	(1.35)	–	(1.52)	-
Firm control variables	No	No	Yes	No	Yes
Fixed effects	Country, industry,year	Country-industry, year	Country-industry-year	Country-industry, year	Country-industry- year
R^2	0.10	0.10	0.11	0.14	0.15
Number of observations	291,418	291,418	291,418	291,418	291,418

issuance: the specification in Column 4 includes country-industry, and year effects, while Column 5 includes country-industry-year effects and firm-level controls.

The first row shows that the estimated coefficient for the interaction between the real estate shock and seniority (λ_1) is positive, as predicted by the strategic debt model, and highly significant in all specifications. Given an increase in the value of its real estate holdings, that is, a firm whose employees have high seniority in liquidation, will increase its leverage more than an identical firm whose employees have lower seniority. The effect is also economically significant: if employees' seniority rank increases by one, the leverage growth induced by the shock increases by about 6% of its standard deviation, in the specification of Column 3. This result contrasts with the credit rationing model of Section 3.2, which predicts that the appreciation of a firm's real estate value will increase its financial capacity and thus its indebtedness, but the response of leverage should be weaker, not stronger, for firms whose employees have high seniority in bankruptcy.

Also, the other estimates in Table 3 are consistent with the predictions of the strategic debt model. The second row gives the coefficient of the interaction between the real estate shock and public insurance coverage for employees in corporate bankruptcies (λ_2): its estimate too is positive and significantly different from zero in all the specifications except that in Column 3. The coefficient of the interaction of the real estate shock with workers' wage bargaining power (λ_3), as proxied by union density, is also estimated to be positive, and it is significant at the 5% confidence level in Columns 1, 2, 4, and 5 and at the 10% level in Column 3. The estimate for the interaction between the real estate shock and workers' rights during restructuring (λ_4), shown in the fourth row of the table, is negative, and it is significant at the 5% confidence level in Columns 1, 2, 4, and 5 and at the 10% level in Column 3: an increase in the bargaining power of employees at the renegotiation stage is associated with a significant reduction in leverage, differently from an increase in their bargaining power in wage negotiations.

The baseline impact of the real estate shock on changes in leverage and debt issuance, i.e., the coefficient λ_0 in Eq. (11), is reported in the fifth row of the table. The estimate of this coefficient is positive: as predicted by both the strategic leverage and the credit-constraint model, the appreciation of a firm's real estate is associated with a stronger increase in leverage.

6.1.2. The role of credit constraints

As noted in Section 3, the strategic debt model and the credit rationing model yield widely different predictions about how employees' rights in bankruptcy should affect leverage decisions. It is possible, however, that each of the two models applies to a different set of firms within our sample, i.e., credit-constrained and unconstrained firms. Identifying financially constrained firms is notoriously problematic because many of the approaches taken in the literature, based on specific firm characteristics, do not jointly model the factors that affect firms' access to finance, often relying on time-invariant characteristics (e.g., ownership) and thus not allowing for firms to shift between financially constrained and unconstrained status, depending on circumstances.

Table 4
Employees' rights in bankruptcy, real estate shocks, and capital structure: financially constrained versus unconstrained firms.

This table presents the estimates of the parameters of regressions obtained by maximum likelihood estimation of an endogenous switching regression model with unknown sample separation, using a sample of 22,592 firms from 29 countries over the period 1988–2015. Columns 1 and 2 (3 and 4, respectively) show the specifications for firms identified as financially unconstrained (financially constrained, respectively). The dependent variable is the change in book leverage ratio in all specifications. Real estate shock is the percent change of the value of the firm's real estate, defined as the historical cost of its land in the year in which the firm first appears in the data set, inflated by the real estate price index of the corresponding country and scaled by the lagged book value of the firm's PPE. Worker seniority, Government insurance coverage, Union density, and Worker rights in restructuring are defined in Appendix B. Firm control variables, used in the specifications of Columns 3 and 5, are the changes in total assets, asset tangibility, profitability (defined as EBITDA normalized by total assets), market-to-book ratio, and CapEx ratio, which are defined in Appendix B. *T*-statistics are reported in parenthesis. Standard errors are clustered at the country level. Asterisks (*, **, and ***) indicate statistical significance (at the 10%, 5%, and 1% level, respectively).

	Unconstrained firms		Constrained firms	
	(1)	(2)	(3)	(4)
Real estate shock × Worker seniority	0.0158***	0.0155***	−0.0091**	−0.0087**
	(4.16)	(4.01)	(−2.62)	(−2.55)
Real estate shock ×	0.0122**	0.0119**	−0.0058**	−0.0054*
Government insurance coverage	(2.10)	(1.99)	(−2.08)	(−1.91)
Real estate shock × Union density	0.0016***	0.0015***	−0.0011**	−0.0010**
	(3.50)	(3.41)	(−2.59)	(−2.43)
Real estate shock ×	−0.0102**	−0.0099**	0.0031*	0.0027
Worker rights in restructuring	(−2.48)	(−2.39)	(1.68)	(1.46)
Real estate shock	0.0402***	0.0378***	0.0383***	0.0371***
	(7.18)	(7.04)	(8.41)	(8.22)
Firm control variables	No	Yes	No	Yes
Fixed effects	Country-industry- year	Country-industry-year	Country-industry- year	Country-industry-year
R^2	0.09	0.10	0.07	0.07
Number of observations	115,019	115,019	176,409	176,409

To overcome this problem, we estimate an endogenous switching regression model with unknown sample separation, as in Hu and Schiantarelli (1998), Almeida and Campello (2007), and Huang et al. (2016). The specification assumes that at each point in time a firm is in one or the other of the two possible financial regimes, with a probability endogenously determined by a selection function. This probability depends on several relevant firm-level variables identified by past studies, namely, changes in the (log of) total assets, asset tangibility, and dividend payments.

The switching regression methodology entails joint maximum-likelihood estimation of the parameters of three equations: one for the change in leverage of unconstrained firms, one for the change in leverage of constrained ones, and the selection function determining the probability of each firm-year observation's being in one regime or the other. Hence, this approach allows the specification in Eq. (11) to yield different estimates for firms that are likely and unlikely to be financially constrained. The two regimes are not observable, but their likelihood is endogenously determined.

All specifications in Table 4 include country-industry-year effects. The first two columns present estimates for financially unconstrained firms, first without firm-level controls (Column 1) and then including them (Column 2). The last two columns report the corresponding estimates for financially constrained firms.

The results in Table 4 corroborate the importance of access to financial markets to a firm's ability to use debt strategically in wage bargaining. In the first row, the estimated coefficient of the interaction between the real estate shock and employees' seniority is positive and highly significant only for firms that are not financially constrained. Those that are constrained behave differently: the coefficient of the interaction between the real estate shock and seniority is negative, as predicted by the credit-constraint model in Section 3.2, and is statistically significant.

Similar results apply to the coefficient estimates of the other three interaction variables: for financially constrained firms, they are in line with the predictions of the strategic debt model and statistically significant: positive for the interactions with wage bargaining power and government insurance coverage and negative for the interaction with workers' rights in firm restructuring. Conversely, for constrained firms, the estimates are in line with the credit-constraint model, as the interactions with wage bargaining power and with government insurance coverage have both negative and significant coefficients.

The endogenous switching regression model shown above is not the only method that can be used to identify financially constrained firms: a vast literature attempts to do so by devising indices based on various firm characteristics, such as size, age, and leverage, and there is a long-standing debate about which indices proposed so far based on US company data are best suited to identify financially constrained firms, if any (Farre-Mensa and Ljungqvist, 2016. However, in an international context, firm size has been shown to consistently correlate with financing obstacles to growth (Beck et al., 2005).

Hence, as a simple alternative to the endogenous switching regression model and a robustness check of its results, we use the lower and upper tercile of firms by total assets to identify financially constrained and unconstrained firms and repeat the regression analysis performed in Section 6.1.1 separately on these two subsamples. Moreover, since financial constraints are generally assumed to be more severe for young firms, whose behavior is very different from that of small firms (Haltiwanger

Table 5
Employees' rights in bankruptcy, real estate shocks, and capital structure: small versus large, and young versus old firms.

This table presents the coefficient estimates of a panel regression for observations in the upper tercile of the firm distribution by size or age in each country in Columns 1 and 3, and in the bottom tercile by size of age in Columns 2 and 4, respectively. Firm size is measured by total assets and firm age by number of years from incorporation. The dependent variable is the change in book leverage ratio in all specifications. Real estate shock is the percent change of the value of the firm's real estate, defined as the historical cost of its land in the year in which the firm first appears in the data set, inflated by the real estate price index of the corresponding country and scaled by the lagged book value of the firm's PPE. Worker seniority, Government insurance coverage, Union density, and Worker rights in restructuring are defined in Appendix B. Firm control variables, used in the specifications of Columns 3 and 5, are the changes in total assets, asset tangibility, profitability (defined as EBITDA normalized by total assets), market-to-book ratio, and CapEx ratio which are defined in Appendix B. *T*-statistics are reported in parenthesis. Standard errors are clustered at the country level. Asterisks (*, **, and ***) indicate statistical significance (at the 10%, 5%, and 1% level, respectively).

	Large firms (1)	Small firms (2)	Old firms (3)	Young firms (4)
Real estate shock ×	0.0139***	−0.0089***	0.0131***	−0.0081***
Worker seniority	(3.44)	(−2.80)	(4.06)	(−2.91)
Real estate shock ×	0.0129**	−0.0065*	0.0111*	−0.0057
Government insurance coverage	(2.32)	(−1.75)	(1.91)	(−1.56)
Real estate shock ×	0.0015**	−0.0010***	0.0016***	−0.0012***
Union density	(2.61)	(−3.09)	(3.41)	(−2.54)
Real estate shock ×	−0.0079**	0.0034*	−0.0082**	0.0019
Worker rights in restructuring	(−2.57)	(1.88)	(−2.47)	(1.48)
Real estate shock	0.0270***	0.0291***	0.0251***	0.0268***
	(6.98)	(8.41)	(7.63)	(8.56)
Firm control variables	Yes	Yes	Yes	Yes
Fixed effects	Country-industry-year	Country-industry-year	Country-industry-year	Country-industry-year
R^2	0.12	0.09	0.11	0.08
Number of observations	99,282	96,120	97,075	98,904

et al., 2013), we also perform the sample split based on firm age from the time of incorporation.

Results are shown in Table 5. Columns 1 and 2 show the results for large and small firms, respectively, and Columns 3 and 4 those for old and young firms, respectively.

The estimates confirm the results found in Table 4 and the importance of distinguishing between the leverage chosen by firms that are free to use it for strategic purposes from that of credit-constrained firms. The results in the first row show that the estimated coefficient of the interaction between real estate shocks and employees' seniority is positive and highly significant for larger and older firms, which are more likely to be financially unconstrained, whereas smaller and younger firms behave more in line with the model with binding credit constraints. The same difference between the two groups of firms emerges from the coefficient of the interaction of the real estate shock and employees' bargaining power: this coefficient is positive, economically sizable, and precisely estimated for larger and older firms but negative and precisely estimated for smaller and younger ones. Finally, the interaction with workers' rights in firm restructuring is negative and significant only for larger and older firms. Hence, the results obtained from this simpler approach are broadly consistent with those obtained from the endogenous switching regression model.

6.2. Regressions based on commodity-price-driven changes in profits

Now we turn to an analysis focusing on exogenous shocks to firm-level profitability, using changes in commodity price indices-reasonably assumed to be exogenous to firms' performance-to instrument changes in profitability.

The results are shown in Table 6, whose specifications include the same dependent variables as Table 3, except that in Columns 3 and 5 the country-industry-time effects are replaced by country-industry and time effects because the instrument varies at the industry-time level. The first-stage regressions show that commodity price changes are relevant instruments, as witnessed by the *F*-test results shown at the bottom of the table (see Table B.6 of the Internet Appendix for first-stage estimates). Again, the predictions of the strategic leverage model are borne out for the typical firm in our sample: the coefficients of the interactions of profitability with employees' seniority and bargaining power are both positive and statistically significant in all the specifications. The effects are also economically significant: for instance, if employees' seniority rank increases by one, the leverage growth induced by the profitability shock increases by about 9% of its standard deviation. Moreover, the coefficient of the interaction with public insurance coverage is positive (though significant at the 5% level only in Columns 1 and 4) and that of the interaction with employees' rights in firm restructuring is negative and significant in all specifications, in accordance with the strategic debt model of Section 3.1.

As in Section 6.1, also in this IV regression approach we explore whether the estimates differ between large and small firms as well as between old and young ones. Table 7 presents the estimates of the IV regression estimated for firms in the upper and lower terciles by total assets in Columns 1 and 2 and for firms in the upper and lower terciles by age from incorporation in Columns 3 and 4, respectively.

Also in this case, the interactions of profitability with employee seniority, with workers' bargaining power, and with government insurance coverage have positive and significant coefficients for larger and older firms, and negative and significant ones for smaller and younger ones, as

Table 6
Employees' rights in bankruptcy, profitability shocks, and capital structure.

This table presents the IV estimates of a panel regression for 22,592 firms from 29 countries. The dependent variable in each specification is indicated at the top of the corresponding column. Debt issuance equals one if Net debt issuances normalized by lagged book assets exceed 1%, and zero otherwise. Firm profitability is measured as EBITDA scaled by total assets. The change in profitability and its interactions with Worker seniority, Government insurance coverage, Union density, and Worker rights in restructuring are instrumented with the percentage changes in five major commodity price indices; the first-stage coefficients are allowed to vary across 15 NAICS industries and are shown in Table B.6 of the Internet Appendix for the change in profitability regression only. Worker seniority, Government insurance coverage, Union density, and Worker rights in restructuring are defined in Appendix B. Firm control variables, used in the specifications of Columns 3 and 5, are the changes in total assets, asset tangibility, market-to-book ratio, and CapEx ratio (defined in Appendix B). *T*-statistics are reported in parenthesis. Standard errors are clustered at the country level. Asterisks (*, **, and ***) indicate statistical significance (at the 10%, 5%, and 1% level).

Dependent variable	(1) Δ Book leverage	(2) Δ Book leverage	(3) Δ Book leverage	(4) Debt issuance	(5) Debt issuance
Profitability shock ×	0.0171***	0.0158***	0.0149**	0.0110***	0.0098***
Worker seniority	(2.91)	(2.67)	(2.49)	(3.22)	(3.07)
Profitability shock ×	0.0584**	0.0550*	0.0536*	0.0476**	0.0442*
Government insurance coverage	(1.98)	(1.87)	(1.74)	(1.98)	(1.87)
Profitability shock ×	0.0041**	0.0039**	0.0038**	0.0065**	0.0060**
Union density	(2.37)	(2.22)	(2.15)	(2.24)	(2.12)
Profitability shock ×	−0.0248**	−0.0239**	−0.0224**	−0.0329**	−0.0320**
Worker rights in restructuring	(−2.27)	(−2.15)	(−2.06)	(−2.26)	(−2.04)
Profitability shock	0.0351*	0.0328*	0.0304*	0.0434**	0.0415*
	(1.91)	(1.86)	(1.81)	(1.97)	(1.85)
Union density	0.0006	0.0006	-	0.0009	-
	(1.07)	(1.02)	-	(0.96)	-
Firm control variables	No	No	Yes	No	Yes
Fixed effects	Country, Industry, Year	Country-Industry, Year	Country-Industy,Year	Country-Industry, Year	Country-Industry,Year
R^2	0.07	0.07	0.08	0.19	0.20
Number of observations	291,418	291,418	291,418	291,418	291,418
F-tests of first-stage regressions:					
Profitability shock × Seniority	331	339	342	425	411
Profitability shock × Employment protection	287	296	295	382	372
Profitability shock × Worker rights in restructuring	309	317	316	368	370
Profitability shock × Government insurance coverage	321	329	328	380	365
Profitability shock	291	296	298	299	301

Table 7
Employees' rights in bankruptcy, profitability shocks, and capital structure: small versus large, and young versus old firms.

This table presents the IV estimates of a panel regression for observations in the upper tercile of the firm distribution by size or age in each country in Columns 1 and 3, and in the bottom tercile by size of age in Columns 2 and 4, respectively. Firm size is measured by total assets, and firm age by number of years from incorporation. The dependent variable is the change in book leverage ratio in all specifications. The change in profitability and its interactions with Worker seniority, Government insurance coverage, Union density, and Worker rights in restructuring are instrumented with the percentage changes in five major commodity price indices; first-stage coefficients are allowed to vary across 15 NAICS industries. Worker seniority, Government insurance coverage, Union density, and Worker rights in restructuring are defined in Appendix B. Firm control variables, used in the specifications of Columns 3 and 5, are the changes in total assets, asset tangibility, market-to-book ratio, and CapEx ratio (defined in Appendix B). *T*-statistics are reported in parenthesis. Standard errors are clustered at the country level. Asterisks (*, **, and ***) indicate statistical significance (at the 10%, 5%, and 1% level, respectively).

	Large firms (1)	Small firms (2)	Old firms (')	Young firms (4)
Profitability shock ×	0.0224***	−0.0097**	0.0250***	−0.0109***
Worker seniority	(4.04)	(−2.61)	(3.84)	(−2.78)
Profitability shock ×	0.1404**	−0.0727**	0.1500**	−0.06703
Government insurance coverage	(2.50)	(−2.16)	(2.07)	(−1.51)
Profitability shock ×	0.0115***	−0.0075***	0.0108***	−0.0078**
Union density	(3.26)	(−2.81)	(3.09)	(−2.48)
Profitability shock × Worker	−0.0731**	0.0207	−0.0802**	0.0210
rights in restructuring	(−2.41)	(1.54)	(−2.48)	(1.34)
Profitability shock	0.0309**	0.0218*	0.0316*	0.0229*
	(1.99)	(1.70)	(1.91)	(1.92)
Firm control variables	Yes	Yes	Yes	Yes
Fixed effects	Country-industry, year	Country-industry, year	Country-industry, year	Country-industry, year
R^2	0.11	0.07	0.08	0.07
Number of observations	99,282	96,120	97,075	98,904
F-tests of first-stage regressions:				
Profitability shock × Seniority	239	225	251	241
Profitability shock × Employment protection	192	181	178	164
Profitability shock × Worker rights in restructuring	200	197	193	185
Profitability shock × Government insurance coverage	216	220	209	197
Profitability shock	189	195	211	203

respectively predicted by the strategic leverage model and by the financial constraints model of Section 3. Similarly, the coefficient of the interaction between profitability and workers' rights in restructuring is negative and significant for larger and older firms, which aligns with the strategic debt model, while it is positive and not precisely estimated for smaller and younger firms. Hence, as in the approach based on real estate shocks, the estimates appear to align well with the predictions of the strategic debt model for firms that are more likely to have access for external finance and with those of the model based on financial constraints for those are unlikely to do so.

7. Extensions and robustness checks

In this section we explore the main extensions and robustness checks of the estimates. These are described and reported in Section B of the Internet Appendix, together with additional ones.

7.1. Allowing for a nonmonotonic effect of top employee seniority

Propositions 1 and 2 of our theoretical model predict that even if the strategic use of leverage increases as workers' seniority increases, it ceases altogether when workers are senior to all creditors ($\theta = 1$): in this case there is no longer any strategic motive for firms to issue debt. To investigate this point, we extend the specification of our regressions to allow for this possible nonmonotonicity in the effect of seniority when $\theta = 1$. We construct a "Top worker seniority" dummy variable that equals one in countries where workers' claims for wages and/or pensions are senior to all commercial debt claims (i.e., all claims except for unpaid taxes due to the local and central government and for administrative expenses incurred by the trustee), and zero otherwise. We expand the specification of Table 3 by adding an interaction between this dummy and the real estate shock (profitability shock). The results, reported in Columns 1 to 3 of Tables B.2.1 and B.2.2, respectively, show that the coefficient estimate of this interaction is negative and statistically significant, but its inclusion leaves the coefficient of the interaction between seniority and the shock itself positive and significant. Moreover, when these expanded specifications are estimated separately for large and small firms (Columns 4 and 5 of Tables B.2.1 and B.2.2), the nonmonotonicity is present only for large firms, in line with the idea that the strategic debt model applies only to financially unconstrained firms.

7.2. Different measures of leverage

A possible concern regarding our results is that the measures of leverage used so far are based on book values. However, we obtain qualitatively similar results when the specifications in Columns 1–3 of Tables 3 and 6 are reestimated using the change in the market value of debt as dependent variable, as shown by Columns 1–3 of Tables B.3.1 and B.3.2, respectively. Columns 4 and 5 of these tables report the corresponding estimates obtained separately for large and small firms, which confirm the results obtained in Columns 1 and 2 of Tables 5 and 7.

We also explore the role of debt maturity. If leverage is driven by strategic concerns, then firms should respond to stronger workers' rights in bankruptcy more via short-term than via long-term debt: not only does a firm's inability to repay short-term debt make financial distress more of a threat in wage bargaining, but short-term claims effectively enable creditors to "circumvent" workers' seniority by obtaining time-seniority even though they would be junior in the eventual liquidation. This prediction is borne out by the data: when the specifications of Table 6 are estimated separately for changes in short-term debt (maturity up to one year) and long-term debt (maturities above one year), the results are stronger for changes in short-term debt than long-term debt, as shown by Table B.5.

7.3. Alternative measures of employee rights in bankruptcy and bargaining power

We check the robustness of our results to different measures of employees' seniority, rights in restructuring, and bargaining power. The results still hold if seniority is based on the average of all three worker claims (pension contributions, wages, and severance pay) rather than pension claims alone (Table B.4.2). They are also robust to measuring employees' seniority as the seniority of wages or severance pay alone and to using the measure of effective employee protection in restructuring described in Section 5.2.3 (Table B.4.3). Finally, replacing union density with the employment protection variable described in Section 5.2.4 as a measure of employees' bargaining power leaves the results qualitatively unaffected (Table B.4.4): this shows that the measures of worker rights in bankruptcy proposed in this paper have an additional explanatory power for leverage decisions vis-à-vis employment protection legislation.

8. Conclusions

In this paper, we show that the balance between the rights of workers and those of other creditors in bankruptcy should affect the response of leverage to changes in the value of the firm's assets and revenue. In a model of strategic leverage, debt should increase more in response to rises in corporate resources if employees have high seniority in liquidation and weak rights in restructuring. However, firms' ability to use debt strategically in wage bargaining hinges on their being financially unconstrained. When instead firms face a binding collateral constraint, the response of their leverage both to workers' claim seniority and to their bargaining power should switch sign compared to the strategic debt model. This offers an incisive way to test this model against an alternative.

To test the predictions deriving from the two models, we collect novel data on workers' legal rights in corporate liquidation and restructuring, which turn out to vary greatly across countries. When we do not distinguish

between financially constrained and unconstrained firms, we find that a positive shock to real estate values or profitability induces a greater increase in leverage in firms whose workers have stronger seniority rights in liquidation, greater wage bargaining power, and weaker rights in corporate restructuring, as predicted the strategic leverage model.

However, when parameter estimates are allowed to differ between firms that are likely to be financially constrained and those that are not, the predictions of the strategic debt model are strongly supported only for the financially unconstrained. The leverage of financially constrained firms instead behaves consistently with the predictions of the model where leverage is dictated by binding financial constraints. Hence each of the two models appears to capture the choice of leverage by a group of firms featuring different access to financial markets and the way their respective leverage is affected by employees' rights in bankruptcy and bargaining power.

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Appendix A. Proofs and derivations

A.1. Optimal wage, employees' expected income, and firm's value

When the wage is set by the union, i.e., $W = W_u$, the expected payoff of workers is

$$U = E(\tilde{Y}_u) - \pi_u(1-\gamma)L = \frac{\left[\overline{R} - (1-\theta)D\right]W_u}{\overline{R}} - \frac{W_u^2}{2\overline{R}} - \frac{D+W_u}{\overline{R}}(1-\gamma)L. \quad \text{(A1)}$$

Maximizing Eq. (A1) with respect to W_u yields the union's optimal wage W_u^* in Eq. (3), which, upon substitution in (A1) yields employees' expected income when the wage is W_u^*:

$$\mathrm{E}(\tilde{Y}_u | W = W_u^*) = \frac{\left[\overline{R} - (1-\theta)D\right]^2 - (1-\gamma)^2 L^2}{2\overline{R}}. \quad \text{(A2)}$$

Setting $\pi(W_f) = D/\overline{R}$ in Eq. (2) yields employees' expected income when the wage is set by the firm:

$$\mathrm{E}\left[W_f(\tilde{R})\right] = W_0 + \frac{D}{\overline{R}}(1-\gamma)L. \quad \text{(A3)}$$

The firm's expected labor cost equals employees' expected income, which is the average of the expressions (A2) and (A3), weighted by the probabilities α and $1-\alpha$, respectively:

$$\mathrm{E}(\tilde{Y}) = \alpha\frac{\left[\overline{R} - (1-\theta)D\right]^2 - (1-\gamma)^2 L^2}{2\overline{R}} + (1-\alpha)\left[W_0 + \frac{D}{\overline{R}}(1-\gamma)L\right]. \quad \text{(A4)}$$

Next, to compute the firm's probability of default, note that default occurs if $\tilde{R} < D + W$, where $W = W_u^*$ with probability $1-\alpha$, and $W = W_f(\tilde{R})$ with probability α. As $W_f(\tilde{R}) = 0$ for $\tilde{R} \le D$, the probability of default $\pi \equiv \Pr(\tilde{R} < D + W) = (1-\alpha)\pi_f + \alpha\pi_u$ is

$$\pi = (1-\alpha)\int_0^D f(\tilde{R})d\tilde{R} + \alpha\int_0^{D+W_u^*} f(\tilde{R})d\tilde{R} = \frac{(1-\alpha)D + \alpha(\overline{R} + \theta D - (1-\gamma)L)}{\overline{R}}. \quad \text{(A5)}$$

The firm's value V as of $t = 1$ is the expected value of its resources $\overline{R}/2$ minus its labor costs $\mathrm{E}(\tilde{Y})$ from Eq. (A4) plus its expected continuation payoff $(1-\pi)C$:

$$V = \frac{\overline{R}}{2} - \left\{\alpha\frac{\left[\overline{R} - (1-\theta)D\right]^2 - (1-\gamma)^2 L^2}{2\overline{R}} + (1-\alpha)\left[W_0 + \frac{D}{\overline{R}}(1-\gamma)L\right]\right\} + (1-\pi)C. \quad \text{(A6)}$$

Using Eq. (A5) in the continuation probability $1-\pi$ in Eq. (A6), and maximizing the resulting expression with respect to D yields the value-maximizing level of debt (4).

A.2. Proofs of Propositions 1 and 2

Proof of Proposition 1. If $\theta < 1$, the optimal debt $\hat{D}_l$ is given by Eq. (4), whose derivatives with respect to workers' bargaining power α, government insurance coverage γ, and workers' seniority θ are, respectively,

$$\frac{\partial \hat{D}_l}{\partial \alpha} = \frac{C + (1-\gamma)L}{\alpha^2(1-\theta)^2} > 0, \quad \frac{\partial \hat{D}_l}{\partial \gamma} = \frac{1-\alpha}{\alpha(1-\theta)^2}L > 0$$

$$\frac{\partial \hat{D}_l}{\partial \theta} = \frac{\overline{R}}{(1-\theta)^2} - \frac{[2-\alpha(1-\theta)]}{\alpha(1-\theta)^3}C - \frac{2(1-\alpha)(1-\gamma)}{\alpha(1-\theta)^3}L.$$

The sign of $\partial \hat{D}_l/\partial\theta$ depends on the continuation payoff C and the loss from unemployment L: it is positive for C and L small enough, negative otherwise. Finally, to show that $\hat{D}_l > 0$ requires $\theta < 1$, note that $\partial V/\partial D < 0$ when $\theta = 1$ in Eq. (A6) combined with (A5). □

Proof of Proposition 2. The effects of α, γ, and θ on the response of $\hat{D}_l$ to a change in $\overline{R}/2$ are given by the following cross-derivatives, using results in the proof of Proposition 1:

$$\frac{\partial^2 \hat{D}_l}{\partial(\overline{R}/2)\partial\alpha} = 2\left[\frac{1}{\alpha(1-\theta)^2}\frac{dC}{d\overline{R}} + \frac{1-\gamma}{\alpha^2(1-\theta)^2}\frac{dL}{d\overline{R}}\right] > 0,$$

$$\frac{\partial^2 \hat{D}_l}{\partial(\overline{R}/2)\partial\gamma} = 2\frac{1-\alpha}{\alpha(1-\theta)^2}\frac{dL}{d\overline{R}} > 0,$$

recalling that $\partial C/\partial\overline{R} > 0$ and $\partial L/\partial\overline{R} > 0$ by assumption, and

$$\frac{\partial^2 \hat{D}_l}{\partial(\overline{R}/2)\partial\theta} = \frac{2}{(1-\theta)^2}\left[1 - \frac{2-\alpha(1-\theta)}{\alpha(1-\theta)}\frac{dC}{d\overline{R}} - \frac{2(1-\alpha)(1-\gamma)}{\alpha(1-\theta)}\frac{dL}{d\overline{R}}\right],$$

which is positive if $dC/d\overline{R}$ is sufficiently small, and negative otherwise. □

A.3. Optimal debt under liquidation with binding participation constraint

The participation constraint $\mathrm{E}(\tilde{Y}_u|W = W_u^*) - \pi_u(1-\gamma)L \geq W_0$, jointly with expression (3) for the wage W_u^*, defines the maximal debt $\overline{D}_l$:

$$\frac{\left[\overline{R} - (1-\theta)\overline{D}_l\right]^2 - [(1-\gamma)L]^2}{2\overline{R}} - \frac{\overline{R} + \theta\overline{D}_l - (1-\gamma)L}{\overline{R}}(1-\gamma)L = W_0. \tag{A7}$$

If $\hat{D}_l$ from Eq. (4) exceeds $\overline{D}_l$ in Eq. (A7), debt is set at the lower level $\overline{D}$. The following proposition characterizes optimal leverage in this case:

Proposition A1. If the workers' participation constraint is binding, the optimal debt level is invariant in employees' bargaining power α, increasing in government insurance coverage γ and employees' seniority θ, and decreasing in the reservation wage W_0.

Proof. Applying the implicit function theorem to Eq. (A7) yields:

$$\frac{\partial \overline{D}_l}{\partial \alpha} = 0, \quad \frac{\partial \overline{D}_l}{\partial \gamma} = \frac{W_u^* + \overline{D}_l}{\Delta_l}L > 0, \quad \frac{\partial \overline{D}_l}{\partial \theta} = \frac{W_u^*\overline{D}_l}{\Delta_l} > 0,$$

$$\frac{\partial \overline{D}_l}{\partial W_0} = -\frac{\overline{R}}{\Delta_l} < 0,$$

where $\Delta_l \equiv (1-\theta)W_u^* + (1-\gamma)L$ for brevity, W_u^* is defined by (3) evaluated at $D = \overline{D}_l$, and $\overline{D}_l > 0$ is a necessary condition for default to be a positive-probability event. □

A.4. Derivations and proofs for the case of renegotiation in bankruptcy

This section proves the results in Section 3.1.3, including Propositions 3 and 4. When upon default workers expect to receive a fraction β of the continuation payoff C at the renegotiation stage, their objective function when the union sets the wage W_u becomes

$$U = E(\tilde{Y}_u) + \pi_u[\beta C - (1-\gamma)L] = \frac{\overline{R} - (1-\theta)D}{\overline{R}}W_u - \frac{W_u^2}{2\overline{R}} + \frac{D + W_u}{\overline{R}}[\beta C - (1-\gamma)L]. \tag{A8}$$

Maximizing Eq. (A8) with respect to W_u yields a new expression for the optimal wage:

$$W_u^* = \overline{R} - (1-\theta)D - (1-\gamma)L + \beta C, \tag{A9}$$

where the last term marks the sole difference from expression (3). Substituting Eq. (A9) into (A1) yields expected labor income when the union sets the wage:

$$\mathrm{E}(\tilde{Y}_u|W = W_u^*) = \frac{\left[\overline{R} - (1-\theta)D\right]^2 - [\beta C - (1-\gamma)L]^2}{2\overline{R}}. \tag{A10}$$

Symmetrically, as workers are expected to obtain the gain βC in insolvency, their expected compensation is lower than the reservation wage W_0 when the firm sets wages:

$$\mathrm{E}\left[W_f(\tilde{R})\right] = W_0 + \frac{D}{\overline{R}}[(1-\gamma)L - \beta C]. \tag{A11}$$

Expected labor income is the average of (A10) and (A11), with weights α and $1-\alpha$:

$$\mathrm{E}(\tilde{Y}) = \alpha\frac{\left[\overline{R} - (1-\theta)D\right]^2 - [(1-\gamma)L - \beta C]^2}{2\overline{R}} + (1-\alpha)\left[W_0 + \frac{D}{\overline{R}}[(1-\gamma)L - \beta C]\right]. \tag{A12}$$

The firm's value includes the continuation payoff C in case of solvency, which occurs with probability $1-\pi$, and the expected fraction $(1-\beta)C$ in case of insolvency, which occurs with probability π. Hence, in the firm's value the continuation payoff C is weighted by the probability $(1-\pi) + \pi(1-\beta) = 1 - \pi\beta$ rather than $1-\pi$ as in Eq. (A6). Moreover, the wage to be used in the probability of bankruptcy is now expression (A9) rather than (3):

$$\pi \equiv \Pr(\tilde{R} < D + W)$$

$$= \frac{(1-\alpha)D - \alpha\left[\overline{R} + \theta D + \beta C - (1-\gamma)L\right]}{\overline{R}}. \quad \text{(A13)}$$

Accordingly, the expression for the value of the firm becomes

$$V = \frac{\overline{R}}{2} + \left[1 - \beta\frac{(1-\alpha)D + \alpha(\overline{R} + \theta D + \beta C - (1-\gamma)L)}{\overline{R}}\right] \times C - \mathrm{E}(\tilde{Y}), \quad \text{(A14)}$$

where $\mathrm{E}(\tilde{Y})$ is given by Eq. (A12). Maximizing expression (A14) with respect to D yields Eq. (5) for optimal debt $\hat{D}_r$ under renegotiation. Using these results, one can prove Proposition 3.

Proof of Proposition 3. Assuming $\theta < 1$, the comparative statics of $\hat{D}_r$ are

$$\frac{\partial \hat{D}_r}{\partial \beta} = -\frac{\theta}{(1-\theta)^2}C < 0, \quad \frac{\partial \hat{D}_r}{\partial \alpha} = \frac{(1-\gamma)L}{\alpha^2(1-\theta)^2} > 0,$$
$$\frac{\partial \hat{D}_r}{\partial \gamma} = \frac{1-\alpha}{\alpha(1-\theta)^2}L > 0, \quad \text{and}$$
$$\frac{\partial \hat{D}_r}{\partial \theta} = \frac{\overline{R}}{(1-\theta)^2} - \beta\frac{1+\theta}{(1-\theta)^3}C - \frac{2(1-\alpha)(1-\gamma)}{\alpha(1-\theta)^3}L,$$

which is positive for sufficiently small values of C and L, and negative otherwise. □

Proof of Proposition 4. The effect of β, α, γ, and θ on the response of $\hat{D}_r$ to a change in $\overline{R}/2$ is given by the following cross-derivatives, using results in the proof of Proposition 3:

$$\frac{\partial^2 \hat{D}_r}{\partial(\overline{R}/2)\partial\beta} = -\frac{2\theta}{(1-\theta)^2}\frac{dC}{d\overline{R}} < 0,$$
$$\frac{\partial^2 \hat{D}_r}{\partial(\overline{R}/2)\partial\alpha} = \frac{2(1-\gamma)}{\alpha^2(1-\theta)^2}\frac{dL}{d\overline{R}} > 0,$$
$$\frac{\partial^2 \hat{D}_r}{\partial(\overline{R}/2)\partial\gamma} = \frac{2(1-\alpha)}{\alpha(1-\theta)^2}\frac{dL}{d\overline{R}} > 0,$$

recalling that $dC/d\overline{R} > 0$ and $dL/d\overline{R} > 0$ by assumption and

$$\frac{\partial^2 \hat{D}_r}{\partial(\overline{R}/2)\partial\theta} = \frac{2}{(1-\theta)^2}\left[1 - \beta\frac{1+\theta}{\alpha(1-\theta)}\frac{dC}{d\overline{R}} - \frac{2(1-\alpha)(1-\gamma)}{\alpha(1-\theta)}\frac{dL}{d\overline{R}}\right],$$

which is positive if $dC/d\overline{R}$ and $dL/d\overline{R}$ are sufficiently small, and negative otherwise. □

A.5. Optimal debt under renegotiation with binding participation constraint

Proposition A2. If the workers' participation constraint binds, optimal debt is increasing in employee renegotiation rights, β, and its responses to the employees' wage bargaining power α, seniority θ, and public insurance γ have the same sign as under liquidation.

Proof. The maximum debt level $\overline{D}_r$ consistent with workers' participation constraint solves $\mathrm{E}(\tilde{Y}_u | W = W_u^*) - \pi_u[(1-\gamma)L - \beta C] \geq W_0$. This condition can be rewritten as the renegotiation analogue of Eq. (A7), using Eq. (A10) and noting that the probability of bankruptcy conditional on $W = W_u^*$ is $\pi_u = [\overline{R} + \theta D + \beta C - (1-\gamma)L]/\overline{R}$:

$$\frac{\left[\overline{R} - (1-\theta)\overline{D}_r\right]^2 - [\beta C - (1-\gamma)L]^2}{2\overline{R}} - \frac{\overline{R} + \theta\overline{D}_r + \beta C - (1-\gamma)L}{\overline{R}}[(1-\gamma)L - \beta C] = W_0. \quad \text{(A15)}$$

If the workers' participation constraint is binding so that debt is $\overline{D}_r$, comparative statics are obtained by applying the implicit function theorem to expression (A15):

$$\frac{\partial \overline{D}_r}{\partial \beta} = \frac{W_u^* + \overline{D}_r}{\Delta_r}C > 0, \quad \frac{\partial \overline{D}_r}{\partial \alpha} = 0,$$
$$\frac{\partial \overline{D}_r}{\partial \gamma} = \frac{W_u^* + \overline{D}_r}{\Delta_r}L > 0, \quad \frac{\partial \overline{D}_r}{\partial \theta} = \frac{W_u^*\overline{D}_r}{\Delta_r} > 0,$$
$$\frac{\partial \overline{D}_r}{\partial W_0} = -\frac{\overline{R}}{\Delta_r} < 0,$$

where $\Delta_r \equiv (1-\theta)W_u^* + (1-\gamma)L - \beta C > 0$ (recalling the assumption $(1-\gamma)L > \beta C$), W_u^* is defined by Eq. (A9) evaluated at $D = \overline{D}_r$, and $\overline{D}_r > 0$ is a necessary condition for default to be a positive-probability event. □

A.6. Derivations and proofs for the model with credit constraints

Here we prove the results in Section 3.1.4. The value of debt in Eq. (7) is obtained as follows:

$$\begin{aligned} V_D = {} & \alpha\left[\int_0^{(1-\theta)D}\tilde{R}f(\tilde{R})d\tilde{R} + (1-\theta)D\int_{(1-\theta)D}^{\overline{R}}f(\tilde{R})d\tilde{R}\right] \\ & + \alpha\left[\int_{(1-\theta)D+W_u}^{D+W_u}\left(\tilde{R} - (1-\theta)D - W_u\right)f(\tilde{R})d\tilde{R} + \theta D\int_{D+W_u}^{\overline{R}}f(\tilde{R})d\tilde{R}\right] \\ & + (1-\alpha)\left[\int_0^{D}\tilde{R}f(\tilde{R})d\tilde{R} + D\int_D^{\overline{R}}f(\tilde{R})d\tilde{R}\right] \\ = {} & \frac{D^2}{2\overline{R}} + D\frac{\overline{R} - D}{\overline{R}} - \alpha\theta D\frac{W_u}{\overline{R}}. \end{aligned}$$

Proof of Proposition 5. Differentiating Eq. (10) and denoting $\kappa \equiv 1/[1 - \alpha\theta(1-\theta)]$ yields

$$\text{(i)}\ \frac{\partial D_{\max}}{\partial \alpha} = -\theta\kappa^2 W_u^* < 0, \quad \frac{\partial D_{\max}}{\partial \gamma} = -\alpha\theta\kappa L < 0,$$
$$\frac{\partial D_{\max}}{\partial \theta} = -\alpha\theta\kappa[\kappa(2 - \alpha\theta)W_u^* + (1-\gamma)L] < 0.$$
$$\text{(ii)}\ \frac{\partial^2 D_{\max}}{\partial(\overline{R}/2)\partial\alpha} = -2\theta\kappa^2\underbrace{\left[\theta - (1-\gamma)\frac{dL}{d\overline{R}}\right]}_{\partial W_u^*/\partial\overline{R}} < 0$$
$$\text{iff}\ \frac{\partial W_u^*}{\partial \overline{R}} > 0, \quad \frac{\partial^2 D_{\max}}{\partial(\overline{R}/2)\partial\gamma} = -2\alpha\theta\kappa\frac{dL}{d\overline{R}} < 0,$$

$$\frac{\partial^2 D_{\max}}{\partial(\overline{R}/2)\partial\theta} = -2\alpha\kappa^2\left\{(2-\alpha\theta)\frac{\partial W_u^*}{\partial\overline{R}} + \frac{1-\gamma}{\kappa}\frac{dL}{d\overline{R}}\right\} < 0$$

$$\text{if} \quad \frac{\partial W_u^*}{\partial\overline{R}} \geq 0.$$

□

Appendix B. Variable definitions

Name of variable	Definition
Book leverage	(Long-term debt + debt in current liabilities) / Total assets
Market leverage	(Long-term debt + debt in current liabilities) / (Long-term debt + debt in current liabilities + market equity)
Market-to-book	Market value of equity / Book value of common equity
Asset tangibility	Net property, plant, and equipment / lagged total assets
Log total assets	Natural logarithm of total assets
Profitability	EBITDA / total assets
Worker seniority	The priority of (i) unpaid pension contributions, (ii) unpaid wages, and (iii) severance pay entitlements in the distribution of the proceeds from liquidation relative to five other claims: (a) claims by creditors with liens on property, (b) administrative expenses incurred by the trustee, (c) post-petition credit, (d) income and other taxes due to local or central government, and (e) unsecured creditors. Since each of the three types of employees' claims lies in an eight-place ranking, they are ranked on a scale from one for the most junior class to eight for the most senior.
Government insurance Coverage	Equals zero if there is no government fund insuring employees' pension contributions not fully repaid in bankruptcy, one if such a fund exists and its insurance coverage is capped at a specific amount stated by the law, and two if such a fund exists and provides uncapped insurance coverage.
Worker rights in restructuring	Based on the following three questions: (i) "Can collective bargaining agreements previously entered into by the debtor be modified by the reorganization plan?" (ii) "Must the plan be proposed to employees' representatives (e.g., unions) for approval?" (iii) "If the employees do not approve the plan, can it still be carried out if authorized by court (possibly in a modified version)?" The variable ranges from one to six, assigning one to countries where workers rights are least protected in firm restructuring and six to those where they are most strongly protected. The precise algorithm used to assign these values based on the answers to our questionnaire is described in Fig. 4.
Union density	Fraction of unionized workers, drawn from two sources: the OECD labor statistics database for most countries in the sample, and the ILO for countries for which OECD data are not available.

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