Workplace Injuries and the Agency Cost of Debt

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Abstract

This paper examines how firm financial policy impacts investment in workplace safety. The agency theory of capital structure hypothesizes that the use of corporate debt can have a significant impact on the firm's non-financial stakeholders such as its employees. Using plant-level data on employee injuries from the Survey of Occupational Injuries and Illnesses, this paper tests whether firm leverage and financial condition impact future injury rates at the firm. Controlling for a number of factors (including year $\times$ industry and establishment fixed effects), we find evidence that firms with higher financial leverage invest less in workplace safety than firms with low leverage. Using an exogenous change in tax law surrounding the repatriation of foreign profits as a natural experiment, we show that this investment is directly related to available cash flows. We also find that the relationship between injury rates and leverage is stronger for establishments located in more union-intensive states, suggesting that leverage attenuates the effects of employee bargaining power on workplace safety.

1 Introduction

The agency theory of capital structure has long emphasized the indirect costs of debt resulting from its propensity to create or exacerbate conflicts among a firm's stakeholders. The

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majority of research on these indirect costs of debt focuses on conflicts between shareholders and creditors and/or between shareholders and managers. However, a firm's financial policies also potentially affect other stakeholders in the firm, including its customers, employees and suppliers (Titman, 1984). In spite of the potential importance of conflicts between these non-financial stakeholders and the firm's financial stakeholders (especially equity holders), there is little empirical research studying indirect costs of debt arising from its effect on these types of conflicts.

In this paper, we examine how debt affects one particular set of decisions that impact the well-being of a firm's employees. Specifically, we use plant-level data on employee injuries to examine how a firm's debt load impacts its investment in workplace safety. Controlling for a number of factors, we find a positive relation between a firm's financial leverage and injury rates at the firm. These results suggest that firms invest less in workplace safety when they have more debt and greater pressure on the use of internal cash flows. Our results as a whole shed new light on the way in which ex-ante financing decisions impact non-financial stakeholders.

Contracts between a firm and its various stakeholders are inherently incomplete. This incompleteness can be especially severe when it comes to investments that a firm makes in maintenance, training, and supervision that affect workplace safety. While the firm is bonded by safety requirements and work rules negotiated by employees, employee unions, and government regulators, these rules cannot fully specify the level of attention paid to investments in overall workplace safety. Moreover, since labor representatives and government regulators do not have the resources to fully observe working conditions, the firm is able to exert some discretion over its investments in workplace safety.

Theory suggests that firms may invest less in employee safety when they have more debt in their capital structure for two reasons. First, since interest payments reduce a firm's investable resources, a firm with more debt may be unwilling or unable to invest in safety at the same level that a firm with less debt would. Consistent with this argument, the financing constraints literature largely concludes that firms invest less in capital assets and research and development when they have less available cash. Second, firms with more debt are more likely to go bankrupt, and any long-run returns to the firm from investing in safety will accrue to creditors rather than current shareholders in the event of bankruptcy.

While we cannot observe a firm's investment in employee safety directly, we can observe the outcome of this investment: the frequency with which its employees are injured on the job. We obtain annual plant-level survey data from the Occupational Health and Safety Administration (OSHA) that includes number of injuries, average number of employees, and total hours worked. To assess the effects of debt on investments in employee safety, we examine the relation between the frequency of injuries at an establishment and the financial leverage of its parent company at the beginning of the year. We find a positive relation using several different models, and controlling for a number of firm characteristics, including industry $\times$ year dummies to account for variation in injury rates within industries over time and a fixed-effects Poisson model controlling for all cross sectional variation at the establishment level. This relation is economically significant, with a 10% increase in leverage translating into an approximately 4% increase in injury rate. Injury rates are also higher when firms are smaller and when firm-level sales growth is high, suggesting that injuries are more common in faster-growing firms. However, injury rates are also higher for firms with lower firm level capital expenditures, suggesting that investment in workplace safety is correlated with investment in other areas.

Of course, we cannot rule out the possibility that, even with all of the controls that we employ, some omitted variable drives the relation we observe between injury rates and leverage. In order to establish constrained cash flow as a channel through which this relationship is generated, we use a 2004 tax holiday on foreign profit repatriation as a quasi-natural experiment. In 2004, The American Jobs Creation Act created a temporary tax holiday that effectively reduced the U.S. tax rate on repatriations from foreign subsidiaries from 35 percent to 5.25 percent. As demonstrated in previous studies, this allowed firms to repatriate a significant amount of cash from overseas. Using this tax holiday as a plausibly exogenous change in the availability of cash, we show that the establishments of firms with positive cumulative foreign profits in the three years prior to the act saw a substantial decline in injury rates after 2004 relative to those of firms with zero or negative overseas profits.[1] Moreover, this decline was most significant among firms with higher leverage.

We also examine how employee bargaining power interacts with capital structure to impact workplace safety using a measure of state-level union intensity. If employee bargaining power attenuates the adverse effects of leverage on employee safety, we should find that the relationship between injury rates and leverage weakens with unionization. However, if increasing the amount of cash flow committed to creditors weakens the ability of employee empowerment to induce firms to invest in workplace safety, the relationship should instead strengthen. Our results support this latter hypothesis.

Since the early work of Jensen and Meckling (1976) and Myers (1977), researchers have emphasized how incomplete contracts between financial stakeholders give rise to an agency cost of debt. Titman (1984) extended this idea to illustrate how such agency costs necessarily extend to other stakeholders with whom the firm must contract, in particular its customers, suppliers, and workers. While a large empirical literature has sought to identify the impact of agency frictions on firm decisions and the value of its financial claims, less attention been paid to the real impact on these non-financial stakeholders.

Rose (1990) and Dionne, Gagné, Gagnon, and Vanasse (1997) examine how the financial

[1] Note that all of the establishments in our sample are located in the United States.

condition of firms may influence customer and employee well-being by examining serious operating accidents in the airline industry in the U.S. and Canada respectively. They find that operating margins are negatively correlated with the likelihood of accidents, and Dionne, Gagné, Gagnon, and Vanasse (1997) find some evidence that beginning of period debt levels impact the likelihood of accident but only for carriers with negative equity. In a similar estimation, Beard (1992) studies a small sample of trucking companies and finds that roadside inspection violations are decreasing in equity valuation. These studies, however are limited to a small handful of firms in specific industries and have little to say about the direct impact of leverage on employee safety.[2]

The closest work to ours is a study by Filer and Golbe (2003), which examine 1,065 OSHA safety inspections at 255 firms from 1972 to 1987 and estimates the occurrence of serious inspection violations as a function of the financial condition of the firm. They find that firms with higher operating margins and higher debt levels have *fewer* predicted violations. Thus their results on leverage are the opposite of ours. We note though that their sample period differs from ours and that they measure only violations occurring from program inspections and not the actual real outcomes (i.e., injuries) that we measure. Moreover, fewer than 30% of inspections report any violations at all, and the sparse nature of their data does not allow Filer and Golbe (2003) to control for time trends.

Our study is also related to the empirical literature on financing frictions and firm employment decisions. Gordon (1998), for instance, show that higher firm debt levels are associated with reductions in employment levels which are not fully attributable to performance, while Cronqvist, Heyman, Nilsson, Svaleryd, and Vlachos (2009) show that firms with more entrenched managers tend to pay their workers more. In a recent working paper, Benmelech,

[2]In a theoretical model, Beard (1990) explores the theoretical link between the asymmetric payoff of bankruptcy costs and worker care, demonstrating that such a relationship can result in either under-investment or over-investment in safety. As such, it is an empirical question whether greater debt usage results in an underinvestment in workplace safety for the majority of firms.

Bergman, and Seru (2011) attempt to measure the importance of financing constraints on firm employment decisions. Using several different approaches, they show that employment levels are sensitive to free cash flow and that this sensitivity is greater for firms with higher leverage. Our study also complements the literature on capital structure and labor bargaining, including work by Bronars and Deere (1991) and Matsa (2010) showing that firms appear to use financial leverage in order to gain bargaining power over their unions. Finally, our paper contributes to the overall literature on financing constraints pioneered by Fazzari, Hubbard, and Petersen (1988).

Finally, our study contributes to a small but important literature examining the consequences of the tax repatriation holiday enacted by the American Jobs Creation Act of 2004. The act was intended to spur domestic U.S. investment by relaxing financing constraints faced by multinational firms, with the hope that this would lead to the creation of additional U.S. jobs. The amount of funds repatriated under the act was considerable ($312 billion according to IRS data). However, there is disagreement about how these funds were ultimately used. While the act required that repatriated funds be used only for certain types of domestic investment, funds in a company are fungible and repatriated funds may have been substituted for existing domestic funds without resulting in additional investment.

Dharmapala, Foley, and Forbes (2011) find no evidence that repatriated funds led to increased capital investment, research and development, or employment in the U.S. Blouin and Krull (2009) find that firms repatriating funds under the act had high free cash flow and poor investment opportunities and were therefore unlikely to have been financially-constrained. Both of these papers conclude that the majority of funds repatriated were effectively paid out to shareholders through share repurchases. Using a different approach, however, Faulkender and Petersen (2011) find that capital-constrained firms did use repatriated funds to invest in physical assets in the U.S. Our study concludes that the increase in available cash positively impacted a different form of investment, specifically investment in workplace safety, especially among firms that were highly-leveraged and therefore more likely to have been financially constrained.

The structure of the paper is as follows. Section 2 describes the data. Section 3 provides an outline of the main tests and presents the empirical results. Section 4 concludes.

2 Data

2.1 Description

Our data on workplace injuries comes from the Bureau of Labor Statistics (BLS) Survey of Occupational Injuries and Illnesses. Through a joint effort with the Occupational Health and Safety Administration (OSHA), the BLS gathers data for hundreds of thousands of establishments each year in a stratified sampling process in order to produce aggregate statistics on the state of occupational risk in various industries in the United States. Employers covered under the Occupational Safety and Health Act and employers selected to be part of the BLS survey are required to maintain records of injuries that meet OSHA definitions. These employers must make this log available to OSHA inspectors and supply the data contained in the log to the BLS.

This data is recorded each year at the establishment level, with unique identifiers and identifying information for each establishment. Each record contains information about the name, location, establishment SIC code, number of recorded injuries, average number of employees, and the total number of hours worked in any given year. We match the establishment level data to firm level data in Compustat via the recorded employee identification number in both the BLS injury data and the Compustat header file. Each firm in Compustat may contain multiple establishments. Injury rates, location data, and industrial classification are taken from the BLS data at the establishment level, and data on firm financial condition is calculated from Compustat.

The matched sample contains 2,398 unique firms and 26,451 unique establishments over eight years. All major SIC codes are represented along with all 48 Fama-French industry classifications. We exclude all financial firms (SIC code 6000-6999) and all regulated utilities (4900-4999) from our main analysis.

The data naturally presents itself as count data which we model in two ways. Using a negative binomial model, we first model the count directly as an unadjusted integer value. Second, we compute two separate measurers of establishment-level injury rates: cases per hour and cases per (average) employee. We pre-multiply the cases per hour measure by 1,000 in all of the analysis that follows to make these numbers easier to report. We use cases per hour as our primary injury rate measure, since hours represent the best measure of the quantity of time employees spend working and therefore facing the possibility of injury. We also treat hours worked as the primary exposure variable in our count models. Conclusions of our analysis are similar when using average employees as the exposure.

2.2 Sample

Table 1 presents summary statistics for the sample. Panel A shows the number of establishment-level observations in the sample by year. The number of observations declines from 2003 through 2005, before rising in 2006, and then declining again through 2009. However, the number of observations is in general fairly stable across years.

Panel B presents establishment-level summary statistics calculated from the BLS data. Consistent with the BLS's confidentiality policy, we show only means and standard deviations and do not show statistics such as medians and individual percentiles that would present data for individual establishments. The average establishment in our sample has 365 employees, though this number varies widely across the sample. The average employee works 1,725 hours in a year, or approximately 43.1 forty-hour work-weeks. On average, approximately one out of every 25 employees is injured during a given year, with slightly less than one in three injuries resulting in lost work time.

Panel C presents firm-level summary statistics for our sample. The average firm in our sample has book leverage (debt-to-total assets) of approximately 0.245, similar to average book leverage for COMPUSTAT firms as a whole. There is substantial variation in book leverage, with firms at the 10th percentile having no debt and firms at the 90th percentile having book leverage of 0.538. The statistics are similar for market leverage. The summary statistics for the other variables are in line with those for COMPUSTAT firms as a whole as well.

Table 2 shows injury rates for our sample across establishments in the 48 different industry classifications of Fama and French (1997). Two industries, Tobacco Productions and Non-metallic and Industrial Metal Mining, are omitted because the relatively small number of establishments in our sample in these industries risks revealing the identity of individual establishments. Injury rates are highest in Candy & Soda, Fabricated Products, and Transportation. Not surprisingly, they are lowest in white collar industries such as Banking, Insurance, Trading, and Computers.

To get a sense of the relative variation of injury occurrence in our sample, we report the between and within variation for three groups. Table 3 lists the variance breakdown grouped by establishment, firm, and industry. This provides a reference for the relative differences in injury occurrence in the cross section and the time series, as well as the within and between variation according to firm and industry. The within standard deviation at the establishment level is approximately one third that of the between and overall standard deviation. This suggests that the unconditional differences are much greater across establishments than over time for the same establishment. This makes identification from a pure time series model somewhat difficult, though the the variation at least appears to be of a similar magnitude. The within firm variation is much larger, suggesting that there may be substantial variation from establishment to establishment within the same firm. Since the between firm variation is actually smaller, this suggests there may be substantial heterogeneity within the establishments at the same firm adding noise to estimations which involve regressors that are constant across firm year groups.

An interesting and useful feature of the data is the identification of industry at the establishment level rather than the firm level. This allows us to assign each establishment a unique industry rather than pooling them over a potentially inaccurate firm level industry classification. This may serve to control for some of the unconditional variation from establishment to establishment when using firm effects. We see significant variation within each industry, at a level close to the overall variation.

Finally, Figure 1 depicts average injury rates by parent firm Standard & Poor's credit rating. A few of the credit rating classifications are combined because the number of firms in these classifications is small (less than ten). Each bar in the figure represents the average injury rate for establishments belonging to parent firms in one credit rating classification. While the pattern is noisy, there is a clear upward trend in injury rates as one moves from more highly-rated companies on the left to less-highly rated companies on the right. Indeed, if we treat the credit rating data as cardinal and fit a regression line to the data presented in Figure 1, the slope of the line (depicted in the figure) is positive and statistically different from zero at the one percent level, with a t-statistic of 3.64. Since credit rating is largely a function of financial leverage, this suggests a positive relation between leverage and injury rates. The next section, which presents the paper's main results, explores this relation in detail.

3 Results

This section presents the paper's main results. We first examine the relationship between injury rates and capital structure, controlling for a number of firm-level characteristics. We then examine changes in injury rates around a 2004 repatriation tax holiday, depending on whether or not a firm had foreign profits that it could have repatriated. Finally, we examine how employee bargaining power and capital structure interact to impact injury rates.

3.1 Injury rates and capital structure

We begin our analysis with a series of establishment-year level count models. Since we suspect the data is likely to be over-dispersed, we will first employ a series of negative binomial models. The negative binomial model employed is a generalization of the standard Poisson model, in which the mean has a degree of over-dispersion. Specifically:

$$y_i \sim Poisson(\lambda_i^*)$$
$$\lambda_i^* = \exp(x_i\beta + \text{exposure}_i + \epsilon_i)$$
$$e^{\epsilon_i} \sim \text{Gamma}(1/\alpha, \alpha)$$

The model relaxes the standard Poisson assumption that $\lambda = \text{E}(\lambda) = \text{Var}(\lambda)$, and it provides a direct method for testing the presence of over-dispersion by testing the significance of α. These tests show a high degree of over-dispersion. One limitation of this model, however, is that it cannot readily accommodate establishment fixed effects. Thus it cannot account for unobserved heterogeneity at the establishment level that affects both injury rates and capital structure. The Poisson model, on the other hand, can account for such fixed effects. We therefore also estimate a fixed effects Poisson model in which the the arrival rate parameter $\lambda_{i,t}$ has a fixed component for every establishment such that:

$$\lambda_{i,t} = \exp(c_i + \beta x_{i,t})$$

In addition to being unable to allow for over-dispersion, which may significantly harm efficiency if the data is over-dispersed, this fixed effects Poisson model also requires that an establishment have at least two (and possibly more) unique observations for it to be used in the estimation, which reduces the available sample size.

3.1.1 Count Model Results

The results of these initial tests are presented in Table 4. The dependent variable in each model is the number of reported injuries for an establishment-year. The first column reports the results with lagged book leverage as the only explanatory variable, along with individual year dummies to control for the time trend. The exposure variable is total hours worked at the establishment. The coefficient on lagged book leverage is positive and statistically significant, consistent with the argument that firms with greater debt burdens invest less in workplace safety.

In the second column, we add several control variables to account for other observable characteristics that might be correlated with injury rates. These control variables, all measured at the firm level, are the natural log of sales, the natural log of lagged total assets, lagged market-to-book ratio, lagged tangible assets, and investment/assets. The coefficient on lagged book leverage is reduced in magnitude, but actually increases slightly in statistical significance. The coefficient on sales growth is positive and statistically significant at the one percent level as well. Thus, once we control for other observable characteristics that are likely to be correlated with injury rates, we find evidence consistent with higher injury rates at firms that are growing more rapidly. This is consistent with an emphasis in growth leading to a less safe work environment.

The third column is the same as the second, except that we add establishment level industry dummies as explanatory variables, where we define industries using Fama and French's 48 industry classifications. Controlling for industry is important, since both injury rates and financial statement measures are likely to vary in systematic ways across industries. The results in the third column show that the coefficient on book leverage changes only slightly when we include industry dummies in the regression, and it remains statistically significant at the one percent level. Adding industry dummies attenuates the coefficient on tangible assets but does not materially alter the coefficient on leverage, which suggests that our controls are effectively capturing the impact of variation in book leverage which is orthogonal to industry specific debt capacity characteristics.

The fourth column is identical to the previous one except that the exposure variable has been changed from hours worked to average number of employees. Changing the primary exposure variable does not materially change any of the coefficients. In all four models presented so far, the alpha parameter is highly statistically significant, indicating that the data is over-dispersed. This suggests that a negative binomial model is likely to be more appropriate than a Poisson model.

The last column reports the coefficients from a fixed-effects Poisson model. In this model, the injury arrival rate is assumed to have a fixed component which is different for every individual *establishment*. Similar to a linear fixed-effects model, this model controls for all time invariant factors which impact the injury rate at the establishment level, identifying the remaining coefficients off time series variation in the data. This has the advantage of controlling for all cross sectional variation that may be due to inherent differences in the way a company operates, and by extension the impact that this variation has on leverage choice. Unfortunately, estimation of the likelihood does not allow us to account for over-dispersion, resulting in a marked decline in efficiency. In spite of this, column five gives a coefficient estimate on book leverage which is markedly similar to the coefficient in the previous three models and is still statistically significant at the 5% level. The other coefficients remain similar as well, with the notable exception of log(assets) and tangible assets. This seems to indicate that these effects are primarily driven by residual cross-sectional variation in the previous models which is not present in the fixed-effects specification.

The economic magnitude of these results can be interpreted by transforming the coefficient into an incidence rate ratio e^{β}. Since β is the difference in the log of the expected counts, the exponential gives the percentage increase in the expected count for a unit increase in the independent variable. The coefficient on leverage in columns (3) and (4) correspond to an incidence rate ratio of 1.39 and 1.42, respectively. Therefore, a difference in firm leverage of 10% of assets corresponds to a roughly 4% increase in the annual accident rate (10% $\times$ (1.4 - 1)). For comparison, the average predicted number of injuries per year evaluated at the median leverage is equal to 14.1 under model (3). Keeping all else equal, an establishment belonging to a firm with leverage at the 90th percentile (0.538) would have 15.9 predicted injuries per year, or slightly less than 2 more injuries per year than a firm at the median.

3.1.2 Tobit Model Results

In addition to our count models, we also estimate specifications using injury rates (injuries divided by hours or employees). For these tests, we use a Tobit model to account for the large clustering of zeros in the data which would otherwise bias a simple linear model. In this model, we treat the target mean injury rate as a latent variable which is censored at zero. Errors in the model represent unforeseen deviations in the target, and the target is effectively "censored" by the fact that negative errors cannot drive the observed injury rate below zero. This also helps deal with the fact that employees cannot be fractionally injured, which would otherwise create a bias in establishments with few employees.

The results of this Tobit specification is presented in Table 5, with the dependent variable being the injury rate in each year, scaled by either hours worked or average employees as noted. The first three columns mirror the results from the negative binomial models, with lagged book leverage entering the equation as significant in all specifications. The fourth column adds an additional set of controls for year $\times$ industry dummies, effectively allowing for every industry to have its own individual time trend. This additional restriction does not materially change the coefficient estimates. This set of controls demonstrates that we are not picking up a set of cross section-specific time trends and that the impact of firm leverage on injury rates is indeed orthogonal to any structural changes in industry makeup over the period.

Column five presents a similar model using average number of employees as the denominator rather than total hours. The results are similar to the previous specifications, and the coefficients all remain significant at the 1 % level.

The results of the Tobit model predict changes of similar economic magnitude to our count model specification. The average firm with leverage at the sample median of 0.19

would have a baseline injury rate of .0170 while the same firm with leverage at the 90th percentile would have an injury rate of .0205 all else equal. Comparing this result to that of the count model, a firm with median leverage with an average of 14.1 injuries would imply a firm with leverage at the 90th percentile to have 17 injuries.

3.2 Tax Driven Profit Repatriation

One obvious concern about the results in Tables 4 and 5 is that leverage may proxy for management quality, industry conditions, or other factors that could also be correlated with injury rates. While the fact that the coefficient on lagged book leverage remains statistically significant after controlling for a number of other variables as well as industry, year $\times$ industry, and establishment fixed effects in various specifications, we seek further verification that we are fully identifying the channel through which leverage is related to injury rates. We do so by appealing to a quasi-natural experiment surrounding a 2004 tax holiday which allowed firms to repatriate foreign profits at a drastically reduced tax rate.

As part of the American Jobs Creation Act of 2004, the U.S. Congress allowed corporations with foreign subsidiaries to repatriate foreign earned income at a rate of just 5.25%, with an effective tax rate as low as 3.7%, down from the standard corporate tax rate of 35%. The act had a significant impact on the total amount of cash repatriated for use in domestic operations. While the act was intended to spur new domestic investment, the evidence that firms actually funded new capital investment with these funds is mixed. What is clear however, is that firms did see a large inflow of funds from overseas subsidiaries as a direct result of the tax holiday.

We use ex-ante variation in available foreign profits prior to the 2004 act as a measure of cash available to be repatriated from foreign subsidiaries during the tax holiday. If the relationship between leverage and injury rates is the result of hard budget constraint issues, the unexpected availability of cash from foreign subsidiaries should attenuate this effect. Specifically, firms with foreign profits in the years prior to the act should see a decline in injury rates immediately after the act relative to firms lacking such profits. Moreover, there should also be a conditional effect whereby firms with significant foreign profits should see an attenuation of the impact of leverage on injury rates, since the servicing of existing debt claims is made easier by the presence of repatriated foreign profits.

The tests we propose are a non-linear analogue to a differences-in-differences specification in a linear model. We gather injury and financial data from the two years before (2002 and 2003) and two years after (2005 and 2006) the act. In addition to the usual controls, we include a dummy variable if the sum of foreign profits (Compustat variable *pifo*) over the three years prior to the act (i.e., 2001-2003) is positive.[3] This variable is interacted with a post-2004 dummy, indicating that the injury observations occur after the 2004 tax holiday. Finally these dummies are interacted with lagged book leverage to examine whether the availability of repatriated funds attenuates the leverage effect. The results of this specification in both a negative binomial count model and a latent variable Tobit model are presented in Table 6.

The first column in Table 6 reports the baseline results of the negative binomial model. The negative coefficient on the Post-2004 indicator variable indicates that the mean injury arrival rate has fallen across the board in the post 2004 period. The similarly negative coefficient on positive foreign profits indicates that firms with positive foreign profits experience

[3]Our choice of both the period over which to calculate foreign profits and the period over which to measure cumulative foreign profits are arbitrary. We chose two years on either side of the tax change to focus on a narrow window around the time of the tax change while still allowing for the possibility that some time is required for investment in workplace safety to translate into observable changes in injury rates. We chose to cumulate foreign profits over three years before the tax change to have a large enough window to reliably measure recent foreign profitability while still avoiding foreign profits from the distant past that may no longer reside in a foreign subsidiary. Our results are robust to alternative windows around the tax change and alternative windows for cumulating foreign profits.

lower overall injury rates. The interaction of the two variables demonstrates that firms with ex-ante foreign profits see an even larger decrease in injury rates after the tax act than those with no available profits to repatriate.

A large group of additional controls are added in column two to control for additional firm characteristics which might influence injury rates. It is interesting to note that the coefficient on positive foreign profits is no longer significant in this specification, suggesting that the additional controls may proxy for the firm specific traits which caused firms with foreign profits to have lower injury rates in column one. The coefficient on the interaction between the positive foreign profits and post-2004 indicators remains negative and statistically significant at the one percent level.

Column three adds lagged book leverage and interacts leverage with the post-2004 indicator, foreign profits indicator, and the interaction thereof. As seen in previous specifications, higher leverage is associated with higher injury rates. The positive coefficient on the interaction of leverage with the foreign profits dummy indicates that high leverage increases the injury rates more among foreign profit firms. The main variable of interest is the triple interaction term of leverage, the positive foreign profits indicator, and the post-2004 indicator. The negative and significant coefficient indicates that the presence of available cash through repatriated foreign profits attenuates the positive impact of leverage on injury rates. This lends additional support to the hypothesis that the conditional correlation between leverage and injury rates is due to under-investment in the face of hard budget constraints. Firms which had a large amount of cheap cash from foreign subsidiaries appear to have invested significantly more in workplace safety than firms with similarly high leverage but no available cash from foreign subsidiaries.

Columns four through six repeat the tests from column one through using a Tobit model where the dependent variable is annual injury count divided by hours worked. The results are very similar to those in the first columns. The coefficient on the interaction of the post-2004 and foreign profits indicator is negative and statistically significant at the one percent level in columns four and five, and the triple interaction with leverage is negative in column six, though it is only statistically significant at about the five percent level.

3.3 Union Intensity and Injury Rates

We next examine how employee bargaining power and leverage interact in determining firms' investments in workplace safety. One possibility is that employee bargaining power attenuates the negative effects of leverage on employee safety. For example, suppose that firms substitute investment away from employee safety and to other uses as cash becomes more scarce due to a higher debt service requirement. Employees endowed with more bargaining power are better positioned to resist such disinvestment in safety. In this case, the injury rate should increase with leverage less in firms where employees have more bargaining power. Consider a regression of a measure of injuries on leverage, a measure of bargaining power, and the interaction of the two. The argument outlined here would predict a negative coefficient on the interaction term.

Another possibility is that leverage attenuates the positive effects of employee bargaining power on employee safety. Employees with more bargaining power are better positioned to resist underinvestment by firms in employee safety. By committing to pay out more cash to creditors, firms can tie their hands by limiting the amount of cash available to invest in safety. In this case, the injury rate should decrease with employee bargaining power less in firms with more leverage. Consider the regression described in the preceding paragraph. The argument here would predict a positive coefficient on the interaction term in that regression.

Thus, whether bargaining power attenuates the effects of leverage or vice versa is an empirical question. To answer this question, we run regressions of the type described above.

We cannot observe bargaining power directly and must therefore use a proxy for it. Perhaps the most important source of employee bargaining power is collective bargaining. If we could observe the rate of unionization at the establishment level, we could use this as a proxy for employee bargaining power. Since we cannot, we construct a state-level measure of unionization intensity and apply this measure to all establishments located in the given state.

We construct our state-level unionization intensity measure as follows. We collect annual household survey data on union membership from the Census Bureau from 2003 through 2009. This data is reported by state and industry, using the Census's own industry categories. In principle, we could simply calculate the union membership rate for each state and use this as our measure of state-level unionization intensity. However, union membership varies across industries, and the composition of industries varies across states. This is a problem, since injury rates vary systematically across industries.

Alternatively, we could simply use the union membership rate for each state-industry cell as the measure of unionization intensity for an establishment. However, this rate is zero in many cells, and would provide a very noisy measure of union intensity. Instead, we regress union membership percentage for a given year-state-industry cell on industry and state dummies, pooling the data across all years in the sample. The state dummy coefficients from this regression represent the residual state effect on unionization after removing industry effects. We use the coefficient for each state dummy as the measure of that state's unionization intensity. The measure appears reasonable in the sense that it is high in states such as Pennsylvania, Ohio and New York, where unions are more active, and low in states such as Alabama, Mississippi and South Carolina, where unions play a smaller role.

We then regress injury measures on leverage, our state-level union intensity measure, and the interaction of the two (along with control variables) to test the two hypotheses described above. Table 7 presents the results of these tests. In the first three columns, we estimate negative binomial count models using number of injuries reported as the dependent variable. In the final three columns, we estimate Tobit models using injury rate (cases per hour times 1,000) as the dependent variable. The results are consistent across all six specifications. The coefficient on the interaction of leverage and state union intensity is positive and statistically significant at the one percent level in all six.

The positive coefficient on the interaction of leverage and state union intensity supports the argument that leverage attenuates the effects of employee bargaining power on investment in workplace safety. However, if employee bargaining power has a positive effect on investment in workplace safety in general, we should find a negative coefficient on the main unionization intensity variable. This coefficient is indeed negative in all six columns in Table 7 but is small in all six and is statistically significant (at the ten percent level) in only one. Our conclusion that leverage attenuates the effect of employee bargaining power is therefore tentative, and further research is required to draw firm conclusions about how the interaction of union intensity and leverage impacts workplace safety.

4 Conclusion

There is evidence in general that firms with higher financial leverage invest less than firms with lower financial leverage. Our evidence suggests that one form of investment that is affected by leverage is investment in employee safety. This represents a cost of debt that is borne, at least ex post, by a firm's employees. We find that employee injury rates are higher in establishments of firms with more leverage. We find supporting results in a quasi-natural experiment using potential tax repatriation resulting from the American Jobs Creation Act of 2004 as an exogenous shock to investable cash flow. We also find that leverage attenuates the positive effects of union intensity on workplace safety.

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Table 1: Summary statistics

This table presents summary statistics for the data used in this study. Panel A shows the number of establishment-year observations by year, where an establishment refers to a single location of a company as identified by the Bureau of Labor Statistics. Panel B shows summary statistics for the 39,604 establishment-year observations that we study. Total hours is the number of hours worked by employees of an establishment during a year. Average employment is the average number of employees working at an establishment during a year. "Cases" is the number of recorded injuries for an establishment in a year. "LTCases" is the number of lost-time injuries recorded for an establishment in a year. Each of these injury counts is also reported per hour and per average number of employees. The per hour rates are multiplied by 1,000 to make them easier to read. Panel C shows summary statistics for the parent-level firm-year observations in our sample. Book leverage is book debt divided by book assets. Market leverage is book debt divided by the sum of book debt and the market value of equity. Sales growth is percent change in sales from the prior year. Sales are total reported sales. Assets are total reported assets. M-to-B is the firm's market-to-book ratio, defined as the ratio of the market value of its equity to the book value of its equity. The tangible asset ratio is plant, property and equipment divided by total assets. Investment/assets is capital expenditures divided by lagged assets.

Panel A: Observations by year

Year	Observations	Percent
2003	5,914	14.61
2004	5,428	13.41
2005	5,356	13.23
2006	6,392	15.79
2007	6,129	15.14
2008	5,973	14.76
2009	5,281	13.05

Panel B: Establishment summary statistics

	Mean	Std. Dev.
Total hours worked	677,662	2,440,440
Average employment	365	1,264
Hours worked/employee	1,725	417
1,000 × Cases/hour	0.0242	0.0320
Cases/employee	0.0405	0.0526
1,000 × LTCases/hour	0.0075	0.0152
LTCases/employee	0.0125	0.0246

Panel C: Firm summary statistics

	Mean	Std. Dev.	10th pctile	Median	90th pctile
Book leverage	0.245	0.302	0.000	0.189	0.538
Market leverage	0.211	0.235	0.000	0.136	0.571
Sales growth	0.079	0.347	-0.160	0.060	0.292
Log (sales)	6.456	1.941	4.017	6.509	8.956
Log (assets)	6.412	1.926	3.923	6.405	8.950
Market-to-book ratio	1.558	1.457	0.577	1.187	2.860
Asset tangibility	0.268	0.213	0.052	0.208	0.598
Invetment/assets	0.055	0.068	0.010	0.034	0.114

Table 2: Injury rates by industry

This table shows various mean annual establishment-level injury rates across different industries from 2003 through 2009. An establishment refers to a single location of a company as identified by the Bureau of Labor Statistics. Each industry depicted represents one of the Fama-French 48 industries. Two industries (Tobacco Products and Non-Metallic and Industrial Metal Mining) are omitted because the small number of establishments in these industries risks revealing the identity of an individual establishment or firm. See Table 1 for definitions of the injury rate variables.

Industry	1,000 × Cases/hour	Cases/employee	1,000 × LTCases/hour	LTCases/employee
Agriculture	0.0251	0.0491	0.0064	0.0120
Food Products	0.0298	0.0613	0.0065	0.0137
Candy & Soda	0.0418	0.0829	0.0111	0.0219
Beer & Liquor	0.0248	0.0447	0.0064	0.0118
Recreation	0.0248	0.0465	0.0043	0.0085
Entertainment	0.0120	0.0140	0.0025	0.0031
Printing and Publishing	0.0183	0.0316	0.0052	0.0090
Consumer Goods	0.0255	0.0494	0.0048	0.0094
Apparel	0.0305	0.0501	0.0072	0.0110
Healthcare	0.0251	0.0406	0.0065	0.0108
Medical Equipment	0.0166	0.0323	0.0043	0.0085
Pharmaceutical Products	0.0150	0.0301	0.0036	0.0072
Chemicals	0.0097	0.0201	0.0022	0.0047
Rubber and Plastic Products	0.0267	0.0535	0.0066	0.0133
Textiles	0.0172	0.0336	0.0026	0.0054
Construction Materials	0.0280	0.0567	0.0062	0.0125
Construction	0.0173	0.0352	0.0056	0.0112
Steel Works Etc	0.0313	0.0656	0.0074	0.0153
Fabricated Products	0.0405	0.0822	0.0106	0.0214
Machinery	0.0253	0.0506	0.0053	0.0105
Electrical Equipment	0.0260	0.0515	0.0048	0.0097
Automobiles and Trucks	0.0353	0.0685	0.0081	0.0154
Aircraft	0.0120	0.0242	0.0024	0.0048
Shipbuilding, Railroad Equipment	0.0216	0.0429	0.0053	0.0103
Defense	0.0106	0.0213	0.0025	0.0050
Petroleum and Natural Gas	0.0118	0.0239	0.0038	0.0077
Utilities	0.0152	0.0309	0.0042	0.0090
Communication	0.0162	0.0308	0.0076	0.0143
Personal Services	0.0252	0.0408	0.0081	0.0133
Business Services	0.0179	0.0329	0.0054	0.0098
Computers	0.0060	0.0119	0.0016	0.0031
Electronic Equipment	0.0093	0.0183	0.0022	0.0043
Measuring and Control Equipment	0.0112	0.0219	0.0027	0.0053
Business Supplies	0.0205	0.0415	0.0059	0.0118
Shipping Containers	0.0184	0.0380	0.0033	0.0068
Transportation	0.0454	0.0771	0.0271	0.0456
Wholesale	0.0235	0.0374	0.0064	0.0103
Retail	0.0286	0.0403	0.0081	0.0113
Restaraunts, Hotels, Motels	0.0313	0.0431	0.0074	0.0099
Banking	0.0055	0.0110	0.0014	0.0027
Insurance	0.0090	0.0151	0.0010	0.0018
Real Estate	0.0272	0.0549	0.0090	0.0174
Trading	0.0062	0.0116	0.0005	0.0010
Almost Nothing	0.0283	0.0533	0.0095	0.0184

Table 3: Panel Variance Statistics

This table presents a summary of the relative variation between and within the establishment, firm, and industry groups. The first two rows report the mean and standard deviation of the variable for the full sample. The second two rows report the standard deviation across different establishments controlling for the time series mean and within each establishment controlling for the establishment mean. The third two rows report the standard deviation between and within different firms. The fourth two rows report the standard deviation between and within each of 48 Fama-French industry categories.

	Cases/Hour x 1,000	Cases/Employee
Overall Mean	0.024	0.041
Overall Std. Dev.	0.032	0.053
Between Establishment	0.033	0.053
Within Establishment	0.013	0.020
Between Firm	0.021	0.037
Within Firm	0.027	0.044
Between Industry	0.010	0.019
Within Industry	0.031	0.050

Table 4: Capital structure and injury counts

This table presents estimates from a series of count models in which the unit of observation is an establishment-year. The dependent variable is the number of injuries reported. The explanatory variables are all measured at the firm level. See Table 1 for definitions of these variables. All regressions include an intercept term, which is not reported. Negative binomial models are estimated in columns (1) through (4). The exposure variable is hours worked during the year in columns (1) through (3) and average number of employees for the year in column (4). A Poisson model with establishment fixed effects and hours as the exposure variable is estimated in column (5). t-statistics based on standard errors clustered at the establishment level are reported in parentheses below each point estimate. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively, based on a two-tailed t-test.

	(1)	(2)	(3)	(4)	(5)
Lagged book leverage	0.2827***	0.3172***	0.3272***	0.3518***	0.3040**
	(7.38)	(7.39)	(8.05)	(8.40)	(2.06)
Sales growth		0.1448***	0.1368***	0.1938***	0.1079**
		(3.28)	(3.31)	(4.40)	(2.19)
Log (sales)		0.3805***	0.3103***	0.2870***	0.2163***
		(24.22)	(17.29)	(16.14)	(2.92)
Lagged log (assets)		-0.4048***	-0.3547***	-0.3196***	-0.1331**
		(25.59)	(20.68)	(18.80)	(2.11)
Lagged M-to-B		-0.0439***	-0.0278***	-0.0200***	-0.0380***
		(6.24)	(4.07)	(2.91)	(2.62)
Lagged tangible assets		1.4404***	0.9517***	0.9567***	-0.0761
		(26.05)	(17.45)	(17.09)	(0.31)
Capex		-1.2534***	-0.5568***	-0.8086***	-0.7371**
		(6.69)	(3.04)	(4.19)	(2.12)
Model	Neg Bin	Neg Bin	Neg Bin	Neg Bin	Poisson
Exposure	Hours	Hours	Hours	Employees	Hours
Year FE	Yes	Yes	Yes	Yes	Yes
Industry FE	No	No	Yes	Yes	No
Establishment FE	No	No	No	No	Yes
Observations	44,220	44,220	44,220	44,220	25,385
Log Likelihood	-379,543	-117,380	-115,354	-115,716	-56,115

Table 5: Capital structure and injury rates

This table presents estimates from a series of Tobit models in which the unit of observation is an establishment-year. The dependent variable is the injury rate, defined as cases per hour (multiplied by 1,000) in columns (1) through (4) and cases per employee in column (5). The explanatory variables are all measured at the firm level. See Table 1 for definitions of these variables. All regressions include an intercept term, which is not reported. t-statistics based on standard errors clustered at the establishment level are reported in parentheses below each point estimate. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively, based on a two-tailed t-test.

	(1)	(2)	(3)	(4)	(5)
Lagged book leverage	0.0128***	0.0079***	0.0101***	0.0104***	0.0189***
	(10.04)	(6.07)	(7.76)	(7.70)	(8.20)
Sales growth		0.0054***	0.0034***	0.0032***	0.0071***
		(4.33)	(3.01)	(2.74)	(3.46)
Log (sales)		0.0074***	0.0075	0.0078***	0.0124***
		(17.95)	(15.39)	(15.65)	(14.62)
Lagged log (assets)		-0.0071***	-0.0073	-0.0076***	-0.0117***
		(17.75)	(16.01)	(16.28)	(14.86)
Lagged M-to-B		-0.0010***	-0.0007	-0.0008***	-0.0012***
		(5.09)	(3.53)	(3.88)	(3.50)
Lagged tangible assets		0.0409***	0.0301***	0.0284***	0.0488***
		(24.74)	(16.97)	(15.30)	(15.66)
Investment/assets		-0.0753***	-0.0381***	-0.0343***	-0.0626***
		(12.34)	(6.35)	(5.51)	(6.02)
Rate	Hourly	Hourly	Hourly	Hourly	Per employee
Year FE	Yes	Yes	Yes	No	No
Industry FE	No	No	Yes	No	No
Year *times* Industry FE	No	No	No	Yes	Yes
Observations	44,220	44,220	44,220	44,220	44,220
Log Likelihood	47,938	48,872	50,085	50,307	34,509

Table 6: Workplace injuries, capital structure, and the American Jobs Creation Act

This table presents a series of regressions examining the change in workplace injuries around the American Jobs Creation Act of 2004. The unit of observation in these regressions is an establishment-year. Only observations in 2002, 2003, 2005 and 2006 are included in the tests in this table. Columns (1) through (3) present negative binomial models in which the dependent variable is the number of injuries reported, with hours worked during the year as the exposure variable. Columns (4) through (6) present Tobit models in which the dependent variable is the injury rate, defined as cases per hour (multiplied by 1,000). Post-2004 is an indicator variable taking a value of one in years 2005 and 2006 and zero in years 2002 and 2003. ForeignProfits>0 is an indicator taking a value of one if a firm's reported foreign profits in 2001-2003 combined were greater than zero and zero otherwise. See Table 1 for a description of the other explanatory variables. All regressions include an intercept term, which is not reported. t-statistics based on standard errors clustered at the establishment level are reported in parentheses below each point estimate. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively, based on a two-tailed t-test.

	———Neg Bin———			———Tobit———		
	(1)	(2)	(3)	(4)	(5)	(6)
Post-2004	-0.0904***	-0.0540***	-0.0267	-0.0009	-0.0001	0.0016
	(4.71)	(2.73)	(0.94)	(1.25)	(0.18)	(1.44)
ForeignProfits>0	-0.0944***	0.0386	-0.2334***	-0.0005	0.0018*	-0.0041**
	(3.27)	(1.27)	(4.63)	(0.54)	(1.68)	(2.38)
Post-2004 * ForProf>0	-0.1037***	-0.1496***	0.0606	-0.0037***	-0.0041***	0.0008
	(3.31)	(4.77)	(1.10)	(3.21)	(3.60)	(0.38)
Lagged book leverage			0.2764***			0.0112***
			(3.94)			(4.37)
Leverage * Post-2004			-0.1088			-0.0071**
			(1.27)			(2.25)
Leverage * ForProf>0			0.8641***			0.0177***
			(6.21)			(3.45)
Leverage * Post-2004 * ForProf>0			-0.5534***			-0.0130*
			(3.04)			(1.95)
Sales growth		0.1067*	0.1247**		0.0032*	0.0038*
		(1.73)	(1.98)		(1.70)	(1.94)
Log (sales)		0.2794***	0.2966***		0.0075***	0.0079***
		(13.28)	(14.15)		(11.77)	(12.32)
Lagged log (assets)		-0.3136***	-0.3331***		-0.0075***	-0.0076***
		(15.51)	(16.48)		(11.71)	(12.32)
Lagged M-to-B		-0.0493***	-0.0402***		0.0018***	-0.0015***
		(4.76)	(3.95)		(5.37)	(4.63)
Lagged tangible assets		0.9432***	0.8846***		0.0327***	0.0303***
		(14.04)	(12.74)		(13.52)	(12.19)
Capex		-0.7780***	-0.5359*		-0.0516***	-0.0473***
		(3.06)	(1.83)		(6.13)	(5.58)
Observations	21,767	21,767	21,749	21,767	21,767	21,749
Log Likelihood	-57,408	-57,004	-56,867	23,314	23,578	23,617

Table 7: Workplace injuries, capital structure, and state union intensity

This table presents a series of regressions examining the relationship between workplace injuries and state union intensity. The unit of observation in these regressions is an establishment-year. Columns (1) through (3) present negative binomial models in which the dependent variable is the number of injuries reported, with hours worked during the year as the exposure variable. Columns (4) through (6) present Tobit models in which the dependent variable is the injury rate, defined as cases per hour (multiplied by 1,000). State union intensity is measured as the coefficient on the state indicator for the state in which an establishment is located from a regression of state-industry union membership rate obtained from the Census Bureau on industry and state dummies. See Table 1 for a description of the other explanatory variables. All regressions include an intercept term, which is not reported. t-statistics based on standard errors clustered at the establishment level are reported in parentheses below each point estimate. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively, based on a two-tailed t-test.

	————Neg Bin————			————Tobit————		
	(1)	(2)	(3)	(4)	(5)	(6)
Lagged book leverage	-0.0304	-0.0870	-0.0800	-0.0007	-0.0048*	-0.0047
	(0.36)	(1.00)	(0.92)	(0.90)	(1.65)	(1.61)
State Union Intensity	-0.2650	-0.1737	-0.2100	-0.0164	-0.0130	-0.0146
	(0.71)	(0.47)	(0.58)	(1.45)	(1.17)	(1.32)
Leverage * State Union Intensity	4.6019***	5.4375***	5.4309***	0.1867***	0.2023***	0.2030***
	(4.35)	(4.94)	(4.97)	(5.12)	(5.63)	(5.66)
Sales growth		0.1411***	0.1153***		0.0036	0.0034***
		(3.38)	(2.70)		(3.11)	(2.82)
Log (sales)		0.3061***	0.3073***		0.0075***	0.0078***
		(17.00)	(16.83)		(14.99)	(15.22)
Lagged log (assets)		-0.3525***	-0.3572***		-0.0073***	-0.0076***
		(20.57)	(20.48)		(15.78)	(16.01)
Lagged M-to-B		-0.0275***	-0.0288		-0.0007***	-0.0008***
		(3.80)	(3.92)		(3.52)	(3.86)
Lagged tangible assets		0.9625***	0.9256***		0.0305***	0.0287***
		(17.31)	(16.05)		(16.72)	(15.11)
Capex		-0.5892***	-0.5033**		-0.0399***	-0.0359***
		(3.17)	(2.49)		(6.50)	(5.65)
Year FE	Yes	Yes	No	Yes	Yes	No
Industry FE	Yes	Yes	No	Yes	Yes	No
Year x Industry FE	No	No	Yes	No	No	Yes
Observations	42,319	42,319	42,319	42,319	42,319	42,319
Log Likelihood	-111,672	-110,715	-110,393	47,612	48,072	48,290

Figure 1: Injury rates by credit rating

The bars in this figure show 1,000 × the mean number of injuries per hour worked for different beginning-of-year parent firm credit ratings for establishment-years between 2003 and 2009. The line is the regression line that best fits the injury rates across the different credit ratings. Credit ratings AA- and AAA are grouped together because the small number of observations in these rating categories creates a risk that an individual firm or establishment could be identified. For the same reason, credit ratings CCC- and CC are grouped together.