

The Effect of Financial Leverage on Workplace Safety*

Jonathan Cohn

The University of Texas-Austin

Malcolm Wardlaw

The University of Texas-Dallas

March 5, 2013

Abstract

This paper uses establishment-level injury data to study the effects of a firm's capital structure on the safety of its workplace. We find that an establishment's injury rate is positively-related to its parent firms' financial leverage, especially when its operating profits are low. Two quasi-natural experiments - one involving a tax law change and the other oil price shocks - suggest that cash constraints impacting a firm's investment in safety-related activities play a role in driving the relationship between leverage and injury rates. Debt overhang also appears to play a role, as injury rates are lower following an increase in creditor control in the form of covenant violations. Finally, we find that employee bargaining power can mitigate the adverse effects of leverage on workplace safety.

*Jonathan Cohn: jonathan.cohn@mcombs.utexas.edu (512) 232-6827. Malcolm Wardlaw: malcolm.wardlaw@utdallas.edu (972) 883-5903. We would like to thank Ashwini Agrawal, Andres Almazan, Aydođan Altı, Sugato Bhattacharyya, Andres Donangelo, Jay Hartzell, Marcin Kacperczyk, Uday Rajan, Avri Ravid, Bill Schwert, Amit Seru, Sheridan Titman, Toni Whited, and seminar participants at New York University, University of Rochester, University of Texas at Austin, University of Texas at Dallas, and the Bureau of Labor Statistics for their comments. We would also like to thank Nicole Nestoriak from the Bureau of Labor Statistics for her assistance with the injury data.

The Effect of Financial Leverage on Workplace Safety

Abstract

This paper uses establishment-level injury data to study the effects of a firm's capital structure on the safety of its workplace. We find that an establishment's injury rate is positively-related to its parent firms' financial leverage, especially when its operating profits are low. Two quasi-natural experiments - one involving a tax law change and the other oil price shocks - suggest that cash constraints impacting a firm's investment in safety-related activities play a role in driving the relationship between leverage and injury rates. Debt overhang also appears to play a role, as injury rates are lower following an increase in creditor control in the form of covenant violations. Finally, we find that employee bargaining power can mitigate the adverse effects of leverage on workplace safety.

1 Introduction

This paper examines whether debt in a firm's capital structure causes a decrease in workplace safety. Many aspects of the employer-employee relationship are governed by implicit rather than explicit contracts. One especially important aspect is the safety of the working environment that the employer provides.¹ Generally, firms invest considerable resources in activities such as maintenance, training, supervision, and the replacement of aging equipment that contribute to workplace safety. However, a firm's financial policies and condition may weaken its incentives to fulfill its implicit contract to provide a safe work environment. Specifically, debt may cause a firm to reduce its investment in safety-related activities by creating incentives to focus on short-run cash flow at the expense of long-run profitability.²

Debt can cause a firm to focus primarily on short-run cash flow, and therefore to reduce investment in safety-related activities, for at least two reasons. First, debt service payments reduce internal cash flow and can cause cash constraints to bind if, as the financing constraints literature argues, external finance is relatively expensive. Second, leverage can create a debt overhang problem as in Myers (1977). Creditors capture the benefits of any increase in long-run productivity due to a safer workplace in the event of bankruptcy. Equityholders in a levered firm therefore underweight these long-run benefits when choosing how much to invest in safety-related activities. Maksimovic and Titman (1991) argue that leverage can cause a firm to underinvest in product quality for the same reason.

We test the hypothesis that leverage results in decreased safety using establishment-level data from the Bureau of Labor Statistics's (BLS's) annual Survey of Occupational Injuries and Illnesses (SOII) for 2002-2009. Consistent with this hypothesis, we find that

¹The annual cost of workplace injuries and illnesses in the U.S. is estimated to be at least \$170 billion (CSTE, 2005; CDC, 2007).

²Though not debt-related, an explosion at BP's Texas City Refinery in 2005 that killed 15 employees and injured 170 has been blamed on a short-term focus. For example, BP repeatedly decided against replacing an outdated venting system that contributed to the explosion due to cost-cutting pressure (Chemical Safety Board report, 2005).

an establishment's injury rate increases with parent firm leverage. This result is robust to controlling for a number of firm characteristics as well as establishment fixed effects, and is stronger for firms with lower operating profits. To seek further evidence that the relationship is causal, we examine the two rationales underlying our hypothesis. To test the role of cash constraints, we use two quasi-natural experiments involving plausibly exogenous cash flow shocks. Consistent with cash constraints limiting investment in safety, we find that injury rates decrease after positive cash flow shocks, especially in more leveraged firms. To test the role of debt overhang, we examine debt covenant violations, which have been shown to increase creditor control. Consistent with creditors using control rights to prevent underinvestment in activities affecting safety, we find that injury rates are lower in firms that have recently violated a debt covenant. Finally, we use data on industry-level unionization to test whether employee bargaining power limits the ability of firms to cut investment in safety when they have incentives to do so. Consistent with such an effect, we find that the relationship between leverage and injury rates is weaker in more unionized industries.³

Our results support the argument that incentives to focus on short-run over long-run cash flow result in decreased workplace safety. More generally, they contribute to the literature examining the impact of capital structure on non-financial stakeholders. Titman (1984) argues that many of the potential costs of debt are borne by agents such as customers, suppliers and employees who do not hold financial claims on the firms. A few papers (Gordon (1998), Benmelech, Bergman, and Seru (2011)) have shown that financial distress impacts employment level, thereby exposing employees to unemployment risk. Ours is the first paper we are aware of to show that leverage impacts employees over long periods of continuous employment. Moreover, while employees can, in principle, hedge unemployment risk by

³One caveat is we have no way to verify that the *reported* injuries in our data equate perfectly to *actual* injuries. These numbers could, in theory, be manipulated by either employers or employees. One factor limiting the scope for manipulation is that the data contains only reported injuries that, at a minimum, required first aid treatment. We also conduct a robustness check using only lost-time injuries, which should be even less subject to manipulation, and find consistent results.

reducing investment in firm-specific human capital, hedging workplace safety risk is likely to be more difficult, making these costs harder to mitigate. Our results also have important implications for capital structure policy, as firms likely bear the cost that leverage imposes on employees through its effect on safety indirectly through higher wages and lost productivity.⁴

We begin our analysis by estimating a series of count models relating establishment-level injury rates to lagged measures of parent firm financial leverage. Our estimates indicate that an increase in parent firm debt-to-assets from the 50th percentile to the 90th percentile in our sample is associated with an increase in the expected number of injuries at an average establishment from 14 to 16, approximately a 14% increase. The relationship between injury rates and debt-to-assets is robust to controlling for a number of other firm characteristics, as well as establishment fixed effects. We also find similar results using alternative measures of indebtedness such as interest coverage ratios and credit ratings. Moreover, the relationship between leverage and injury rates is stronger when a firm's operating profits are lower, i.e., when a firm is most likely to be financially distressed.

One alternative explanation for the positive relationship between leverage and injuries is that poor management could cause both high injury rates and the accumulation of debt due to persistent losses. Establishment fixed effects help some in addressing this and other potential omitted variables problems by controlling for any *time-invariant* heterogeneity across establishments. We seek further evidence that our results reflect a causal effect of leverage on injuries by examining the roles of cash constraints and debt overhang, the hypothesized underlying causes of this relationship, directly.

We test the role of cash constraints using two quasi-natural experiments involving plausibly exogenous cash flow shocks. The first of these is the American Jobs Creation Act

⁴Estimates of the compensating wage differential in the industrial economics literature are \$20,000 - \$70,000 per expected non-fatal injury and \$9 million per fatal injury in 2000 dollars (Viscusi and Aldy, 2003). Perhaps more importantly, a firm with an unsafe workplace may face difficulty attracting talented employees and maintaining morale.

(“AJCA”) of 2004. The AJCA lowered the cost of accessing cash tied up overseas by temporarily lowering the tax rate on income repatriated from foreign subsidiaries.⁵ This increased cash available to invest in the U.S. We find that injury rates at U.S. establishments of firms with unrepatriated foreign profits as of the end of 2003 declined immediately after 2004 relative to those of firms without unrepatriated profits.⁶ Moreover, the decline was most significant among firms with higher leverage (i.e., those most likely to be constrained). While other changes around this time could explain differential changes in injury rates across the two groups, it is more difficult to argue that they would also have differentially affected changes in the sensitivity of injury rates to leverage.⁷

Our second quasi-natural experiment is in the spirit of Lamont’s (1997) oil price shock experiment. Specifically, we examine the impact of oil price innovations on injury rates at non-oil producing establishments of firms that also have oil-producing establishments. We find that injury rates at non-oil establishments of firms with oil exposure decrease with oil prices, relative to those of firms without oil exposure.⁸ Both of our experiments then indicate that firms respond to positive cash flow shocks by improving workplace safety, consistent with cash constraints limiting investment in safety pre-shock.

We investigate the role of debt overhang in driving the relationship between leverage and injury rates using data on debt covenant violations. Several papers indicate that creditors

⁵The IRS estimates that \$312 billion of cash was repatriated as a consequence of the AJCA.

⁶Dharmapala, Foley, and Forbes (2011) find no evidence that firms with unrepatriated foreign profits increased capital investment in response to the act. However, it is possible that constrained firms were forgoing investment in safety-related activities (e.g., maintenance) rather than in more strategically-critical productive assets pre-AJCA. Faulkender and Petersen (2011) find that capital-constrained firms that actually repatriated funds did use them to invest in physical assets in the U.S.

⁷One alternative explanation for these results is that constrained firms used additional cash to expand more in low-injury risk activities rather than to increase the safety of existing activities. However, we find that firms did not increase employment in establishments in lower injury rate industries relative to those in higher injury rate industries in response to the shock.

⁸One concern with this approach is that non-oil operations of firms with oil-producing operations may experience investment opportunity shocks that are correlated with oil prices, perhaps because they are located in oil-producing regions. If anything, however, this probably works against our conclusions, as such investment opportunities are likely to be substitutes for investment in workplace safety.

gain control rights in the event of covenant violations, allowing them to influence capital investment decisions (Chava and Roberts (2008), Roberts and Sufi (2009), Nini, Smith, and Sufi (2009)). If equityholders underinvest in activities affecting safety because much of the benefit of this investment accrues to creditors, then an increase in creditor control should result in more investment in these activities. Consistent with this argument, injury rates are lower for firms that have experienced a recent covenant violation, controlling for leverage. Moreover, these results are stronger for highly-leveraged firms, where a greater fraction of the expected benefits of such investment is likely to accrue to creditors.

Finally, we investigate the ability of employee bargaining power to mitigate the adverse effects of leverage on workplace safety. Employees with more bargaining power are better positioned to resist actions that might lead to a deterioration in safety, for example by threatening work stoppages or slowdowns. Following the literature, we use industry-level unionization rates as a proxy for employee bargaining power.⁹ Consistent with a mitigating effect, we find that the sensitivity of injury rates to leverage decreases with the unionization rate in the industry to which an establishment belongs.

In related papers, Rose (1990) and Dionne, Gagné, Gagnon, and Vanasse (1997) find that operating margins are negatively correlated with the likelihood of serious accidents in the airline industry. Dionne, Gagné, Gagnon, and Vanasse (1997) find some evidence that leverage impacts the likelihood of airline accidents, but only for carriers with negative equity. Beard (1992) studies a small sample of trucking companies and finds that roadside inspection violations are decreasing in equity valuation. These studies 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. The closest work to ours is a study by Filer and Golbe (2003). They find that firms with more debt have *fewer* OSHA safety violations, a conclusion seemingly inconsistent with ours. However, they measure inspection violations rather than actual

⁹See Bronars and Deere (1991) and Chen, Kacperczyk, and Ortiz-Molina (2011) for examples.

injuries, their sample is much smaller, and their tests are more limited.

Other papers have examined the effect of financing on employees by studying firm employment decisions. Gordon (1998) shows that higher firm debt levels are associated with reductions in employment that are not fully attributable to performance. Benmelech, Bergman, and Seru (2011) show that employment levels are sensitive to free cash flow and that this sensitivity is greater for firms with higher leverage. Agrawal and Matsa (2012) present evidence that firms increase leverage in response to exogenous increases in unemployment benefits, suggesting that they at least partly internalize the cost of unemployment risk. Our study extends this literature by linking leverage to negative employee outcomes beyond job loss. It 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.¹⁰

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

In this section, we describe the data that we use in the paper. We also present summary statistics for our sample.

2.1 Description

Our data on workplace injuries comes from the Bureau of Labor Statistics (BLS) Survey of Occupational Injuries and Illnesses (SOII). Through a joint effort with the Occupational Health and Safety Administration (OSHA), the BLS gathers data for hundreds of thousands

¹⁰Other related papers include those by Bae, Kang, and Wang (2011), who find that firms with more debt score lower on a third party rating of employee friendliness, and Brown and Matsa (2012), who show that firms in financial distress have fewer and lower quality job applicants.

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 a log recording any injuries that, at a minimum, require first aid treatment. These employers must make their injury logs 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 a unique identifier for each establishment. Each record contains information about an establishment's name, location, SIC code, number of recorded injuries, number of injuries resulting in days away from work ("lost-time" injuries), average number of employees, and the total number of hours worked at the establishment during the year. It also includes, for the period 2002-2009, the employer identification number (EIN) of the establishment's parent company. We use the EIN to match the establishment level data to firm level data in Compustat. Because EINs are available in the BLS data only for 2002-2009, our sample period is limited to these years. Each firm in Compustat may contain multiple establishments.

We calculate several firm-level financial variables using the Compustat data. Our primary measure of financial leverage is *Debt/Assets*, which is book debt (the sum of Compustat items *dlc* and *dltt*) divided by total book assets (*at*). We also use a firm's interest coverage ratio and its credit rating as alternative measures of leverage that measure not the quantity of its debt, but rather its capacity to service its debt. *InterestCoverage* is pre-interest cash flow divided by interest expense (*xint*), where pre-interest cash flow is the sum of income before extraordinary items (*ib*), depreciation expense (*dp*), and interest expense. This variable is then divided by 1000 to make the regression output more readable. *CreditRating* is the firm's Standard and Poor's credit rating as reported in Compustat.

Log(assets) is the natural log of total book assets. *AssetTurnover* is total sales (*sale*) divided by lagged total book assets. *MarketToBook* is the market value of assets divided

by total book assets. The market value of assets is defined as the sum of the market value of common equity (the product of shares outstanding, *cs hpri*, and the firm’s stock price, *prcc_f*), preferred stock (*pstkl*) and book debt, minus the book value of deferred taxes (*txdb*). We set the value of preferred stock or deferred taxes to zero if the relevant item is missing in Compustat. *TangibleAssetRatio* is net property, plant and equipment (*ppent*) divided by total book assets. *Capex/Assets* is capital expenditures (*capx*) divided by lagged total book assets. *ROA* is income before extraordinary items divided by lagged total assets. We winsorize all of the financial variables at the 1st and 99th percentiles to reduce the possible influence of outliers.

We exclude from our sample any observations for which any of the firm-level Compustat variables described above is missing. We also exclude all establishments belonging to financial firms (SIC code 6000-6999) or regulated utilities (4900-4999) from our sample. This leaves us with a primary sample consisting of 44,244 establishment-year observations for 26,451 unique establishments, which belong to 2,398 unique firms. For the purposes of some of our tests, we also match our sample to data on oil prices, union coverage, and covenant violations. We defer descriptions of these data until the specific points at which we discuss these tests.

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 355 employees, though this number varies widely across the sample. The average employee works 1,720 hours in a year, or approximately 43 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 0.238, 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 mean of interest coverage is 0.034, corresponding to a coverage ratio of 34 times annual interest. Variation in coverage is substantial, with the 10th percentile representing negative pre-interest cash flow. The summary statistics for the other variables are in line with those for Compustat firms as a whole as well.

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. Table 2 shows injury rates (per hour worked and per average number of employees) for our sample across establishments in different industries. We define industries using the 48 industry classifications of Fama and French (1997), and assign each establishment to one of these industries based on its SIC code as reported in the BLS data. 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 groupings. Table 3 lists the variance breakdown of injury rates 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 establishment standard deviation is approximately one third that of the between and overall standard deviation.

3 Results

This section presents the paper's main results. As a preliminary step, we begin by plotting injury rates against parent firms' credit ratings (a discrete measure of leverage). We then turn to our main analysis, where we examine the relationship between injury rates and capital structure controlling for other firm characteristics that may be related to both injury rates and leverage. Next, we use two quasi-natural experiments - one involving a change to the tax rate on repatriated foreign income, and the other involving oil price shocks - to further test whether our main results are driven by higher debt levels causing reduced expenditure on safety-related activities by causing cash constraints to bind. We then test the role of debt overhang in driving the relationship between leverage and injury rates by examining whether injury rates decline when creditors gain control rights as a result of a covenant violation. Finally, we investigate whether employee bargaining power mitigates the effects of financial leverage on workplace safety.

3.1 Injury rates and capital structure - graphical depiction

We begin our analysis of the relationship between injury rates and capital structure by showing average injury rates by parent firm Standard & Poor's credit rating in a simple plot in Figure 1. A few of the credit rating classifications are combined in this graph 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 z-statistic of 3.64.

3.2 Injury rates and capital structure

Our injury data naturally presents itself as annual count data. Our multi-variate analysis therefore consists primarily of estimating a series of count models. The dependent variable in these models is generally the number of injuries at an establishment in a given year, though we also use the number of lost-time injuries in one specification. Naturally, injury counts are likely to be higher in larger establishments. Specifying an exposure variable, which reflects the amount of exposure that a unit has to the event in question occurring, accounts for these differences in exposure. We use the number of hours worked at the establishment during the year as the exposure variable, since an employee's conditional likelihood of being injured in any time interval should naturally be driven by the number of hours she works during that interval.¹¹

The two most commonly-used count models are the Poisson model and the negative binomial model. The Poisson model imposes the assumption that the mean and variance of the arrival rate are the same. The negative binomial model is a generalization of the Poisson

¹¹We reach the same conclusions in the paper using average number of employees at an establishment for the year as the exposure variable.

model that does not impose this assumption, and is written:

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

The validity of the Poisson model assumption that $\lambda = E(\lambda) = \text{Var}(\lambda)$ can be tested directly using the estimate of α obtained from the negative binomial model. An α statistically different than zero is evidence of over-dispersion in the data (i.e., that the variance of the arrival rate is greater than the mean). We find that α is highly statistically significant in all of our tests. We therefore focus on estimates from negative binomial models in our analysis.

One limitation of the negative binomial 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 measures. 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 reduce efficiency if the data is over-dispersed, the 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.

3.2.1 Main Results

We begin by estimating count models in which the explanatory variable of interest is *Debt/Assets*. The results of these tests are presented in Table 4. The dependent variable in each model is the number of reported injuries for an establishment-year. The exposure variable in this table and in all subsequent tables in which we estimate count models is the total number of hours worked at the establishment during the year. The explanatory variables are all lagged one year, with the exception of the flow variables *AssetTurnover* and *Capex/Assets* which are contemporaneous. Column (1) reports the results with *Debt/Assets* as the only explanatory variable, along with individual year dummies to account for any aggregate time trends in injury rates. The coefficient on *Debt/Assets* is positive and statistically significant at the one percent level, consistent with the argument that firms with greater debt burdens invest less in workplace safety-related activities.

In column (2), we add several control variables to account for other observable characteristics that might be correlated with injury rates. The coefficient on lagged book leverage becomes slightly larger in magnitude when we include these controls, and remains statistically significant at the one percent level. The positive significant coefficient on *AssetTurnover* is consistent with higher injury rates at firms that produce more per factor unit. The positive significant coefficient on *TangibleAssetRatio* is consistent with higher injury rates in firms in which production relies more on physical assets than in more service-oriented firms. The negative coefficient on *Capex/Assets* is consistent with injury rates declining as firms replace old production equipment with newer equipment that must meet higher safety standards.

Column (3) is the same as column (2), 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. For example, the coefficients on *TangibleAssetRatio* and *Capex/Assets* both decline substan-

tially in magnitude when we include industry dummies. Thus these variables at least partly capture information about the industries in which a firm operates that is related to injury rates. However, the coefficient on book leverage actually becomes somewhat larger, suggesting that the relationship between the injury rate and leverage in the first two columns is not being driven by differences across industries. The coefficient on *AssetTurnover* also retains a similar magnitude.

Column (4) replaces the year and industry effects with year \times industry effects. Thus a separate dummy is included for every industry-year combination, accounting for the possibility that different industries experience different trends. Coefficient estimates on the variables of interest remain almost unchanged.

In all four models presented so far, the alpha parameter (not reported) 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. However, we also estimate a Poisson model with establishment fixed effects in order to control for any time-invariant factors that impact the injury rate at the establishment level, acknowledging that over-dispersion causes a marked loss in the efficiency of the estimation.

Before doing so, we first estimate a Poisson model without fixed effects so that we can compare the results from otherwise comparable negative binomial and Poisson models. Column (5) shows the results from this estimation. The coefficient on *Debt/Assets* declines slightly in magnitude, but remains statistically significant at the one percent level. All of the other coefficients retain their signs as well, though the magnitudes of some change considerably, and statistical significance levels are generally lower than in the negative binomial model estimates.

Column (6) reports the coefficients from a fixed-effects Poisson model. Note that an establishment must have at least two observations in the data to be used when estimating an establishment fixed effects model. As a result, the number of observations falls from 44,244

to 25,396 when establishment fixed effects are included. These observations are distributed over 8,019 unique establishments, implying slightly more than three observations per establishment. In addition to the reduced sample size, Table 3 shows that within-establishment injury rate variation is only about 1/3 of the between-establishment variation in injury rates in our sample. Thus reliance on only time series variation within establishment to identify coefficients substantially reduces power. Nevertheless, the coefficient on *Debt/Assets* is of a similar magnitude to those in the first five columns, and is statistically significant at the five percent level.

The economic magnitude of the estimates in Table 4 can be analyzed by transforming the β coefficients into incidence rate ratios 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 associated independent variable. The coefficient on *Debt/Assets* in columns (3), where we account for other observable firm characteristics as well as year and industry dummies, corresponds to an incidence rate ratio of 1.46. Therefore, a 10% increase in *Debt/Assets* corresponds to a roughly 4.6% increase in the annual accident rate ($10\% \times (1.46 - 1)$). For comparison, the average predicted number of injuries per year evaluated at the median of *Debt/Assets* (0.189) is equal to 14.0 in the same model. Keeping all else equal, an establishment belonging to a firm with leverage at the 90th percentile (0.538) would have 16.0 predicted injuries per year, or around two more injuries per year than a firm at the median.

3.2.2 Alternative Specifications

To verify that our results are robust and to expand upon them, we estimate several alternative specifications using different measures of injury rates and leverage. The results of these alternative specifications are reported in Table 5. Again, all explanatory variables are lagged one year. We include year and industry dummies in all of the regressions in this

table.

Column (1) repeats the test from column (3) of Table 4 using number of lost-time injuries rather than total injuries as the dependent variable. Lost time injuries are those that are so severe that the employee cannot return to work, in any capacity, for at least a full day. The coefficient on *Debt/Assets* in this specification is very similar to those in Table 4, suggesting that the relationship between leverage and injuries is not limited to minor injuries, but applies to more serious injuries as well. The other coefficients are also similar in magnitude to those in Table 4.

In column (2), we examine how the sensitivity of injuries to leverage varies with parent firm operating performance by adding the interaction of *Debt/Assets* to *ROA* (return on assets) to the main regression. High leverage should cause cash constraints to bind more tightly in unprofitable firms than in profitable firms. Consistent with such a difference, the coefficient on the interaction term is negative and statistically significant at the one percent level. Thus it appears that high cash flow mitigates the adverse effects of high leverage on workplace safety. This provides further evidence that the effect of leverage on injuries is directly related to the pressure that hard debt claims creates on free cash flow available for investments in activities that increase safety.

In column (3), we replace *Debt/Assets* with *InterestCoverage* as our measure of financial leverage. While interest coverage can be difficult to interpret when interest payments (the denominator) are small, the measure is useful because it accounts for the size of a firm's debt service requirement *relative to* the amount of cash flow it has available to service its debt. It also represents a short-term measure of debt service requirement. A firm's short-term debt servicing needs may be more directly relevant to the degree to which it is cash-constrained in the current period than its total debt level (which reflects information about all future interest payments) is. The negative coefficient on *InterestCoverage* is consistent with the positive coefficient on *Debt/Assets* in the previous regressions. The injury rate is lower in

an establishment when the parent firm generates more cash flow relative to the size of its interest payments (i.e., when it is less leveraged).

Finally, while our analysis focuses on count models, we also conduct one test where the dependent variable is the (continuous) injury rate for the year (specifically, $1,000 \times$ injuries per hour). For this test, 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 that is left-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 are presented in column (4) and are consistent with the results of our count models.

The results of the Tobit model predict changes of similar economic magnitude to our count model specifications. The average firm with *Debt/Assets* at the sample median would have a baseline injury rate of 0.0170 while the same firm with leverage at the 90th percentile would have an injury rate of 0.0205 all else equal. The average predicted number of injuries per year evaluated at the median of *Debt/Assets* is equal to 14.1. Keeping all else equal, an establishment belonging to a firm with leverage at the 90th percentile would have 17.3 predicted injuries per year, or slightly more than three more injuries per year than a firm at the median.

3.3 Credit Ratings

As a last step in examining the relationship between leverage and workplace safety, we formalize the results in Figure 1 by testing for statistically significant variation in injury rates across credit rating classifications. For each establishment year, we record the outstanding S&P long-term debt rating of the parent firm as of the beginning of the year. In order to

get sufficient power, we aggregate credit ratings into five bins: AA and above, A, BBB, BB, and B or below. For each group we generate an indicator variable if the credit rating of the firm is in a given rating bin. We then regress the injury count on each of these indicators using our negative binomial specification. The lowest default risk rating category, AA and above, is taken as the baseline.

The results of these tests are reported in Table 6. The first column reports the results using year dummies to control for the time trend and the second column adds industry controls as well. Below each set of results, we report the predicted mean injury rates conditional on being in each of the five credit rating bins. For each specification, injury rates are increasing across most of the major rating categories, with AA and above having the lowest average injury rates and B or below having the highest average injury rates. The difference in injury rates is significant, with the lowest credit quality firms having between 70% to 30% higher injury rates than the highest quality firms.

We directly test whether each of these rating categories is different from the one above it. For the first specification, all ratings categories are significantly different from each other at the 5% level with the exception of BB to BBB, for which the difference is statistically indistinguishable from zero. For the second specification the relationship is perfectly monotonic, though the differences from BBB to A and B or below to BB are not statistically significant at conventional levels.

3.4 Tax-Driven Profit Repatriation

One obvious concern about the results in Tables 4, 5 and 6 is that measures of leverage may proxy for management quality, industry conditions, or other factors that could also be correlated with injury rates. We are comforted somewhat by the fact that the injury rates continue to vary with leverage measures at a statistically significant level after controlling for a number of other variables, industry and year \times industry dummies, and establishment

fixed effects in various specifications. However, we seek further verification that we are fully identifying the channel through which leverage is related to injury rates by examining the specific channels underlying our hypothesis - cash constraints and debt overhang. To test the role of cash constraints, we appeal to two quasi-natural experiments, both of which involve plausibly exogenous shocks to available cash flow. If the relationship between leverage and injury rates is due to highly-leveraged firms facing cash constraints that limit their investment in activities that contribute to workplace safety, then, by relaxing such constraints, an exogenous increase in available cash flow should result in reduced injury rates. Moreover, the reduction in injury rates should be greater in firms with more leverage at the time than in those with less leverage.

The first of our quasi-natural experiments exploits a 2004 tax holiday that allowed firms with foreign subsidiaries to repatriate foreign profits at a drastically reduced tax rate. The American Jobs Creation Act (AJCA) of 2004 permitted 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 foreign profits in the years immediately 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 constraints, 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. Thus we employ a difference-in-differences approach to testing for evidence that the shock to available cash relaxes constraints on investment in activities that contribute to workplace safety.

To focus on the period right around the AJCA of 2004, we limit the sample we use in these tests to establishment-year observations in the years 2002, 2003, 2005 and 2006 (i.e., the two years before and two years after the shock). For each firm with an establishment in the sample, we compute the firm's cumulative foreign profits over the years 2001-2003 (i.e., the three years prior to the shock), where foreign profits are defined as Compustat variable *pifo*. While the period over which we cumulate foreign profits is somewhat arbitrary, a three-year window is long enough to reliably measure recent foreign profitability while avoiding foreign profits from the distant past that may no longer reside in a foreign subsidiary. Our results are robust to both alternative windows around the tax change and alternative windows for cumulating foreign profits. Any noise in our measure of accumulated foreign profits due to our approach should bias against finding results.

We compute a dummy variable $FrgnProf > 0$ that is equal to one if the sum of a firm's foreign profits from 2001 through 2003 is positive, and zero if it is zero or negative. We also construct a dummy variable $Post2004$ that is equal to one if an observation occurs in 2005 or 2006 and zero if it occurs in 2002 or 2003. We then estimate negative binomial models in which the dependent variable is injury count, and the primary explanatory variables of interest are $FrgnProf > 0$, $Post2004$, and especially the interaction of the two. Table 7 presents the results from these tests.

In column (1), $FrgnProf > 0$, $Post2004$, and the interaction of the two are the only explanatory variables. The negative coefficient on $Post2004$ indicates that the mean injury arrival rate has fallen across the board in the post 2004 period. The negative coefficient on $FrgnProf > 0$ indicates that the establishments of firms with positive foreign profits in the years prior to the tax shock experience lower injury rates in the pre-2004 period. Most importantly, the coefficient on the interaction of the two variables is negative. This indicates that the establishments of firms with foreign profits in the years prior to the tax shock see a larger decrease in injury rates after the tax shock than those with no available profits to

repatriate.

In column (2), we add firm-level control variables. The coefficient on *Post2004* shrinks and ceases to be statistically significant. The coefficient on *FrgnProf* > 0 flips signs and becomes positive. However, the coefficient on the interaction of the two remains negative and statistically significant, and increases in magnitude.

In column (3), we add industry dummies to the regression. The coefficient on *Post2004* becomes negative and statistically significant again. The coefficient on *FrgnProf* > 0 shrinks in magnitude and ceases to be statistically significant once we add industry dummies. This suggests that there is nothing inherent about having foreign profits that causes a firm's establishments to have lower injury rates than those of firms without foreign profits once the establishment's industry membership is taken into account. The coefficient on the interaction of *FrgnProf* > 0 and *Post2004* remains negative and statistically significant, and is of approximately the same magnitude as in column (2).

Column (4) adds *Debt/Assets*, as well as interactions of it with *Post2004*, *FrgnProf* > 0, and the interaction of those two variables. The triple interaction term - *Debt/Assets* * *Post2004* * *FrgnProf* > 0 - is the main variable of interest in this specification. The negative and significant coefficient on the triple interaction term indicates that the presence of available cash through repatriated foreign profits attenuates the positive relationship between leverage and 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. In fact, the statistically insignificant coefficient on the interaction *Post2004* * *FrgnProf* > 0 suggests that a shock to available cash flow has no impact on injury rates if a firm has no leverage.

One alternative explanation for our results using the AJCA is a shift in the profile of establishments following a positive cash flow shock. For example, a cash constrained firm experiencing a positive cash flow shock may use the additional cash to expand productive

activities associated with lower injury rates, perhaps because returns to investment in those activities happen to be higher. This would lead to a relative decrease in observed injury rates post-AJCA for firms with previously unrepatriated profits, even if existing jobs do not become any safer. We cannot test this explanation directly as we do not observe growth in specific activities within an establishment. However, for a subsample of firms, we can measure growth (in number of employees) *across* establishments.

In untabulated tests, we examine cases where a firm with positive foreign profits has two establishments appearing in our sample in at least one of the years 2002 and 2003 (the two years before the act) and at least one of 2005 and 2006 (the two years after the act). We compute the pre-act year injury rate for each of the two establishment's industries (using the Fama-French 48 industries). We then test whether the number of employees increases more from before to after the act in the establishment belonging to the industry with the lower injury rate. We find, if anything, that the opposite is the case. There is slightly more growth in establishments in higher-injury rate industries than lower-injury rate industries. This suggests that a shift in the profile of activities towards activities with lower injury risk is unlikely to explain our results.

While our statistical tests based on the AJCA of 2004 focus on the window encompassing the two years on either side of 2004, we also examine the longer-run trend in injury rates at firms with and without foreign profits. Figure 2 depicts these trends. If the relative drop in injury rates after 2004 in firms with foreign profits that we find in Table 7 is due to a shock to available cash flow and not to different longer-term trends in injury rates in firms with and without foreign profits, we should see the difference in injury rates dissipate as more time elapses after 2004.

As the figure shows, the gap between injury rates at firms with and without foreign profits begins to open up in 2004, is at its largest in 2005 and 2006, and shrinks after 2006. This gap virtually disappears by 2009. The opening of this gap in 2004 could be due to firms

with unrepatriated foreign profits facing a reduced need to conserve cash already held in the U.S. in 2004, as they anticipate an increase in available cash starting in 2005. Overall, our analysis of the AJCA of 2004 provides strong evidence that cash constraints are at least partly responsible for the relationship we find between injury rates and capital structure.

3.5 Workplace Injuries and Oil Price Shocks

Our second quasi-natural experiment exploits time-series variation in oil prices. Over the course of our sample, 2002-2009, oil prices have undergone dramatic and largely unexpected changes. From 2002 to early 2008, average oil prices rapidly increased from around \$25 per barrel to well over \$120 per barrel, driving record profits for established producers like ExxonMobil. Prices subsequently saw a radical decrease at the end of 2008 and into 2009. These fluctuations in oil price had a dramatic impact on the cash flow of firms involved in petroleum exploration and production.

Lamont (1997) examines the impact of an oil price shock, the collapse of crude oil prices in 1985, on the investment of non-oil segments belonging to conglomerates whose cash flow was exposed to the price of oil through oil-producing segments that they also owned. In the same spirit, we examine whether injury rates at non-oil establishments change in response to oil price movements in firms that are involved in oil exploration or production. We employ a similar approach to our AJCA test - comparing firms with and without oil establishments in this case - to account for any correlation between aggregate injury rates and oil prices. If cash constraints limit investment in activities that affect workplace safety, then the relationship between injury rates and oil prices should be negative at non-oil establishments of firms that have oil business, relative to those that don't. Since we are examining injuries only in those establishments that are not involved in the business of petroleum exploration and production, we eliminate any direct effect that may result from the rapid expansion and growth in the exposed establishments.

We first identify every establishment in the full sample that has a 2-digit SIC code of 13 (Oil and Gas Extraction), and remove these establishments from our sample. This reduces our sample size from 44,244 to 43,973. Then, for all remaining establishment-years, we create an indicator variable *OilExposed* that takes a value of one if the establishment's parent firm has an establishment in 2-digit SIC code 13 at any time during the sample period, and zero otherwise.¹² The *OilExposed* variable takes a value of one for 798 establishment-years, representing 97 unique firm-years across 16 unique firms. We also construct a variable *OilPrice* that is equal to the average annual oil price for a given year as reported by the US Energy Information Agency.

We then estimate negative binomial models in which the dependent variable is injury count, and the explanatory variables of interest are *OilExposed* and especially the interaction of *OilExposed* and *OilPrice*. We include year dummies in all of the regressions. We do not include the main effect of *OilPrice* as a separate variable as it is cross-sectionally invariant and therefore fully explained by the year dummies. Table 8 presents the results of these tests.

Column (1) reports the baseline results. The coefficient on *OilExposed* is negative, indicating that establishments belonging to firms with oil producing arms have a lower baseline injury rate than establishments whose parent companies do not have oil producing arms. More importantly, the coefficient on the interaction of *OilExposed* and *OilPrice* is negative and significant at the 5% level. This indicates that injury rates at an establishment fall more when oil prices rise if the establishment belongs to a firm with an oil-producing establishment than if it does not. This is consistent with increased parent firm cash flow relaxing cash constraints and having a positive effect on investment in activities that improve workplace safety.

¹²We define firms with oil establishments as those that have an oil establishment in any year in the sample rather than in the same year as an observation because the BLS surveys only a subset of establishments in any given year.

Additional firm-level controls are included in column (2), and the results remain qualitatively similar. In the column (3), we include industry dummies. The *OilExposed* variable becomes insignificant, indicating that the level effect is likely the result of industry-specific variation. However, the interaction term becomes slightly larger in magnitude and significant at the one percent level. This confirms that injury rates fall in the non-oil related establishments of firms that receive positive cash flow shocks due to an increase in oil prices via their oil-related establishments.¹³

3.6 Covenant Violations and Bank Oversight

Next, we examine how creditor control rights impact workplace safety. One reason then why a highly-leveraged firms might invest less in workplace safety than a less-leveraged firm is that part of the long-run benefit of such investment accrues to creditors. If this is the case, then, upon gaining control rights, creditors should force the firm to invest more in activities that increase safety and we should observe a reduction in injury rates. We examine the effect of creditor control on workplace safety by studying loan covenant violations. Public bond and private loan contracts typically contain a variety of covenants. Covenants are contractual provisions that require firms to maintain certain financial ratios or to take certain positive actions in order to fulfill the terms of the debt contract. Violation of one of these covenants creates a state of technical default, where the creditor is able to take some control over the firm's actions. These covenants are particularly prominent in private bank debt, where they tend to be set very tightly to give banks more control over the firm's actions.

Our data on covenant violations comes from Amir Sufi's website. As described in Nini, Smith and Sufi (2012), this dataset was obtained through a computer text search on the 10-K

¹³While we would like to be able to test whether the relationship between injury rates and the interaction of *OilExposed* and *OilPrice* varies with leverage - similar to what we do with the AJCA shock - there is little variation in leverage in the subsample of firms for which *OilExposed* is one. Specifically, the standard deviation of *Debt/Assets* is 0.11, compared to 0.25 for the whole sample. As a result, such a test would have little power.

and 10-Q documents for each company filed with the Securities and Exchange commission. The data records whether a firm discloses the violation of one or more covenants during a given quarter from 1996 to 2008. We match the data by gvkey to our sample of firms. We create a variable, *CovViolation*, which takes a value of one if the firm had a covenant violation in at least one quarter during the previous year and zero otherwise. We then estimate the relationship between injury rates and this variable, as well as the interaction of this variable with financial leverage.

Specifically, we estimate negative binomial count models in which the dependent variable is the number of injuries. We include year dummies in all specifications. Table 9 reports the results from these tests. The only explanatory variables in column (1) are *CovViolation* and *Debt/Assets*. The coefficient on *Debt/Assets* is positive and statistically significant, consistent with the results in Table 4. The coefficient on *CovViolation* is negative, consistent with more creditor control leading to lower injury rates, but is not statistically significant.

In column (2), we add firm-level control variables. When we add these controls, the coefficient on *CovViolation* remains negative, increases substantially in magnitude, and becomes statistically significant at the one percent level. In column (3), we add industry dummies to the set of explanatory variables. The coefficient on *CovViolation* remains negative, large, and statistically significant at the one percent level.

In column (4), we add the interaction of *CovViolation* and *Debt/Assets* as an explanatory variable. If firms underinvest in activities that affect safety because creditors realize the gains from these activities in the event of bankruptcy, this underinvestment should be greater when the firm has more debt and hence is likely closer to the bankruptcy threshold. Therefore, creditor control should have a larger impact on injury rates in more indebted firms. Consistent with this argument, the coefficient on the interaction of *CovViolation* and *Debt/Assets* is negative. Overall, the results in Table 9 suggest that creditor control rights mitigate the adverse effects of leverage on workplace safety, and provide support for the debt

overhang explanation for the connection between leverage and injuries.

3.7 Unionization and Injury Rates

Finally, we examine how employee bargaining power affects the impact of financial leverage on workplace safety. Our evidence so far supports the argument that firms with more leverage invest less in workplace safety. The ability of firms cut such investment is likely to depend on how much bargaining power employees have. Employees with a high degree of bargaining power may be able to at least partly prevent such cuts by threatening work stoppages and slowdowns in response. We now test whether employee bargaining power mitigates the adverse effects of leverage on workplace safety.

One important source of employee bargaining power is union representation. We therefore focus on how the relationship between injury rates and leverage varies with union representation. Ideally, we would measure the rate of unionization at each individual establishment or firm in our sample. However, this information is not readily available. Instead, we follow the literature and use industry-level unionization rates as a proxy for employee bargaining power. While this measure is somewhat coarse, it does capture the additional impact of the threat of unionization for firms in certain industries that may increase bargaining power even if a particular establishment is not unionized.

We use industry-level data on union representation from the Census's Current Population Survey as reported by unionstats.com to construct our measure of unionization. This data is reported annually and includes the union representation rate for each Census Industry Code (CIC). We assign each establishment in our sample to a CIC based on its 4-digit SIC code as reported in the BLS data. We code the variable *UnionRep*, which is the union representation rate reported in the Census data for the CIC to which an establishment is assigned. We then estimate negative binomial models in which the dependent variable is injury count, and the primary explanatory variables of interest are *Debt/Assets*, *UnionRep*, and the interaction

of the two. Table 10 reports the results of these tests.

Column (1) in Table 10 reports the baseline results. Unconditionally, union coverage is significant and positively related to workplace injuries levels. The fact that injury rates are higher in industries with greater levels of unionization suggests a selection effect where employees in industries with a higher potential to be injured are more likely to unionize (see (Arabsheibani and Marin, 2000)). This is perhaps unsurprising, as a demand for safer working conditions was one of the primary drivers of union growth during the 19th and 20th centuries. Of more relevance to our study, the interaction effect of firm leverage and unionization rates is negative and significant, suggesting that unions do play a role in forcing continued investment in workplace safety.

In column (2), we add firm-level control variables. The coefficient on the interaction of *Debt/Assets* and *UnionCov* doubles in magnitude and increases in statistical significance. Finally, in column (3) we include industry dummies for the 48 Fama-French industries. Since these categories are coarser than the CIC code level at which unionization is calculated, they do not completely subsume the main effect of union coverage. The coefficient on the interaction of *Debt/Assets* and *UnionCov* remains negative and statistically significant at the one percent level. Overall, these results support the argument that employee bargaining power mitigates the adverse effects of leverage on workplace safety.

4 Conclusion

In summary, this paper has presented evidence that financial leverage in a firm causes the firm's workplace to be less safe by constraining investment in activities that produce workplace safety. This lends support to the more general argument that incentives to focus on short-term cash flows can cause firms to break implicit contracts with employees that necessitate current expenditures. Our results also have ramifications for research on capital

structure policy, as they provide evidence of a specific cost that debt imposes ex post on non-financial stakeholders, which a leveraged firm is likely to have to bear ex ante through a compensating wage differential and greater difficulty in attracting talent employees. Finally, our research contribute to the labor and industrial relations literatures by shedding light on some of the firm-level determinants of workplace injuries and should be of importance to safety regulators and labor negotiators for this reason.

References

- Agrawal, Ashwini, and David Matsa, 2012, Labor Unemployment Risk and Corporate Financing Decisions, *Journal of Financial Economics* forthcoming.
- Arabsheibani, Gholamreza, and Alan Marin, 2000, Stability of Estimates of the Compensation for Danger, *Journal of Risk and Uncertainty* 20, 247–269.
- Bae, Kee-Hong, Jun-Koo Kang, and Jin Wang, 2011, Employee Treatment and Firm Leverage: A Test of the Stakeholder Theory of Capital Structure, *Journal of Financial Economics* 100, 130–153.
- Beard, T. Randolph, 1992, Financial aspects of motor carrier safety inspection performance, *Review of Industrial Organization* 7, 51–64.
- Benmelech, Efraim, Nittai K. Bergman, and Amit Seru, 2011, Financing Labor, *National Bureau of Economic Research Working Paper Series* No. 17144.
- Bronars, Stephen G, and Donald R Deere, 1991, The Threat of Unionization, the Use of Debt, and the Preservation of Shareholder Wealth, *The Quarterly Journal of Economics* 106, 231–254.
- Brown, Jennifer, and David Matsa, 2012, Boarding a Sinking Ship? An Investigation of Job Applications to Distressed Firms, *working paper*.
- Chava, Sudheer, and Michael Roberts, 2008, How does financing impact investment? The role of debt covenants., *Journal of Finance* 63, 2085–2121.
- Chen, Jason, Marcin Kacperczyk, and Hernaán Ortiz-Molina, 2011, Labor Unions, Operating Flexibility, and the Cost of Equity, *Journal of Financial and Quantitative Analysis* 46, 25–58.
- Dharmapala, Dhammika, C. Fritz Foley, and Kristin J. Forbes, 2011, Watch What I Do, Not What I Say: The Unintended Consequences of the Homeland Investment Act, *The Journal of Finance* 46, 753–787.
- Dionne, Georges, Robert Gagné, François Gagnon, and Charles Vanasse, 1997, Debt, moral hazard and airline safety An empirical evidence, *Journal of Econometrics* 79, 379–402.
- Faulkender, Michael, and Mitchell Petersen, 2011, Investment and Capital Constraints: Repatriations Under the American Jobs Creation Act, *Review of Financial Studies* forthcoming.
- Filer, Randall K, and Devra L Golbe, 2003, Debt, Operating Margin, and Investment In Workplace Safety, *The Journal of Industrial Economics* 51, 359–381.

- Gordon, Hanka, 1998, Debt and the terms of employment, *Journal of Financial Economics* 48, 245–282.
- Lamont, Owen, 1997, Cash Flow and Investment: Evidence from Internal Capital Markets, *Journal of Finance* 52, 83–109.
- Maksimovic, Vojislav, and Sheridan Titman, 1991, Financial Policy and Reputation for Product Quality, *Review of Financial Studies* 4, 175–200.
- Matsa, David A., 2010, Capital Structure as a Strategic Variable: Evidence from Collective Bargaining, *The Journal of Finance* 65, 1197–1232.
- Myers, Stewart C., 1977, Determinants of corporate borrowing, *Journal of Financial Economics* 5, 147 – 175.
- Nini, Greg, David C. Smith, and Amir Sufi, 2009, Creditor control rights and firm investment policy, *Journal of Financial Economics* 92, 400–420.
- Roberts, Michael R., and Amir Sufi, 2009, Renegotiation of financial contracts: Evidence from private credit agreements, *Journal of Financial Economics* 93, 159 – 184.
- Rose, Nancy L., 1990, Profitability and Product Quality: Economic Determinants of Airline Safety Performance, *Journal of Political Economy* 98, 944–964.
- Titman, Sheridan, 1984, The effect of capital structure on a firm’s liquidation decision, *Journal of Financial Economics* 13, 137–151.
- Viscusi, W. Kip, and Joseph E. Aldy, 2003, The Value of a Statistical Life: A Critical Review of Market Estimates Throughout the World, *Journal of Risk and Uncertainty* 27, 5–76.

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 44,244 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. *Debt/Assets* is book debt divided by book assets. *InterestCoverage* is the sum of income before extraordinary items, depreciation, and interest expense, divided by interest expense. *Assets* are total reported assets. *AssetTurnover* is sales divided by lagged assets. *MarketToBook* is the ratio of the market value of equity to the book value of equity. *TangibleAssetRatio* is net plant, property and equipment divided by total assets. *Capex/Assets* is capital expenditures divided by lagged assets. *ROA* is income before extraordinary items divided by lagged total assets.

Panel A: Observations by year			Panel B: Establishment summary statistics		
Year	Observations	Percent		Mean	Std. Dev.
2002	5,476	12.38	Total hours worked	656,136	2,430,868
2003	5,642	12.75	Average employment	355	1,260
2004	5,234	11.83	Hours worked/employee	1,720	418
2005	5,145	11.63	1,000 × Cases/hour	0.0247	0.0322
2006	6,148	13.90	Cases/employee	0.0413	0.0529
2007	5,857	13.24	1,000 × LTCases/hour	0.0077	0.0153
2008	5,743	12.98	LTCases/employee	0.0128	0.0249
2009	4,999	11.30			

Panel C: Firm summary statistics						
	Mean	Std. Dev.	10th pctile	Median	90th pctile	
Debt/Assets	0.238	0.253	0.002	0.201	0.489	
Interest Coverage	0.034	0.157	-0.004	0.007	0.078	
Log (assets)	6.525	1.918	4.004	6.544	9.052	
Asset Turnover	1.372	0.890	0.492	1.171	2.505	
Market To Book	1.449	1.156	0.566	1.137	2.640	
Tangible Asset Ratio	0.273	0.212	0.057	0.215	0.602	
Capex/Assets	0.055	0.068	0.011	0.035	0.115	
ROA	0.011	0.272	-0.131	0.044	0.134	

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
Restaurants, 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 rates

This table presents estimates from a series of count models in which the dependent variable is the number of injuries reported at an establishment in a given year. The exposure variable is the number of hours worked at the establishment during the year. The explanatory variables are all measured at the establishment's parent firm level and are lagged one year. 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). A Poisson model is estimated in column (5), and a Poisson model with establishment fixed effects is estimated in column (6). The exposure variable in all specifications is the reported number of hours worked during the year at the establishment. z-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 z-test.

	(1)	(2)	(3)	(4)	(5)	(6)
Debt/Assets	0.2823*** (7.37)	0.3106*** (7.20)	0.3766*** (8.99)	0.3751*** (8.78)	0.2668*** (2.76)	0.3246** (2.21)
Log (assets)		-0.0417*** (8.18)	-0.0593*** (11.54)	-0.0625*** (12.12)	-0.0743*** (6.72)	0.0129 (0.30)
Asset Turnover		0.1932*** (21.84)	0.1935*** (17.48)	0.1912*** (17.31)	0.2250*** (9.07)	0.0794* (1.86)
Market ToBook		-0.0436*** (5.99)	-0.0276*** (4.02)	-0.0291*** (4.13)	-0.0065 (0.38)	-0.0344** (2.41)
TangibleAsset Ratio		1.4182*** (25.47)	0.8821*** (16.02)	0.8654*** (15.21)	1.0073*** (8.39)	-0.1096 (0.42)
Capex/Assets		-1.4626*** (7.96)	-0.7411*** (4.04)	-0.7117*** (3.61)	-2.3879*** (5.92)	-0.8671** (2.36)
Model	Neg Bin	Neg Bin	Neg Bin	Neg Bin	Poisson	Poisson
Year dummies	Yes	Yes	Yes	No	Yes	Yes
Industry dummies	No	No	Yes	No	Yes	No
Year x Industry dummies	No	No	No	Yes	No	No
Establishment fixed effects	No	No	No	No	No	Yes
Observations	44,244	44,244	44,244	44,244	44,244	25,396
Log pseudo likelihood	-119,232	-117,702	-115,445	-115,124	-255,028	-56,278

Table 5: Capital structure and injury rates - alternative specifications

This table presents estimates from a series of alternative models relating injury rates and capital structure. The unit of observation in all of these models is an establishment-year. Columns (1) through (3) show estimates from Negative Binomial count models. The dependent variable in column (1) is the number of lost-time injuries. The dependent variable in columns (2) and (3) is the number of injuries. The exposure variable in columns (1) through (3) is the number of hours worked during the year. Column (4) shows estimates from a Tobit model. The dependent variable in column (4) is number of injuries divided by number of hours worked. The explanatory variables are all measured at the establishment's parent firm level and are lagged one year. See Table 1 for definitions of these variables. All regressions include an intercept term, which is not reported. z-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 z-test.

	(1)	(2)	(3)	(4)
Debt/Assets	0.3523*** (6.04)	0.2327*** (5.85)		0.0114*** (8.59)
ROA		0.2916*** (4.28)		
Debt/Assets x ROA		-0.0783*** (3.87)		
InterestCoverage			-0.6900*** (9.31)	
Log (assets)	-0.0590*** (8.31)	-0.0731*** (14.22)	-0.0614*** (11.61)	-0.0000 (0.38)
AssetTurnover	0.1844*** (11.68)		0.1881*** (16.63)	0.0056*** (17.13)
MarketToBook	-0.0356*** (3.72)	-0.0258*** (3.81)	-0.0444*** (4.92)	-0.007*** (3.66)
TangibleAssetRatio	1.0063*** (13.53)	0.9751*** (17.47)	0.9640*** (17.47)	0.0286*** (16.07)
Capex/Assets	-0.8242*** (3.48)	-0.5106*** (2.76)	-0.7562*** (4.00)	-0.0439*** (7.38)
Dependent variable Model	Lost-time injuries Neg Bin	Injuries Neg Bin	Injuries Neg Bin	Injuries/hour Tobit
Observations	44,244	44,244	44,244	44,244

Table 6: Credit ratings and injury rates

This table presents estimates from two models relating injury rates and credit ratings. The dependent variable in both models is the number of injuries reported. The exposure variable is the number of hours worked at the establishment during the year. The explanatory variables are indicators equal to one if the parent firm's credit rating at the end of the previous year is equal to the value listed, and zero otherwise. All regressions include an intercept term, which is not reported. z-statistics based on standard errors clustered at the establishment level are reported in parentheses below each point estimate. p-values from χ^2 tests of the equality of different coefficients are shown at the bottom. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively, based on a two-tailed z-test.

	(1)	(2)
A	0.3135*** (7.86)	0.1079*** (3.01)
BBB	0.3716*** (9.69)	0.1387*** (3.84)
BB	0.3403*** (8.09)	0.2302*** (5.72)
B or below	0.5333*** (11.89)	0.2766*** (6.66)
Year dummies	Yes	Yes
Industry dummies	No	Yes
Observations	28,570	28,570
<i>Predicted Conditional Injury Rates</i>		
AA or above	14.25	14.80
A	19.30	16.39
BBB	20.79	17.03
BB	19.98	18.75
B or below	24.43	19.62
<i>p-values from equality test</i>		
AA or above = A	0.000***	0.001***
A = BBB	0.0155**	0.2098
BBB = BB	0.2447	0.0010***
BB = B or below	0.000***	0.1476

Table 7: Workplace injuries and the American Jobs Creation Act

This table presents results from Negative Binomial count models estimating the change in workplace injuries around the American Jobs Creation Act of 2004. The dependent variable in each model is the number of injuries reported at an establishment in a given year. The exposure variable is the number of hours worked at the establishment during the year. Only observations in 2002, 2003, 2005 and 2006 are included in the tests in this table. *Post2004* is an indicator variable taking a value of one in years 2005 and 2006 and zero in years 2002 and 2003. *FrgnProf > 0* is an indicator taking a value of one if the parent firm's cumulative reported foreign profits in 2001-2003 were positive, and zero otherwise. The other explanatory variables are all measured at the establishment's parent firm level and are lagged one year. See Table 1 for definitions of these variables. All regressions include an intercept term, which is not reported. z-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 z-test.

	(1)	(2)	(3)	(4)
Post2004	-0.0624*** (3.23)	-0.0140 (0.70)	-0.0532*** (2.67)	-0.0174 (0.61)
FrgnProf>0	-0.0856*** (3.08)	0.0959*** (3.20)	0.0402 (1.32)	-0.2754*** (5.41)
Post2004 * FrgnProf>0	-0.0735** (2.30)	-0.1644*** (5.09)	-0.1676*** (5.33)	0.0782 (1.41)
Debt/Assets				0.3027*** (4.30)
Debt/Assets * Post2004				-0.1458* (1.68)
Debt/Assets * FrgnProf>0				1.0063*** (7.10)
Debt/Assets * Post2004 * FrgnProf>0				-0.6788*** (3.68)
Log (assets)		-0.0349*** (5.51)	-0.0446*** (6.72)	-0.04756*** (7.14)
AssetTurnover		-0.1648*** (15.75)	0.1636*** (11.98)	0.1902*** (13.73)
MarketToBook		-0.0664*** (6.31)	-0.0558*** (5.39)	-0.0464*** (4.53)
TangibleAssetRatio		1.3075*** (5.52)	0.8832*** (13.11)	0.8140*** (11.70)
Capex/Assets		-1.3075*** (5.52)	-0.8980*** (3.64)	-0.6780** (2.37)
Industry dummies	No	No	Yes	Yes
Observations	21,774	21,774	21,774	21,774
Log Likelihood	-58,773	-58,159	-57,050	-56,892

Table 8: Workplace injuries and oil price shocks

This table presents results from Negative Binomial count models estimating the effect of oil price shocks on establishment-level injury rates. The dependent variable in each model is the number of injuries reported at an establishment in a given year. The exposure variable is the number of hours worked at the establishment during the year. Establishments are divided into oil-related (2-digit SIC code of 13 in the BLS data) and non-oil (all other SIC codes) establishments. The sample consists of non-oil establishments. *OilExposed* is an indicator variable taking a value of one if an establishment's parent firm has an oil-related establishment in any year during the sample period. *OilPrice* is the price of oil. The other explanatory variables are all measured at the establishment's parent firm level and are lagged one year. See Table 1 for definitions of these variables. All regressions include an intercept term, which is not reported. z-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 z-test.

	(1)	(2)	(3)
OilExposed	-0.5142*** (3.82)	-0.3962*** (2.96)	0.0226 (0.17)
OilExposed * OilPrice	-0.0049** (2.33)	-0.0036* (1.71)	-0.0051*** (2.73)
Log (assets)		-0.0400*** (7.81)	-0.0564*** (10.99)
AssetTurnover		0.1652*** (19.07)	0.1733*** (15.78)
MarketToBook		-0.0520*** (6.99)	-0.0334*** (4.80)
TangibleAssetRatio		1.4811*** (27.40)	0.9878*** (18.34)
Capex/Assets		-1.4752*** (7.86)	-1.1377*** (5.99)
Year dummies	Yes	Yes	Yes
Industry dummies	No	No	Yes
Observations	43,973	43,973	43,973
Log Likelihood	-118,582	-117,083	-114,977

Table 9: Workplace injuries and covenant violations

This table presents results from estimation of Negative Binomial count models examining the relationship between workplace injuries and covenant violations. The dependent variable in each model is the number of injuries reported at an establishment in a given year. The exposure variable is the number of hours worked at the establishment during the year. *CovViolation* is an indicator variable equal to one if the establishment's parent firm violated a bank loan covenant in the previous two years. The covenant violation data is from Nini, Sufi and Smith (2011). The other explanatory variables are all measured at the establishment's parent firm level and are lagged one year. See Table 1 for definitions of these variables. All regressions include an intercept term, which is not reported. z-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 z-test.

	(1)	(2)	(3)	(4)
CovViolation	-0.0209 (0.65)	-0.1806*** (5.32)	-0.1372*** (4.17)	-0.0121 (0.25)
Debt/Assets	0.4278*** (8.67)	0.5867*** (10.03)	0.4788*** (8.74)	0.5408*** (8.98)
CovViolation * Debt/Assets				-0.3855*** (3.46)
Log (assets)		-0.0590*** (10.34)	-0.0630*** (10.81)	-0.0640*** (10.93)
AssetTurnover		0.2236*** (20.82)	0.1851*** (14.92)	0.1872*** (15.07)
MarketToBook		-0.0783*** (6.86)	-0.0690*** (6.16)	-0.0657*** (5.82)
TangibleAssetRatio		1.0299*** (16.07)	0.6729*** (9.99)	0.6768*** (10.03)
Capex/Assets		-0.9423*** (4.90)	-0.1768 (0.88)	-0.1564 (0.78)
Industry dummies	No	No	Yes	Yes
Observations	30,615	30,615	30,615	30,615
Log Likelihood	-80,785	-79,788	-78,519	-78,512

Table 10: Workplace injuries, capital structure, and unionization

This table presents results from estimation of Negative Binomial count models examining the relationship between workplace injuries, capital structure, and state union intensity. The dependent variable in each model is the number of injuries reported at an establishment in a given year. The exposure variable is the number of hours worked at the establishment during the year. *UnionCov* is the percentage of workers in an industry and given year who are represented by unions in the Current Population Survey as reported by unionstats.com. The other explanatory variables are all measured at the establishment's parent firm level and are lagged one year. See Table 1 for definitions of these variables. All regressions include an intercept term, which is not reported. z-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 z-test.

	(1)	(2)	(3)
Debt/Assets	0.2997*** (4.96)	0.7016*** (10.08)	0.5443*** (8.12)
UnionCov	0.0255*** (23.79)	0.0320*** (27.09)	0.0259*** (11.98)
Debt/Assets * UnionCov	-0.0159*** (4.43)	-0.0308*** (7.94)	-0.0207*** (5.21)
Log (assets)		-0.0629*** (11.81)	-0.0757*** (13.75)
AssetTurnover		0.2901*** (30.26)	0.2021*** (17.85)
MarketToBook		-0.0469*** (5.89)	-0.0297*** (4.07)
TangibleAssetRatio		0.8702*** (15.46)	0.7155*** (11.68)
Capex/Assets		-0.7421*** (4.25)	-0.4683** (2.50)
Year dummies	Yes	Yes	Yes
Industry dummies	No	No	Yes
Observations	38,768	38,768	38,768
Log Likelihood	-103,245	-101,691	-100,307

Figure 1: Injury rates by credit rating

The bars in this figure show $1,000 \times$ 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.

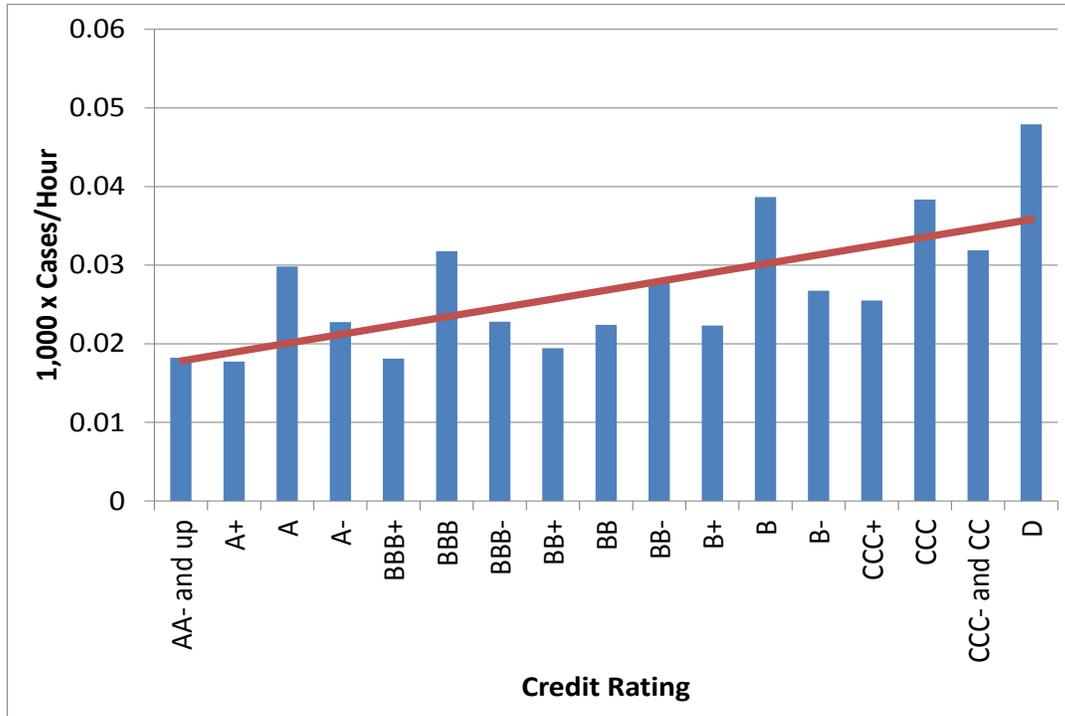


Figure 2: Injury rates over time by foreign profit status

The green line in the figure shows the mean reported injury rate (1,000 times cases per hour) for establishments belonging to firms reporting positive cumulative foreign profits over the period 2001-2003. The blue line shows the mean reported injury rate for establishments belonging to firms reporting zero or negative cumulative foreign profits over this period.

