Organizational capital and corporate resilience to workplace COVID-19 threat*

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Abstract

This paper presents evidence that workplace safety-related organizational capital made businesses more resilient to COVID-19 as a workplace safety threat. Establishments with better pre-pandemic workplace injury records experienced fewer workplace COVID-19 infections in 2020, even within the same firm. Firms with worse pre-pandemic workplace safety records received more 2020 COVID-related employee whistleblower complaints and experienced lower stock returns and greater return volatility early in the pandemic. Firms experiencing more workplace COVID-19 infections suffered significantly larger declines in productivity and profitability, suggesting that workplace COVID-19 infections were highly disruptive. We document a number of other factors that predict workplace COVID-19 infections.

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Abstract

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Economists increasingly recognize the importance of organizational capital as a factor of production. An underexplored value of organizational capital is its role in making an organization resilient to unanticipated shocks by enabling it to adapt to a changing environment. Few shocks in modern industrial history have been as unanticipated or as momentous as the onset of the COVID-19 pandemic in 2020 caused by the novel SARS-CoV-2 coronavirus. In addition to radically altering patterns of demand and disrupting supply chains, the arrival of COVID represented an unprecedented workplace hazard. David Michaels, former head of the Occupational Safety and Health Administration (OSHA), observed that "Workers have never been so threatened by a hazard as they have by the coronavirus." This paper investigates the role of a particular form of organizational capital - that relating specifically to workplace safety - in making firms resilient to the COVID pandemic shock.

Organizational capital can take different forms, and different forms may be relevant for different aspects of production. We define the collection of organizational knowledge, systems, practices, and culture that allows an organization to mitigate the risk of work-related injuries as "workplace safety capital." Our concept borrows from the fields of applied psychology, organizational behavior, and management, which study the importance of factors such as safety climate and safety practices for workplace safety outcomes. Like other forms or organizational capital, workplace safety capital represents a complex amalgam of organizational attributes and practices that requires years to develop and continued effort to maintain. If workplace safety capital makes an organization more resilient to the threat of a new safety hazard, then organizations with more workplace safety capital entering the pandemic should have experienced fewer workplace COVID-19 infections and better operating performance in the early stages of the pandemic.

We test this hypothesis using annual establishment-level workplace safety records from the U.S. OSHA's Injury Tracking Application (ITA). While workplace safety capital is difficult to measure directly, its components have been shown to correlate strongly with an organization's observable workplace safety record (Hofmann et al., 2017; Zacharatos et al., 2005; Beus et al., 2010). In addition to providing information about general workplace injuries, the ITA data also provides an approximate count of documented workplace COVID cases in 2020.[1] We find that establishments with better pre-2020 workplace safety records, as measured by rate of workplace injury and illness per employee, experienced lower workplace COVID-19 infection rates in 2020, controlling for establishment size, work intensity, 6-digit NAICS code industry, and county of location. A one-standard deviation increase in pre-pandemic workplace injury rate is associated with a 10.5% increase in workplace COVID infections.[2] The relationship is stronger for establishments in industries characterized by a high degree of physical worker proximity based on the measure of Mongey et al. (2020).

While researchers often measure organizational capital at the firm level, it exists at various levels throughout a firm. Firm-level workplace safety capital may have been important for the ability of a firm to develop protocols and procedures for managing workplace COVID infection risk. However, these protocols and procedures ultimately had to be implemented by individual business units. Establishment-level workplace safety capital may have been important in successful implementation and compliance. Consistent with this hypothesis, we find that the positive relationship between establishment-level workplace COVID infection rates and pre-2020 workplace injury rates holds even when we add firm fixed effects to our regressions. That is, within the same firm and controlling for other observables such as establishment 6-digit NAICS code industry, establishments with lower pre-pandemic work-

[1]OSHA requires establishments to report workplace injuries and illnesses disaggregated into a small number of categories. One such category is respiratory conditions. OSHA instructed establishments to record documented workplace COVID cases in the respiratory condition category. We therefore use 2020 respiratory conditions as our measure of establishment-level workplace COVID infections. In aggregate, reported respiratory conditions increased by about 4,000% from 2019 to 2020, suggesting that the vast majority of reported respiratory conditions in 2020 represented workplace COVID infections (all other specific categories of injury and illness declined in 2020). The noise in our measure due to the incidence of other respiratory conditions therefore appears to be negligible.

[2]These quantities likely underestimate the magnitude of the relationship between workplace COVID infections and pre-pandemic injury rates, since workplace injury rates measure workplace safety capital with error, producing attenuation bias in OLS regressions.

place injury rates have lower workplace COVID-19 infection rates. This finding suggests that diffusely-distributed "front-line" organizational capital may play an important role in making an organization resilient to unanticipated shocks.

We also find interesting relationships between workplace COVID infection rates and other observables. For example, we find that COVID infection rates are lower at establishments in industries with greater unionization rates. While it is difficult to rule out the possibility that industries vary on other dimensions that might correlate with both unionization and workplace COVID exposure risk, these results point to a possible benefit of having a unionized labor force - that unions can help coordinate employees to mitigate unanticipated threats and hence make an organization more resilient to these threats. We also find that workplace COVID infection rates are lower at establishments in counties with higher levels of social capital. This result suggests that... OTHER OBSERVABLES?

One concern about our analysis is the self-compiled nature of OSHA workplace injury logs, which are the basis of the ITA data. It is possible that differences in reporting practices could induce a non-causal relationship between pre-2020 injury rates and 2020 COVID infection rates. The results from our firm fixed effects regressions suggest that such differences would have to exist at the establishment level within firm to cause this relationship. To further mitigate concerns about differential reporting, we analyze data on employee-filed COVID OSHA whistleblower complaints. Since these complaints were outside of the employer's control, differential establishment-level reporting practices should induce a relationship between pre-2020 injury rates and these complaints. Further supporting a causal interpretation, we find that firms with higher pre-2020 workplace injury rates also receive more whistleblower complaints.

We also examine the financial implications of workplace COVID exposure for firms. We find that firms with larger pre-2020 workplace injury rates experienced larger stock price decreases and larger increases in return volatility in the period between February 24, 2020, when Italy first announced a lockdown, through April 7, 2020, when the 50th U.S. state implemented a lockdown. This period coincides with the realization that COVID-19 would significantly impact the western world, including the U.S., and is characterized by a substantial fall in U.S. stock prices in general. A one-standard deviation higher pre-pandemic workplace injury rate is associated with a 2.4 percentage point lower abnormal return during this period. Moreover, the relative fall in the stock prices of firms with higher pre-pandemic workplace injury rates during this period does not reverse over the subsequent three months, even as the market as a whole recovers. These findings suggest that investors viewed pre-pandemic workplace safety capital as an important factor when assessing the financial implications of the COVID pandemic for firms.

Finally, we find that firms with higher COVID rates during 2020 experienced larger declines in profitability, measured as either return-on-assets or income-per-employee, from 2019 to 2020. A one-standard deviation higher rate of workplace COVID infections is associated with an 3.6 percentage point larger reduction in return-on-assets. The change in return-on-assets also decreases with a firm's pre-2020 workplace injury rate, even after controlling for its reported 2020 workplace COVID infection rate. The incremental explanatory power of pre-2020 workplace injury rate may in part reflect measurement error in recorded workplace COVID infections. It may also suggest that better safety conditions entering the pandemic may have insulated firms from other adverse effects of COVID even if it did not prevent workplace COVID infections. For example, employee morale may have remain higher at firms that generally treat employees better, suggesting another avenue through which organizational workplace safety capital makes firms resilient. The relationships between the 2019-2020 change in profits and both the 2020 workplace COVID infection rate and pre-2020 workplace injury rate are stronger in firms in industries characterized by greater physical worker proximity.

Our paper contributes to the emerging literature exploring the factors that made organizations resilient to the COVID-19 pandemic. Recent papers find smaller declines in stock prices in the early stages of the pandemic for firms with stronger finances (Ramelli and Wagner, 2020; Ding et al., 2021; Fahlenbrach et al., 2021), less institutional ownership (Glossner et al., 2020), and better ESG records (Albuquerque et al., 2020), and those in industries more amendable to remote work and social distancing Papanikolaou and Schmidt (2022); Pagano et al. (2020). Begley and Weagley (2021) find that nursing homes with less liquidity experienced a higher likelihood of COVID infections among residents. In the paper most closely related to ours, Li et al. (2021) find that stock prices for firms exposed to COVID-19 declined less in the early stages of the pandemic when they had strong corporate cultures. While most papers rely on stock returns to infer market expectations about the resilience of firms to COVID, we are able to measure resilience to COVID and link it to organizational capital directly through workplace infections. We are also able to pinpoint workplace COVID infection risk specifically as a source of pandemic risk.

More broadly, our paper contributes to the growing body of work in economics on the importance of organizational capital in firms. Existing work connects a firm's organizational capital (and related concepts) to its productivity (e.g., Bloom and Van Reenen, 2007; Ichniowski et al., 1997), growth (İmrohoroğlu and Tüzel, 2014), market valuation (e.g., Bresnahan et al., 2002), stock returns (e.g., Edmans, 2011; Eisfeldt and Papanikolaou, 2013), and merger success (Li et al., 2018).[3] We contribute to this literature in three ways. First, we highlight the importance of organizational capital for making a firm resilient to large, unexpected shocks, which, to our knowledge, has not been explored previously.[4] Second, while most prior research focuses on organizational capital at the firm level, we demonstrate the importance of considering organizational capital embedded in lower levels of an organi-

[3]See Lev et al. (2016) for a thorough survey of the literature linking organizational capital and firm outcomes.

[4]While the management literature considers the importance of organizational resilience, we are aware of no paper linking resilience to organizational capital.

zation. Third, we illustrate the importance of considering specific forms of organizational capital that may be relevant for specific outcomes.

Finally, our paper contributes to the literature on the effects of COVID on workers. This literature has focused almost exclusively on job losses, finding that job losses early in the pandemic are especially high for low-wage workers (Cajner et al., 2020), male immigrants (Borjas and Cassidy, 2020), and workers in industries relying heavily on customer contact (Koren and Pető, 2020). One exception is Begley and Weagley (2021), who find evidence of more COVID transmission between nursing home staff and residents in financially-weaker nursing homes. Our paper adds to this literature by documenting several establishment, industry, and location factors predicting workplace COVID infection. Understanding the factors predicting the spread of COVID in the workplace is important for regulators, policymakers, and businesses preparing for future pandemics, which experts have argued are increasingly likely. Our conclusion that workplace safety conditions entering the pandemic predict workplace infections suggests that organizations can make themselves more resilient to threats such as epidemic disease by upgrading workplace safety-related organizational capital more generally.

1 COVID-19 and Workplace Safety Practices

Safety risk is inherent in most production processes. Protecting workers from workplace safety and health hazards is an important aspect of all business operations and a legal responsibility of employers in many countries. In the U.S., the Occupational Safety and Health Act (OSH) of 1970 stipulates that employers have a general duty to provide employees with a place to work that is "free from recognized hazards that are causing or are likely to cause death or serious physical harm." Hence, although the COVID-19 health hazard is new, employers are no stranger to dealing with workplace safety and health hazards in general. A large literature on occupational safety and health, which spans multiple fields of study, including applied psychology, organizational behavior, and management, finds that organizational factors have a large impact on the safety performance of an organization. In the following, we examine these factors and apply them to COVID-19 safety. As we will see, the set of factors that help an organization to outperform in routine workplace safety tasks likely help it to outperform in COVID-19 safety as well.

The first and foremost organizational factor is management commitment to safety. Managers often face tradeoffs between safety and other organizational goals such as productivity, cost savings, etc. Although almost all firms claim that safety is their first priority, not all of them follow this claim through in practice. When maintaining safety hinders the reach of production goals, managers at different levels often choose to prioritize production instead. Organizations with strong management commitment to safety are ones that can continue to prioritize safety even when production and cost-cutting goals conflict with safety. During the COVID-19 pandemic, federal and state agencies issued many guidelines on COVID-19 safety, such as wearing masks, social distancing, etc. Since public health guidelines are not meant to enforce but to recommend practices based on the best evidence available, the commitment of the management to the safety of its workers can be an important factor determining the extent to which the firm implements and adheres to these guidelines. We expect that firms with strong management commitment to safety would be more willing to invest in COVID-19 safety measures, such as making costly changes to production process to ensure social distancing, providing personal protection equipment, increasing efforts to deep clean and sanitize facilities, etc., and prioritize employee safety in other firm decisions during the pandemic, such as encouraging workers who feel sick to stay at home through relaxed attendance policies.

The second factor that affects an organization's safety performance is safety climate. Zohar (1980) defines safety climate as the "shared perceptions about the relative importance of safety conduct in their organizational behavior." In other words, safety climate represents a shared, agreed upon cognition regarding the relative importance or priority of acting safely versus meeting other competing demands such as productivity or cost cutting. Safety climate has many dimensions. Prior studies typically include the following dimensions: management commitment to safety, management safety practices, safety values, supervisor support (supervisor safety consciousness, values and communications), safety policies and procedures, safety communication (e.g. the degreee to which employees feel free and are willing to raise safety concerns), safety reporting, and work pressure (See Christian et al. (2009) and Beus et al. (2010)).

Safety climate affects an organization's safety performance through its effect on employee safety behavior. One important contributor to safety incidents is workers cutting corners with safety protocols during production, especially when they suffer from fatigue or are under pressure to meet production quotas. Workers may also skip safety procedures during production if these procedures increase the time required to complete a task or cause discomfort or inconvenience. Prior studies find that positive safety climates predict better safety compliance and more active safety participation by employees, where safety participation refers to voluntary engagement in safety activities and promotion of safety in the workplace by employees (Neal et al., 2000). Meta-analyses of more than 200 safety climate studies have found safety climate to be a robust predictor of safety performance across industries and countries (Hofmann et al., 2017). Hence, we expect that employees in firms with positive safety climate show better compliance with their organization's COVID-19 safety rules during the pandemic, like wearing face masks and obeying social distancing, and are more active in other activities promoting COVID-19 safety at the workplace, like raising concerns about the deficiency of COVID-19 safety procedures to the management or monitoring coworkers' safety behavior. Employee safety behavior can be especially important for COVID-19 safety because unsafe behaviors by a small number of employees can significantly increase the risk of clustered infections in the entire organization given the high contagiousness of the virus.

Leadership style and high-performance work systems are also found to directly or indirectly affect employee safety behavior. Transformational leadership, characterized by greater concern for employees and high-quality relationships between employees and supervisors, is found to increase employee safety compliance and participation and safety-related citizenship behavior (Zohar (2002); Barling et al. (2002); Hofmann et al. (2003)). High-performance work systems are a cluster of human resource management practices emphasizing, among other things, group cohesion, members' sense of belongingness, and information sharing. Zacharatos et al. (2005) find that high-performance work systems consisting of 10 specific human resource practices increases employee trust in management, commitment to the organization and positive perception of safety climate, which eventually leads to improved safety performance. It seems reasonable to expect that firms with this type of leaders and human resource management systems are also likely to have better COVID-19 safety.

Overall, existing findings in the occupational safety and health literature indicate that the safety performance of an organization depends on a complicated set of organizational attributes and practices that directly or indirectly influence the availability of safety resources, the effectiveness of safety management systems, and employee safety behavior. Most of these attributes cannot be changed quickly. For example, it takes time to change management commitment to safety at all levels of the organization. Safety climate is another example. Safety climate is based on shared employee perceptions. These perceptions emerge from observations of patterns of managerial decisions and coworker behaviors related to safety and are shared among employees through social interactions.To the extent that it is the system of these attributes and practices that determine an organization's workplace safety,marginal changes in individual component may have little effect (Ichniowski et al., 1997). We collectively call this set of organizational attributes and management practices workplace safety-related capital.

To measure the strength of an organization's workplace safety-related capital, we use its pre-pandemic workplace injury and illness rate (for brevity, "injury rate"). This proxy is supported by prior studies. For example, Beus et al. (2010) find that an organization's injury rate is a strong predictor of its safety climate, one of the important factors affecting workplace safety. Hence, our main hypothesis is that organizations with strong safety records before the pandemic will perform better in COVID-19 safety during the pandemic.

Alternatively, given the novelty of COVID-19 as a workplace hazard, it is possible that existing safety-related practices and organizational factors, such as management commitment to safety and employee safety behavior at workplaces, have negligible impacts on an organization's COVID-19 safety performance. It is also possible, given the severity of the hazard, that even employers and employees in organizations with weak safety-related practices and poor employee safety compliance and participation were able to mobilize quickly in response to the workplace safety threat posed by COVID-19. If this is the case, we expect to find no significant relation between an organization's safety record entering the pandemic and its COVID-19 safety performance.

Ultimately, whether an organization's pre-existing workplace safety practices can help it to better withstand the safety and health risk from a novel pandemic is an empirical question.

2 Data and Sample

2.1 Sample Construction

Our workplace injury data comes from the Occupational Safety and Health Administration (OSHA)'s ITA data. In May 2016, OSHA issued a final rule under *Standard 29 CFR Part 1904* that requires employers to submit their workplace injury and illness data electronically. Each year, establishments with 250 or more employees as well as establishments with 20-249 employees that are classified in designated industries with historically high incident rates *must* submit their injury and illness data with their OSHA 300A Forms to OSHA via the Injury Tracking Application (ITA). OSHA uses this data to enhance its ability to target enforcement and allocate assistance resources. The ITA database covers over 200,000 establishments. Annual establishment-level ITA data became available in 2016.

The ITA database assigns each establishment a unique identifier that tracks establishment information across data years and provides the parent firm's name and EIN number for each establishment, allowing a crosswalk with other databases. Each establishment-year record contains establishment's name, location (state, city, zip code), 6-digit NAICS industry code, average number of employees, total number of hours worked, total number of injuries, and total number of illnesses.

The record also contains three components of injuries – number of cases with days away from work, number of cases with job transfer or restriction, and number of other cases, and five components of illnesses – number of skin disorders, number of respiratory illnesses, number of poisonings, number of hearing loss, and number of all other illnesses. On April 10, 2020, OSHA issued an "Enforcement Guidance for Recording Cases of Coronavirus Disease 2019 (COVID-19)," in which it made it clear that COVID-19 is a respiratory illness and should be recorded as so in Form 300. On May 19, 2020, OSHA issued a revised guidance which made the same point together with more guidance on determining work-relatedness. Figure 1 shows the constituency of these incidents by injuries (Panel A) and illnesses (Panel B). Notably, respiratory illnesses represent the second smallest component of total illnesses (7 percent) in 2019 but became the leading illness category (60 percent) in 2020.

We supplement the ITA injury/illness data analysis with establishment-level data on employee complaints about COVID-19 concerns through OSHA's whistleblower program. In February 2020, OSHA initiated a COVID-19 whistleblower program that invites US employees to file complaints regarding their employer's deficient COVID-19 safety practices to facilitate inspections and safety standard enforcement under *Standard 29 CFR Part 1910.*

The COVID-19 complaint data contains information on each establishment's name, location, 6-digit NAICS code, COVID-19 safety hazard description, and alleged violation of safety standards. This data, however, does not have a unique establishment-level identifier, which makes it difficult to link it to the ITA injury data. To overcome this problem, we aggregate the complaints to their parent firm level.

We further obtain stock return data from CRSP database, accounting data from Compustat database, and ESG data from MSCI KLD database. See Appendix A for variable definitions.

We construct two samples - one at the establishment level and one at the firm level. Our establishment level sample begins with all establishments in the ITA database. We exclude establishments with fewer than 3 employees (50 and 100 employees in robustness tests) to ensure meaningful interpretation of workplace safety practices. The final sample contains 187,228 unique U.S. establishments in 2020.

To construct the firm level sample, we first match establishments from the ITA database to their parent firms in the Compustat database using the parent firm's name and the employer identification number (EIN) of each establishment in the ITA database. We then construct a firm-level injury rate by aggregating the number of establishment level injuries and illnesses and dividing by the total working hours of all establishments within each parent firm, and average this firm-year injury rate over the period 2016-2019. Our initial sample contains 1,491 Compustat firms that we are able to match to the ITA data. After separately merging the firm level database with the COVID-19 employee complaint data and CRSP database, we obtain two firm level samples. The one for studying COVID complaints consists of 1,004 firms, and the one for studying stock returns and operating performance consists of 838 firms. Panels B and C of Table 1 describe the firm-level variables we use in the second part of our analysis.

2.2 Key Variables

Our main independent variable, "Injury Rate," is the annual number of injuries and illnesses per 100 full-time equivalent (FTE) employees as reported in the ITA database averaged over 2016-2019. We compute this measure by dividing the total number of injuries and illnesses by the total employee hours in the year multiplied by 200,000 [5]. We use this variable as a measure of the strength of workplace safety practices in an establishment. Our main dependent variable, "COVID Rate," is the number of workplace COVID-19 infections per 100 FTE employees at an establishment, which we also obtain from the ITA data.

Using the parent firm-level COVID-19 employee complaint data that we constructed, we create two outcome variables. The first variable, "COVID-19 Complaint," is an indicator variable that equals one if a firm covered by Compustat and ITA has at least one COVID-19 complaint by employees in the Weekly OSHA COVID-19 Complaint Database, and zero otherwise. The second variable, "COVID-19 Number of Complaints," is the number of COVID-19 complaints by employees against a firm between February 2020 and the end of December 2020. Table 1 summarizes the establishment- and firm-level variables used in our analyses.

[Table 1 about here]

In the Appendix Table 2, we tabulate distribution of injuries and illnesses in the U.S. private sector in 2010 by cause (Panel A) and nature (Panel B) using aggregate statistics from the BLS's annual statistics release.The leading causes of incidents are overexertion, falls, and contact with objects, while the most common nature of incidents are sprains, strains or tears, soreness and pain, and cuts, lacerations, punctures.

Our worker physical proximity measures are constructed using the high physical proximity measure of Mongey et al. (2020) and the Occupational Employment Statistics (OES) data

[5]This number is the total number of hours of a full time employee who works for 8 hours a day, 5 days a week and 50 weeks a year.

of Bureau of Labor Statistics (BLS). Using the O*NET measure of physical-proximity at the occupation level and the OES data, Mongey et al. (2020) classify each 3-digit OCC occupation as either having high or low physical proximity using the O*NET measure of physical-proximity at the occupation level and the OES data. The average worker in jobs that are classified as high physical proximity reports working at or within arm's length of others. We then calculate an industry level measure of worker physical proximity by weighing the high physical proximity indicators at the occupational level by the percentages of workers in those occupations within each 4-digit NAICS industry.

3 Results - Workplace COVID-19 Infections

This section presents establishment-level analysis of the relation between the strength of pre-pandemic workplace safety practices, as proxied by workplace injury rate, and workplace COVID-19 infection rates.

3.1 Baseline results

We begin our analysis by estimating cross-sectional regressions of the relationship between an establishment's COVID-19 infection rate in 2020 and its pre-pandemic workplace injury rate. Our primary regression model takes the following form:

$$COVIDRate_i = \alpha_j + \gamma_s + \beta InjRate_i + \delta Ln(Emp)_i + \lambda Ln(Hrs/Emp)_i + \epsilon_i, \qquad (1)$$

where α_j and γ_s represent vectors of industry and location fixed effects, respectively. The coefficient of interest is β. We include $Ln(Emp)$ and $Ln(Hrs/Emp)$ as control variables to account for differences in COVID-19 infection rates based on the scale of an establishment or employees' average workload, respectively. We cluster standard errors at the parent firm level when estimating equation (1). Table 2 presents our regression estimates.

[Table 2 about here]

Column (1) presents results without controls. The coefficient on $InjRate$ is positive and statistically significant at the 1% level, indicating that the 2020 COVID-19 infection rates are higher at establishments with higher pre-pandemic workplace injury rates. Column (2) presents results where we add the two control variables. The coefficient on $InjRate$ in column (2) is almost identical to the coefficient in column (1). For the control variables, the coefficient on $Ln(Emp)$ is positive and statistically significant at the 1% level. Higher COVID-19 infection rates in establishments with more employees is consistent with more potential contacts resulting in higher transmission. The coefficient on $Ln(Hrs/Emp)$ is not statistically significant.

The coefficient of 0.007 on $InjRate$ in column (2) indicates that one-unit higher workplace injuries per 100 full-time equivalent employees is associated with 0.007 additional COVID-19 infection per 100 full-time equivalent (FTE) employees. As the standard deviation of $InjRate$ is 5.55, a one-standard deviation higher workplace injury rate is associated with 0.039 more COVID-19 infection per 100 FTE employees, or 10.6% of the 0.366 sample mean COVID-19 infection per 100 FTE employees.

Column (3) presents results with parent firm fixed effects. The coefficient on $injRate$ in this specification captures the sensitivity of COVID infections to prior workplace injury rates across different establishments within the same firm. Controlling for parent firm fixed effects helps to alleviate concerns about firm-level factors that might drive both COVID infections and workplace injury rates more generally, such as corporate culture or ESG. The coefficient on $InjRate$ is still positive and statistically significant at the 1% level, though its magnitude drops a little to 0.006. The results in column (3) suggest that differences in establishment-level safety practices are important for explaining COVID infection rates.

We return to the question of the relative importance of firm- versus establishment-level differences in workplace safety in explaining COVID infections shortly. Overall, the results in Table 2 are consistent with stronger workplace safety practices entering the pandemic allowing an establishment to respond to COVID-19 infection hazard quickly and effectively.

Columns (4) and (5) present results from Poisson regressions, where the dependent variable is the number of COVID infections in an establishment, $InjCount_i$. In Columns (4), we include no controls. Consistent with the OLS results, the coefficient on $InjRate$ is positive and statistically significant at the 1% level. Column (5) includes controls. The result is similar to Column (4) except the magnitude of the coefficient on $InjRate$ is slightly larger. The 0.017 coefficient on $InjRate$ indicates that one-unit higher workplace injuries per 100 FTE employees is associated with 1.7% more COVID-19 cases per 100 FTE employees. This estimates implies that one-standard deviation higher workplace injuries per 100 FTE employees is associated with 10.0% more COVID-19 infections, comparable to the effect implied by the OLS estimates in column (4).

3.2 Controlling for confounding factors

At least three factors relating to inherent differences in the nature of the work conducted at different workplaces may confound our interpretation of the estimates in Table 2. First, high workplace injury rate may select for production processes that inherently puts employees at higher COVID-19 infection risk. Second, low workplace injury rate may select for production processes more suitable for remote work, and remote workers likely face less COVID-19 infection than those working in person. Third, high workplace injury rate may select for workplaces where peripheral employees in occupations with relatively low risk of workplace COVID-19 infection are disproportionately laid off in 2020. While these differences are likely to be largely industry-specific, and we control for 4-digit NAICS code industry fixed effects in our regression analysis, this industry categorization may be too coarse to capture all important differences in the nature of work. We estimate four additional regressions to address these specific concerns. Table 3 presents the estimates from these regressions.

[Table 3 about here]

We address concerns about inherent differences in the nature of work in general in two ways. First, we re-estimate regression equation (1) but include 6-digit NAICS code industry fixed effects in place of 4-digit NAICS code fixed effects. Column (1) presents estimates from this regression. The estimates are similar to those in Table 2 column (2), where we include 4-digit NAICS code fixed effects. Second, we re-estimate (1) while restricting the sample to establishments in relatively homogeneous industries, where differences in the nature of work are likely to at least be smaller. If differences in the nature of work, even after controlling for industry, drive the relationship between COVID-19 infection and pre-pandemic injury rates, then the relationship should weaken when we restrict the sample to firms in relatively homogeneous industries. We define industries as relatively homogeneous if their within-industry return correlations are above the median for the sample (Parrino, 1997). Column (2) presents estimates where we restrict the sample to this subsample of establishments. The coefficient on $InjRate$ actually increases slightly when we impose this sample restriction.

We address concerns about the effects of a shift to remote work by restricting the sample to establishments in industries designated essential by the U.S. government and re-estimate (1). Workers in these industries by and large continued to work in person throughout 2020. Column (3) presents results where we restrict the sample to establishments in essential industries. The coefficient on $InjRate$ remains the same as in Table 2 column (4). Finally, we address concerns about systematic layoffs by removing from the sample establishments with a reduction in working hours of more than 10% from 2019 to 2020 and re-estimating (1). The coefficient on $InjRate$ is again largely unchanged.

3.3 Firm versus establishment workplace safety practices

We next further investigate the relative importance of firm- and establishment-level workplace safety practices in explaining COVID infection rates. To do so, we add the parent firm-level pre-pandemic injury rate to each establishment in our sample, and then regress COVID infection rate on establishment injury rate and parent firm injury rate, controlling for establishment characteristics as well as industry and county fixed effects. Table 4 presents the results.

[Table 4 about here]

In column (1), we begin with the firm-level injury rate as the only regressor. The coefficient on firm-level injury rate is positive, significant, and slightly larger than the coefficient on establishment-level injury rate in column (1) of Table 2 (0.008 vs 0.007). In column (2), we add establishment-level controls. Neither the statistical significance nor the size of the coefficient on firm level injury rate changes. In column (3), we include the firm- and the establishment-level pre-pandemic workplace injury rates simultaneously. Establishment-level injury rate enters with a positive and statistically significant coefficient, similar in magnitude to the comparable estimate with parent firm fixed effects in column (3) of Table 2. Interestingly, including the establishment-level injury rate effectively subsumes the explanatory power of the firm-level injury rate. That is, establishment- rather than firm-level pre-pandemic workplace injury rate appears to explain COVID infection rate at the establishment level. This is consistent with the findings in Zohar and Luria (2005) that the relationship between organizational-level safety climate and individual safety outcomes are fully mediated by subunit safety climate. In column (4), we add a number of firm characteristics to the specification in column (3), including firm size, leverage, cash holdings, capital expenditure, asset tangibility, asset utilization, ROA, Institutional ownership, and corporate governance. Again, only the establishment-level injury rates are statistically significant.

3.4 Cross sectional variations

Our estimates suggest that pre-pandemic workplace safety practices mitigate workplace COVID-19 infection during the pandemic. We next consider two factors that may explain cross-sectionally when this mitigating effect is more important. The first is how closely together employees in establishment work physically. The mitigating effect of workplace safety practices should be more important in workplaces where workers operate in closer proximity to one another. We test this prediction by estimating regressions of COVID-19 infection rate on the interaction of $InjRate$ and $WorkProximity$ (recall that $WorkProximity$ is measured at the industry level).

The second factor is unionization. The direction of the prediction here is less clear *a priori*. On the one hand, union representation may complement workplace safety practices, with unionized establishments better able to coordinate procedures designed to mitigate COVID infection risk and to get employees to adopt these procedures. On the other hand, union representation may substitute for workplace safety practices, with more unionized establishments able to force employers to adopt more COVID-preventing practices even absent better workplace safety practices in general. We test the effect of unionization by estimating regressions of COVID-19 infection rate on the interaction of $InjRate$ and $Unionization$ (also measured at the industry level) Table 5 presents the results.

[Table 5 about here]

All of the regressions presented in this table include establishment-level controls and county fixed effects. We begin by estimating a regression where we include $WorkProximity$ as the sole additional covariate in column (1). Not suprisingly, an establishment's COVID-19 infection rate has a strong positive relationship with the degree of work proximity in its industry. In column (2), we add $InjRate$ and the interaction of $InjRate$ and $WorkpProximity$ as covariates. The interaction term is positive and statistically significant at the 1% level, implying that a workplace's COVID-19 infection increases with its pre-pandemic workplace injury rate more if it is in an industry with a greater degree of work proximity. In column (3), we add industry fixed effects, which fully explain the effect of work proximity since work proximity is measured at the industry level. The interaction term is attenuated but remains positive and statistically significant, in this case at the 5% level.

In column (4), we include *Unionization* as the only covariate in addition to establishment-level controls and county fixed effects. The coefficient on unionization is negative and statistically significant. The negative coefficient could indicate that more unionized establishments take more precautions to mitigate COVID infection risk, but the fact that unionization is only measured at the industry level limits the strength of inference. In column (5), we add add *InjRate* and the interaction of *InjRate* and *Unionization* as covariates. The interaction term is negative but statistically insignificant. Finally, in column (6), we include industry fixed effects. The coefficient on the interaction of *InjRate* and *Unionization* becomes positive but remains statistically insignification. It is possible that unionization is not important at explaining the sensitivity of COVID infection rate to pre-pandemic workplace injury rate or that the complementary and substituting effects mostly offset.

3.5 COVID-19 complaints

One additional concern about analyzing COVID-19 infection rates is that infections are recorded by employers, some employers could tacitly discourage employees from reporting infections. Time-invariant establishment-level differences in propensity to report could induce a positive relationship between pre-2020 reported workplace injuries and reported COVID-19 infections in 2020. We address this concern analyzing the relationship between pre-2020 workplace injuries and COVID-19-related employee complaints to OSHA. Because our measure of employee complaints is at the firm level and not the establishment level, we conduct this analysis at the firm level, using a firm's aggregate workplace injury rate across all of its establishments in the ITA data to measure firm-level workplace safety capabilities. Table 6 reports regression results from this analysis.

[Table 6 about here]

Column (1) presents results from a logistic regression where the dependent variable is $I\{Complaint\}$, which is 1 if a firm was the subject of an employee COVID-19 complaint in 2020 and 0 otherwise, and the only explanatory variable is $InjRate$. Column (2) presents results from a comparable linear probability model. In column (3), we add three firm-level control variables and industry fixed effects. We control for $Ln(Assets)$, ROA, and $Tobin'sQ$ to account for differences in a firm's size, profitability, and growth orientation. The coefficients on $InjRate$ in all columns are positive and statistically significant. Not surprisingly, larger firms in terms of assets, which generally also have more employees, are more likely to be the subject of an employee complaint.

Column (4) presents results from a Poisson regression where the dependent variable is $\#Complaints$, the number of employee COVID-19 complaints against a firm in 2020, and the only explanatory variable is $InjRate$. In column (5), we add firm-level controls and industry fixed effects. The coefficient on $InjRate$ is positive and statistically significant in both columns. Thus, the number of COVID-19 complaints – and not just the probability of a complaint – is positively related to pre-pandemic injury rates. Overall, our analysis suggests that employees are more likely to file COVID-19 complaints against employers with weaker existing workplace safety capabilities at the onset of the pandemic. This finding helps to allay concerns that reporting differences drive the relationship between COVID-19 infection rates and pre-pandemic workplace injury rates.

4 Results - Consequences for Employers

The results in Section 3 suggest that stronger workplace safety practices entering the pandemic mitigate the risk to employees of workplace COVID-19 infection. In this section, we study the consequences for the employers. On the one hand, greater capability to mitigate workplace COVID-19 infection risk potentially benefits employers by reducing production disruptions due to employee absences, employee turnovers, and operation shutdowns and by improving employee morale. One the other hand, more extensive adoption of COVID-19 safety measures increases operating costs and may even restrict production capacity. The net consequence is an empirical question, which we examine in this section.

4.1 Long-short portfolio returns

We first present a descriptive graph of the real time returns on a portfolio that loads positively on firms with high pre-pandemic injury rates and loads negatively on firms with low pre-pandemic injury rates over the 35 trading days between February 24, 2020 – the date that Italy implemented its first lockdown – and April 7, 2020 – the date that the final U.S. state (South Carolina) implemented a lockdown. While this choice of period is somewhat arbitrary, it approximately captures the period over which it became clear that the pandemic would substantially affect the U.S.

Figure 2 plots two daily time series over the six-month period between December 31, 2019 and June 30, 2020. The first, depicted by the brown line, is the cumulative daily return on the S&P 500. The second, depicted by the blue line, is the cumulative daily sensitivity of returns to pre-pandemic workplace injury rates. The daily sensitivity is captured by the slope coefficient from a regression of CAPM-adjusted daily return on firm-level $InjRate$ as follows:

$$Stock\ Returns_{i,t} = \alpha + \beta_t FirmInjuryRate_i + \epsilon_f,$$

The realized time-series of the slope estimates β_t have a portfolio return interpretation. They are a noisy estimate of the source of common variation in returns that is related to the strength of pre-pandemic workplace safety practices as a result of the pandemic. Intuitively, this factor is a long-short portfolio of firms based on their pre-pandemic workplace injury rates: It loads positively on firms with high injury rates, while loading negatively on firms with low injury rates. An upward slope in a given period indicates that firms with high injury rates earn higher abnormal returns over the period than firms with low injury rates, while a downward slope indicates that firms with high injury rates earn lower abnormal returns. The construction of our "Safety factor" is similar to that of the "COVID-19 return factor" of (Papanikolaou and Schmidt, 2022) who are interested in the variation of the production disruption risk exposure with the fraction of workers that report that they can work remotely at the industry level.

[Figure 2 about here]

Figure 1 shows that the S&P 500 is generally down over the period from February 24, 2020 through April 7, 2020. It also shows that firms with high injury rates generally underperformed firms with low injury rates during this period. It is worth noting that the relationship between returns and pre-pandemic workplace injury rates largely flattens out after April 7. This flattening out suggests that the market's relative pessimism about the consequences of COVID-19 for firms with higher workplace injury rates persisted, without reversing, at least through the end of the first half of 2020.

4.2 Stock performance: event studies

We more formally test the relationship between stock returns as the implications of COVID-19 for the U.S. were becoming clear and pre-pandemic workplace injury rates using cross-sectional regression analysis. We do so by regressing a firm's CAPM-adjusted cumulative 35-trading day abnormal return on $InjRate$, controlling for various firm characteristics as well as industry fixed effects. Table 7 presents estimates from this regression analysis. We report standard errors clustered at the firm level in the table, though we will compute standard errors in a manner that better accounts for arbitrary cross-sectional error correlations in a future version of the paper.

[Table 7 about here]

In column (1), the only covariate is $InjRate$. Column (2) adds basic firm controls. Column (3) adds additional firm controls. Column (4) adds ESG as an additional firm-level covariate. Note that the number of observations decreases as we add additional variables due to missing data.

The coefficient on $InjRate$ is negative and statistically significant in all four columns, confirming the patterns that Figure 1 depicts. The -0.923 coefficient in column (3), where we include basic firm-level controls and industry fixed effects, implies a sizeable 2.0 percentage point lower return for each one standard deviation (2.189) increase in firm-level $InjRate$. Thus, it appears that the market was especially concerned about the implications of COVID-19 for firms with higher pre-pandemic workplace injury rates. The coefficient on ESG is positive but statistically insignificant, suggesting that a firm's ESG rating does not seem to make a firm more resilient to the pandemic. More importantly, our results are not driven by any ESG effect, i.e. better stakeholder relations making a firm more resilient to crises.

4.3 Accounting performance and labor productivity

We assess the implications of COVID-19 and of workplace safety capabilities entering the pandemic for employers by analyzing firms' accounting performance in 2020. Specifically, we regress ΔROA – the change in a firm's ROA from 2019 to 2020 – separately on two variables – $COVIDRate$ and $InjRate$. The coefficient on $COVIDRate$ captures the sensitivity of a firm's accounting performance in 2020 to its actual workplace COVID-19 infection rate. The coefficient on $InjRate$ captures the sensitivity of a firm's accounting performance to its per-pandemic workplace injury rate. Table 8 presents the estimates from this regression analysis.

[Table 8 about here]

The covariate of interest in columns (1) and (2) is $COVIDRate$. Column (1) includes industry fixed effects, while column (2) adds firm-level control variables. The coefficient on $COVIDRate$ is negative and statistically significant in both columns. Thus, it appears that firms with higher COVID-19 rates did, indeed, experience larger declines in accounting performance in 2020. In column (3), we include both $COVIDRate$ and $InjRate$, along with firm-level controls, as covariates. The coefficients on both $COVIDRate$ and $InjRate$ enter with negative signs and are statistically significant. The coefficient on $COVIDRate$ falls only slightly in magnitude from column (2).

The significant coefficient on $InjRate$ suggests that pre-pandemic workplace safety practices have a positive effect on operating performance beyond what is through the actual rate of COVID infections. One possible explanation is that employees' belief that a firm was well-positioned to mitigate COVID-19 infection risk kept employee morale higher. In columns (4) and (5), we interact $COVIDRate$ and $InjRate$ with $WorkProximity$, respectively. The coefficients on both interaction terms are negative and statistically significant, suggesting that the relation between a firm's workplace safety practices and COVID infection and its accounting performance in 2020 is more pronounced for firms in industries with close work proximity. This evidence allays concerns that the relation may not be driven by COVID infections.

In Panel B of Table 8, we regress the change in labor productivity from 2019 to 2020 separately on two variables – $COVIDRate$ and $InjRate$. We also examine how the relationships vary with work proximity measured at the industry level. The setup of the models is similar to that in Panel A. First, we find that $COVIDRate$ has a negative and statistically significant association with change in labor productivity. Although the coefficient on $InjRate$ has a negative sign, it is statistically insignificant. Hence, it appears that the effect of workplace safety practices on labor productivity during the pandemic is mainly through differences in COVID infections. Second, the coefficient on the interaction of $COVIDRate$ and $WorkProximity$ is negative and statistically significant so the relation is more pronounced for firms where workplace safety practices likely matter more.

Overall, the results suggest that firms benefit from the mitigating effects of better workplace safety capabilities entering the pandemic on COVID-19 incidence. This conclusion has important implications. It suggests that a previously unrecognized benefit of better workplace safety practices in general is that they help to shield the firm from the adverse consequences of epidemics, which could otherwise cripple production.

5 Conclusion

This paper presents new evidence on the effect of a firm's workplace safety practices prior to the COVID-19 pandemic on its COVID-19 infection rate, stock returns and operating performance. We proxy for the strength of workplace safety practices using pre-pandemic workplace injury rates. Consistent with stronger workplace safety practices entering the pandemic making an organization more resilient to the hazard posed by workplace COVID-19 infections, we find that workplace COVID-19 infection rates in 2020 are higher for establishments with higher pre-pandemic workplace injury rates, especially in industries where employees work in close physical proximity to each other. OSHA also receive more employee complaints about inadequate COVID-19 safety measures being taken at workplaces from establishments with higher pre-pandemic injury rates. In addition, we find that firms with greater exposure to workplace COVID infections experienced a larger drop in stock prices and a larger decline in profitability and labor productivity in 2020. Overall, our results suggest that building stronger workplace safety practices is an important task of corporate managers and can make an organization better positioned to maintain production during the current pandemic and be more resilient to future pandemics.

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Figure 1: The Evolution of U.S. Workplace Injuries and Illnesses Over 2016-2020
This chart displays the trends of establishment injuries and illnesses in the ITA database over the period of 2016-2020. Illnesses include five categories: respiratory illnesses, skill illnesses, hearing illnesses, poisoning illnesses, and other illnesses. Injuries include injuries with days away from work, injuries with job transfer or restriction, and other injuries. Panel A and B present the evolution of establishment illnesses by number and rate. Panel C and D present the evolution of establishment injuries by number and rate. Injury (illness) rate is the number of injuries (illnesses) divided total hours worked by employees multiplied by 200,000 at an establishment in a year.

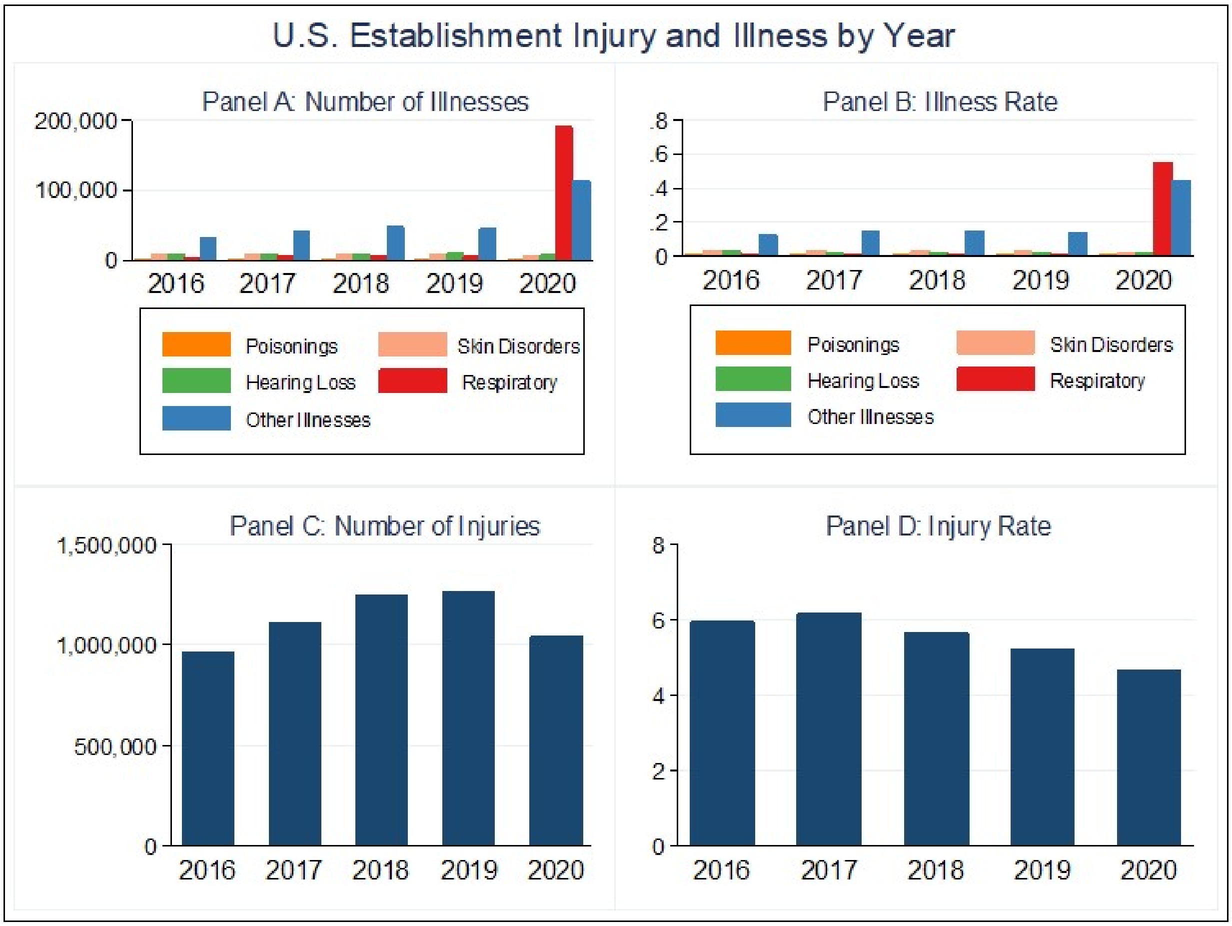

Figure 2: Real-time Safety Factor vs Market Portfolio

The figure shows the time-series of the estimated slope coefficients from the regression of CAPM-adjusted daily return on firm TCR during the first half year of 2020. As noted by Fama and MacBeth (1973), the realizations of these slope coefficients have a portfolio interpretation, here labeled as the 'Safety factor'. These implied portfolio returns are accumulated since beginning of the year. The brown line represents cumulative returns to the S&P 500 market portfolio during this period. Events are dated on the date of their occurrence.

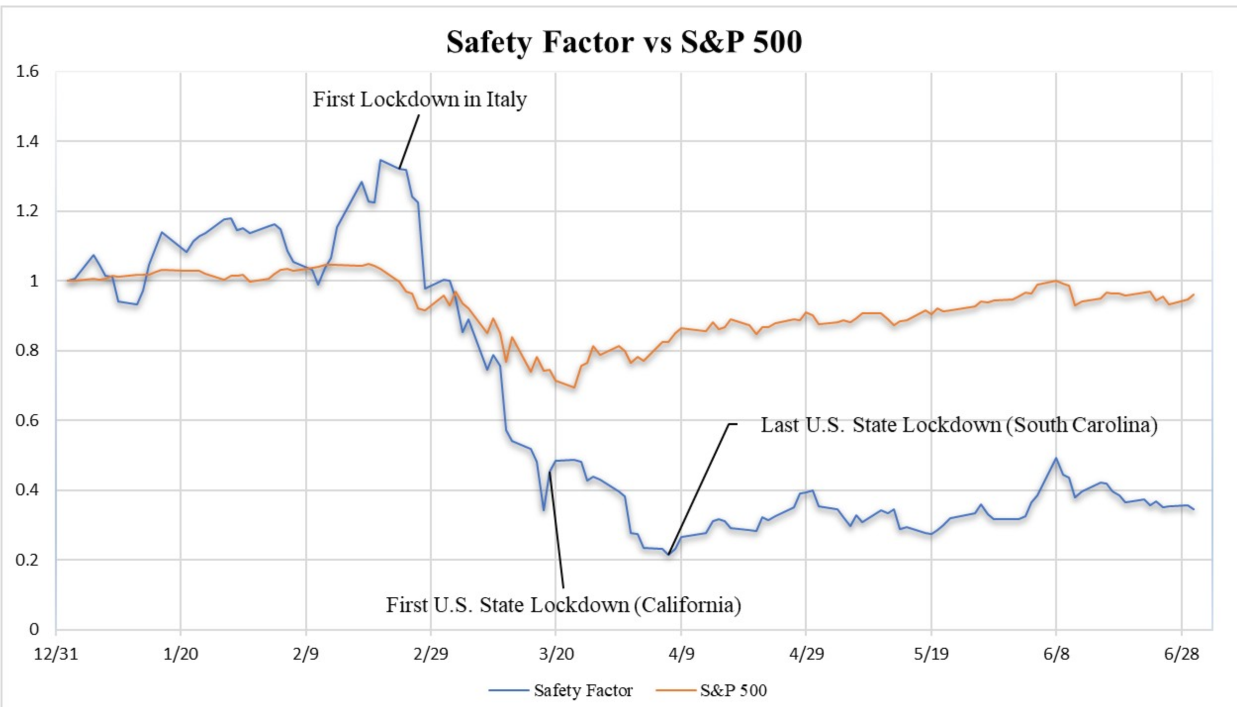

Table 1: Summary Statistics

This table reports summary statistics of the main variables used in the analyses. Establishment injury and illness data from 2016 to 2019 are from the OSHA ITA database. COVID-19 employee complaint data are from the OSHA COVID-19 Complaint Data. Accounting characteristics data are from the Compustat database.Stock return data are from the CRSP database. All continuous variables are winsorized at 1% and 99%. All variables are defined in Table A1.

Variable	N	Mean	S.D.	25%	Median	75%
Panel A: Establishment-level Variables for COVID-19 Infection Analysis						
Injury Rate	187228	5.058	5.550	1.119	3.692	7.002
COVID-19 Rate	187228	0.366	2.113	0.000	0.000	0.000
Number of Employees	187228	117.515	199.943	25.000	52.000	120.000
Ln(Number of Employees)	187228	4.032	1.167	3.219	3.951	4.787
Hours Per Employee	187228	1751.426	502.730	1466.445	1807.895	2050.944
Ln(Hours Per Employee)	187228	7.417	0.350	7.291	7.500	7.626
Work Proximity (4-digit NAICS Level)	226	0.531	0.098	0.468	0.504	0.586
Unionization (4-digit NAICS Level)	274	0.084	0.099	0.016	0.049	0.132
Panel B: Firm-level Variables for COVID-19 Employee Complaint Analysis						
Firm Injury Rate	1004	2.458	2.129	0.893	1.806	3.445
COVID-19 Complaint	1004	0.202	0.402	0.000	0.000	0.000
COVID-19 Number of Complaints	1004	1.549	5.759	0.000	0.000	0.000
Panel C: Firm-level Variables for Financial Analysis						
Firm Injury Rate	838	2.537	2.189	0.917	1.884	3.614
Firm COVID-19 Rate	606	0.095	0.428	0.000	0.000	0.006
CAPM-adjusted Cumulative Return (%)	838	-10.094	22.224	-23.726	-8.243	4.985
ROA Change	783	-0.019	0.069	-0.037	-0.011	0.005
Labor Profitability Change	753	6.604	2.850	7.498	7.681	7.762
Ln(Assets)	838	8.230	1.683	7.116	8.107	9.348
ROA	834	0.133	0.111	0.089	0.134	0.180
Tobin's q	833	1.897	1.175	1.149	1.486	2.168

Table 2: Pre-pandemic Workplace Injury Rate and COVID-19 Infection in 2020

This table presents results from OLS regressions of establishment COVID-19 infection rate in 2020 on establishment injury rate averaged over 2016 through 2019. The COVID-19 infection rate equals the number of respiratory illness cases per 100 full-time equivalent employees in 2020. The injury rate equals to the number of work-related injuries and illnesses per 100 full time equivalent employees averaged over 2016-2019. All variables are defined in Table A1. Heteroscedasticity-robust standard errors are clustered at the parent firm level and shown in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.

Dependent Variable	COVID-19 Rate or Count in 2020				
	(1)	(2)	(3)	(4)	(5)
Injury Rate	0.007***	0.007***	0.006***	0.014***	0.017***
	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)
Ln(Number of Employees)		0.065***	0.062***		0.608***
		(0.010)	(0.020)		(0.022)
Ln(Hours Per Employee)		0.008	-0.032		0.595***
		(0.035)	(0.035)		(0.077)
Model	OLS	OLS	OLS	Poisson	Poisson
Establishment Controls	N	Y	Y	Y	Y
Establishment Industry FE	Y	Y	Y	Y	Y
Establishment County FE	Y	Y	Y	Y	Y
Parent Firm FE	N	N	Y	N	N
Adjusted (Pseudo) R^2	0.192	0.193	0.516	0.502	0.537
Observations	186,636	186,636	129,214	173,012	173,012

Table 3: Controlling for Differences in Production Technology and Lockdown

This table presents results from OLS regressions of establishment COVID-19 infection rate in 2020 on establishment injury rate controlling for industry-level production technology and establishment lockdown. Injury Rate is the number of injuries and illnesses divided by total hours worked by employees multiplied by 200,000 at an establishment, averaged over 2016-2019. COVID-19 Rate is the number of workplace COVID-19 infections divided by total hours worked by employees multiplied by 200,000 at an establishment in 2020. NAICS 4-digit industry homogeneity is computed based on Parrino (1997). NAICS 6-digit essential industry list is from the CDC at `https://www.cdc.gov/niosh/topics/coding/essentialworkers/default.html`. All variables are defined in Table A1. Heteroscedasticity-robust standard errors are clustered at the parent firm level and shown in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.

	NAICS 6-digit Industry	Homogeneous Industry	Essential Industry	Exclude Establishment with 10% Reduction in Total Working Hours
Dependent Variable	COVID-19 Rate in 2020			
	(1)	(2)	(3)	(4)
Injury Rate	0.007***	0.009**	0.007***	0.007***
	(0.002)	(0.004)	(0.002)	(0.002)
Establishment Controls	Y	Y	Y	Y
Establishment Industry FE	Y	Y	Y	Y
Establishment County FE	Y	Y	Y	Y
Adjusted R^2	0.198	0.231	0.196	0.192
Observations	186,538	67,557	166,550	123,364

Table 4: The Relative Importance of Firm- and Establishment-Level Workplace Safety Practices

This table presents results from OLS regressions of establishment COVID-19 infection rate in 2020 on firm-level injury rate and establishment-level injury rate. Within-firm Average Injury Rate is the average injury rate of all establishments within a firm. Injury Rate is the number of injuries and illnesses divided by total hours worked by employees multiplied by 200,000 at an establishment, averaged over 2016-2019. COVID-19 Rate is the number of workplace COVID-19 infections divided by total hours worked by employees multiplied by 200,000 at an establishment in 2020. All variables are defined in Table A1. Heteroscedasticity-robust standard errors are clustered at the parent firm level and shown in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.

Dependent Variable	COVID-19 Rate in 2020			
	(1)	(2)	(3)	(4)
Within-firm Average Injury Rate	0.008***	0.008***	0.002	0.005
	(0.003)	(0.002)	(0.003)	(0.011)
Injury Rate			0.006***	0.004**
			(0.002)	(0.002)
Size				0.123*
				(0.075)
Leverage				0.452*
				(0.243)
Cash				-2.245*
				(1.285)
Capital Expenditures				3.547*
				(1.942)
Tangible Assets				-1.400*
				(0.849)
Asset Utilization				0.096**
				(0.047)
ROA				2.118*
				(1.129)
Institutional Ownership				0.098
				(0.157)
E Index				0.316***
				(0.111)
Board Independence				-0.305
				(0.647)
Establishment Controls	N	Y	Y	Y
Establishment Industry FE	Y	Y	Y	Y
Establishment County FE	Y	Y	Y	Y
Adjusted R^2	0.192	0.193	0.193	0.323
Observations	186,636	186,636	186,636	29,058

Table 5: Cross-Sectional Variation: Physical Proximity and Union

This table presents results from OLS regressions of establishment COVID-19 infection rate in 2020 on establishment injury rate conditional on industry work proximity. Work Proximity is the NAICS 4-digit-level work proximity, computed as the industry employment-weighted average of occupational work proximity (Mongey et al., 2021). Injury Rate is the number of injuries and illnesses divided by total hours worked by employees multiplied by 200,000 at an establishment, averaged over 2016-2019. COVID-19 Rate is the number of workplace COVID-19 infections divided by total hours worked by employees multiplied by 200,000 at an establishment in 2020. All variables are defined in Table A1. Heteroscedasticity-robust standard errors are clustered at the parent firm level and shown in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.

Dependent Variable	COVID-19 Rate in 2020					
	(1)	(2)	(3)	(4)	(5)	(6)
Work Proximity	6.440***	5.001***				
	(0.438)	(0.372)				
Injury Rate * Work Proximity		0.261***	0.064**			
		(0.036)	(0.029)			
Unionization				-0.935***	-0.802***	
				(0.148)	(0.117)	
Injury Rate * Unionization					-0.018	0.017
					(0.015)	(0.014)
Injury Rate	0.016***	0.013***	0.008***	0.022***	0.022***	0.007***
	(0.003)	(0.003)	(0.002)	(0.003)	(0.003)	(0.002)
Establishment Controls	Y	Y	Y	Y	Y	Y
Establishment Industry FE	N	N	Y	N	N	Y
Establishment County FE	Y	Y	Y	Y	Y	Y
Adjusted R^2	0.101	0.105	0.212	0.034	0.034	0.206
Observations	128,335	128,335	128,329	153,417	153,417	153,412

Table 6: Workplace Injury Rate and COVID-19 Safety Employee Complaints

This table presents results from regressions of firm COVID-19 employee complaints in 2020 on firm injury rate. Firm Injury Rate is the number of injuries and illnesses divided by total hours worked by employees multiplied by 200,000 across all establishments of a firm, averaged over 2016-2019. The data on COVID-19 safety violations and complaints are from Weekly OSHA COVID-19 Complaint Data from January 16, 2020, to December 13, 2020. Complaint(0/1) is an indicator variable that equals one if a firm has at least one COVID-19 safety employee complaint case from Weekly OSHA COVID-19 Complaint Database, and zero otherwise. Number of Complaints is the number of COVID-19 safety employee complaint cases. All specifications include Fama-French 48 industry fixed effects. All variables are defined in Table A1. Heteroscedasticity-robust standard errors are shown in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.

Dependent Variable	Complaint (0/1)			Number of Complaints	
	(1)	(2)	(3)	(4)	(5)
Firm Injury Rate	0.148***	0.027***	0.016**	0.236***	0.097**
	(0.033)	(0.006)	(0.007)	(0.037)	(0.040)
Ln(Assets)			0.060***		0.546***
			(0.008)		(0.055)
ROA			0.262**		4.283***
			(0.108)		(1.236)
Tobin's q			0.006		-0.043
			(0.010)		(0.089)
Model	Logit	OLS	OLS	Poisson	Poisson
Industry FE	N	N	Y	N	Y
Adjusted (Pesudo) R^2	0.018	0.019	0.143	0.091	0.497
Observations	1,004	1,004	1,003	995	939

Table 7: Workplace Injury Rate and Stock Returns During 2020 Stock Market Crash
This table presents results from OLS regressions of cumulative stock returns on firm injury rate during the stock market crash of 2020. The sample consists of firms in the ITA data for the period of 2016-2019. Firm Injury Rate is the number of injuries and illnesses divided by total hours worked by employees multiplied by 200,000 across all establishments of a firm, averaged over 2016-2019. The dependent variable is CAPM-adjusted Cumulative Return over the period of Feb 24 2020 to April 07 2020. All specifications include Fama-French 48 industry fixed effects. All variables are defined in Table A1. Heteroscedasticity-robust standard errors are shown in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.

Accumulation Period	02/24/20 - 04/07/20			
Dependent Variable	CAPM-adjusted Cumulative Return			
	(1)	(2)	(3)	(4)
Firm Injury Rate	-1.298***	-0.923***	-0.780**	-0.887**
	(0.363)	(0.352)	(0.363)	(0.393)
Ln(Assets)		0.765	1.032*	0.561
		(0.496)	(0.588)	(0.621)
ROA		17.656*	20.670**	11.431
		(9.049)	(9.347)	(10.487)
Tobin's q		3.475***	2.896***	2.742***
		(0.723)	(0.735)	(0.764)
Historical Volatility		-1.201***	-0.845**	-0.904**
		(0.331)	(0.344)	(0.424)
Leverage			-18.095***	-18.121***
			(4.226)	(4.611)
Cash			12.214*	14.586*
			(7.369)	(7.915)
WW			-4.721*	-3.657
			(2.848)	(3.262)
SA			-3.695**	-2.708
			(1.805)	(1.974)
ESG				0.435
				(1.381)
Industry FE	Y	Y	Y	Y
Adjusted R^2	0.193	0.307	0.339	0.317
Observations	837	827	825	714

Table 8: COVID-19 Infection and Operating Performance in 2020

This table presents results from OLS regressions of the changes of operating performance measures on COVID-19 rate and firm injury rate. Firm Injury Rate is the number of injuries and illnesses divided by total hours worked by employees multiplied by 200,000 across all establishments of a firm, averaged over 2016-2019. Firm COVID-19 Rate is the number of workplace COVID-19 infections divided by total hours worked by employees multiplied by 200,000 across all establishments of a firm in 2020. Annual ROA Change is the return on assets in 2020 minus the return on assets in 2019. Annual Sales/Employee Growth is revenue per employee in 2020 divided by revenue per employee in 2019 minus one. All specifications control for Fama-French 48 industry fixed effects All variables are defined in Table A1. Heteroscedasticity-robust standard errors are shown in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.

Panel A: Dependent Variable	Annual ROA Change from 2019 to 2020				
	(1)	(2)	(3)	(4)	(5)
Firm COVID-19 Rate	-0.022***	-0.023***			-0.019**
	(0.007)	(0.007)			(0.008)
Firm Injury Rate			-0.005**	-0.004*	-0.005**
			(0.002)	(0.002)	(0.003)
Ln(Assets)		-0.003*		-0.002	-0.004**
		(0.002)		(0.002)	(0.002)
Leverage		0.019		-0.008	0.024
		(0.015)		(0.018)	(0.015)
Tobin's Q		-0.003		-0.001	-0.003
		(0.004)		(0.003)	(0.004)
Industry FE	Y	Y	Y	Y	Y
Adjusted R^2	0.193	0.185	0.183	0.187	0.200
Observations	533	476	687	616	476
Panel B: Dependent Variable	**Annual Sales/Employee Growth from 2019 to 2020**				
	(1)	(2)	(3)	(4)	(5)
Firm COVID-19 Rate	-0.062***	-0.062***			-0.061***
	(0.018)	(0.019)			(0.020)
Firm Injury Rate			-0.002	-0.003	-0.003
			(0.005)	(0.006)	(0.007)
Ln(Assets)		-0.003		-0.010	-0.003
		(0.008)		(0.008)	(0.008)
Leverage		0.068		0.004	0.071
		(0.050)		(0.045)	(0.049)
Tobin's Q		0.022***		0.023***	0.022***
		(0.007)		(0.008)	(0.007)
Industry FE	Y	Y	Y	Y	Y
Adjusted R^2	0.132	0.138	0.138	0.145	0.136
Observations	522	473	671	611	473

Internet Appendix

Appendix 1: Variable Definitions

Variables for COVID-19 Analysis	
Injury Rate	The number of injuries and illnesses divided by total hours worked by employees multiplied by 200,000 at an establishment, averaged over 2016-2019.
COVID-19 Rate	The number of workplace COVID-19 infections (respiratory illnesses) divided by total hours worked by employees multiplied by 200,000 at an establishment in 2020.
Ln(Number of Employees)	The natural logarithm of the number of employees at an establishment.
Ln(Hours Per Employee)	The natural logarithm of the number of hours worked per employee at an establishment.
Work Proximity	The level of NAICS 4-digit employement-weighted average of occupational work proximity. Occupational work proximity is obtained from Mongey et al. (2020)
Unionization	The level of NAICS 4-digit union membership. Union membership is obtained from https://www.unionstats.com/
COVID-19 Complaint	An indicator variable that equals one if a firm has at least one COVID-19 safety employee complaint case in 2020 from Weekly OSHA COVID-19 Complaint Database, and zero otherwise.
COVID-19 Number of Complaints	The number of COVID-19 safety employee complaint cases in 2020 from Weekly OSHA COVID-19 Complaint Database.
Variables for Financial Analysis	
Firm Injury Rate	The number of injuries and illnesses divided by total hours worked by employees multiplied by 200,000 across all establishments of a firm in the ITA data, averaged over 2016-2019.
Firm COVID-19 Rate	The number of workplace COVID-19 infections (respiratory illnesses) divided by total hours worked by employees multiplied by 200,000 across all establishments of a firm in 2020.
Annual ROA Change	The return on assets in 2020 minus the return on assets in 2019 with fiscal year ending in December.
Annual Labor Productivity Change	[SALES - [total expense (SALES-OIBDP) - labor expense (XLR)]]/number of employees (EMP), deflated by GDP price deflator from NIPA. Missing XLR is replaced by the number of employees (EMP) multiplied by average wages from Social Security Administration.
CAPM-adjusted Cumulative Return	The cumulative return of CAPM-adjusted daily returns for the period of February 24 2020-April 07 2020. CAPM-adjusted daily return is raw return minus market beta multiplied by CRSP value-weighted market return ("vwretd"). Market beta is calculated using daily stock return in 2019.
Ln(Assets)	The natural logarithm of total assets in 2019.
ROA	The ratio of a firm's operating income over lagged total assets in 2019.
Tobin's q	The sum of book value of total assets minus book value of equity plus market value of equity over book value of total assets in 2019.

Appendix 2: Injuries and Illnesses by Cause and Nature

This table presents the distribution of injuries and illnesses in U.S. private sector in 2019 by cause (Panel A) and nature (Panel B). The percentages are computed by incidents from the BLS at https://www.bls.gov/iif/oshwc/osh/case/cdr122019.htm.

Panel A: Injuries and Illnesses by Cause	
Cause of Injury and Illness	Percent
Overexertion and bodily reaction	31.03
Falls, slips, trips	27.47
Contact with objects	25.83
Transportation incidents	5.57
Violence and other injuries by persons or animal	5.01
Exposure to harmful substances or environments	4.15
Fires and explosions	0.19
All other events or exposures	0.76
Panel B: Injuries and Illnesses by Nature	
Nature of Injury and Illness	Percent
Sprains, strains, tears	33.23
Soreness, pain	17.73
Cuts, lacerations, punctures	10.10
Fractures	9.65
Bruises, contusions	9.08
Multiple traumatic injuries	2.61
Heat (thermal) burns	1.68
Amputations	0.68
Carpal tunnel syndrome	0.47
Chemical burns and corrosions	0.45
Tendonitis	0.16
All other natures	14.16

Appendix 3: Workplace Injury Rate and COVID-19 Infection: Alternative Samples

This table presents robustness tests on the COVID-19 infection analysis in Table 2. Column (1) excludes healthcare sector, Column (2) excludes state of Arkansas, and Column (3) and (4) retain establishments with above 50 employees and with above 100 employees. The sample consists of establishments in the ITA data for the period of 2016-2020. Injury Rate is the number of injuries and illnesses divided by total hours worked by employees multiplied by 200,000 at an establishment, averaged over 2016-2019. COVID-19 Rate is the number of workplace COVID-19 infections divided by total hours worked by employees multiplied by 200,000 at an establishment in 2020. All variables are defined in Table A1. Heteroscedasticity-robust standard errors are clustered at the parent firm level and shown in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.

	Exclude Healthcare Sector	Exclude State of Arkansas	Retain Estab. with 50+ Emp	Retain Estab. with 100+ Emp
Dependent Variable	COVID-19 Rate in 2020			
	(1)	(2)	(3)	(4)
Injury Rate	0.003***	0.007***	0.010***	0.014***
	(0.001)	(0.002)	(0.003)	(0.004)
Establishment Controls	Y	Y	Y	Y
Establishment Industry FE	Y	Y	Y	Y
Establishment County FE	Y	Y	Y	Y
Adjusted R^2	0.057	0.188	0.231	0.224
Observations	165,127	184,897	96,006	55,580

Appendix 4: Workplace Injury Rate and COVID-19 Infection: Alternative COVID-19 Rate

This table presents results from OLS regressions of establishment COVID-19 infection rate in 2020 on average establishment injury rate over 2016 through 2019. Injury Rate is the number of injuries and illnesses divided by total hours worked by employees multiplied by 200,000 at an establishment, averaged over 2016-2019. COVID-19 Rate is the number of workplace COVID-19 infections divided by total hours worked by employees multiplied by 200,000 at an establishment in 2020 **minus** the number of workplace COVID-19 infections divided by total hours worked by employees multiplied by 200,000 at an establishment averaged over 2016-2019. All variables are defined in Table A1. Heteroscedasticity-robust standard errors are clustered at the parent firm level and shown in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.

Dependent Variable	COVID-19 Rate in 2020				
	(1)	(2)	(3)	(4)	(5)
Injury Rate	0.007***	0.007***	0.006***	0.013***	0.016***
	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)
Model	OLS	OLS	OLS	Poisson	Poisson
Establishment Controls	N	Y	Y	Y	Y
Establishment Industry FE	Y	Y	Y	Y	Y
Establishment County FE	Y	Y	Y	Y	Y
Parent Firm FE	N	N	Y	N	N
Adjusted (Pseudo) R^2	0.192	0.193	0.515	0.502	0.536
Observations	186,636	186,636	129,214	172,462	172,462

Appendix 5: Workplace Injury Rate and Stock Returns: Alternative Returns

This table presents results from OLS regressions of cumulative stock returns on firm injury rate during the stock market crash of 2020. The sample consists of firms in the ITA data for the period of 2016-2019. Firm Injury Rate is the number of injuries and illnesses divided by total hours worked by employees multiplied by 200,000 across all establishments of a firm, averaged over 2016-2019. The dependent variables are Fama-French-3 factors-adjusted Cumulative Return, Fama-French-4 factors-adjusted Cumulative Return, and Raw Cumulative Return over the period of Feb 24 2020 to April 07 2020. All specifications include Fama-French 48 industry fixed effects. All variables are defined in Table A1. Heteroscedasticity-robust standard errors are shown in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.

Accumulation Period	02/24/20 - 04/07/20		
Dependent Variable	FF3-adjusted Cumulative Return	FF4-adjusted Cumulative Return	Raw Cumulative Return
	(1)	(2)	(3)
Firm Injury Rate	-1.095***	-0.835**	-0.653**
	(0.415)	(0.407)	(0.310)
Industry FE	Y	Y	Y
Adjusted R^2	0.149	0.146	0.225
Observations	837	837	837

Appendix 6: Workplace Injury Rate and Return Volatility

This table presents results from OLS regressions of return volatility on firm injury rate during the stock market crash of 2020. The sample consists of firms in the ITA data for the period of 2016-2019. Firm Injury Rate is the number of injuries and illnesses divided by total hours worked by employees multiplied by 200,000 across all establishments of a firm, averaged over 2016-2019. Idiosyncratic Volatility is the standard deviation of CAPM-adjusted daily returns over the period of Feb 24 2020 to April 07 2020. All specifications include Fama-French 48 industry fixed effects. All variables are defined in Table A1. Heteroscedasticity-robust standard errors are shown in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.

Accumulation Period	02/24/20 - 04/07/20	
Dependent Variable	Idiosyncratic Volatility	
	(1)	(2)
Firm Injury Rate	0.172***	0.080**
	(0.053)	(0.040)
Ln(Assets)		0.001
		(0.052)
ROA		-0.319
		(1.026)
Tobin's q		-0.177***
		(0.068)
Historical Volatility		0.522***
		(0.035)
Industry FE	Y	Y
Adjusted R^2	0.149	0.513
Observations	837	837