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October 20, 2023

COLLEGE OF THE HOLY CROSS, DEPARTMENT OF ECONOMICS

FACULTY RESEARCH SERIES, PAPER NO. 23-01

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A higher minimum wage promotes workplace safety: Evidence from the restaurant industry

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Abstract

The American workplace is distressingly dangerous, with 5,333 workplace deaths and 2.8 million nonfatal injuries and illnesses in 2019. This paper uses a difference-in-differences methodology to exploit staggered changes in the minimum wage from 1992-2016 to demonstrate that an increase in the minimum wage reduces workplace injuries and deaths in the United States restaurant sector, with an elasticity between -0.73 and -1.45. We limit attention to the restaurant sector because minimum wage workers are strongly overrepresented in that sector. Safety violations in routine inspections decline when the minimum wage is increased. These violations are found in domains where the employer is most responsible (e.g., expired fire extinguisher), which suggests that employer behavior is an important mechanism.

Additionally, it is possible that the exiting restaurants tend to be more dangerous. Previous research shows that the restaurants which are driven out of business by minimum wage hikes were those that were already close to the margin of exit, and firms that are barely staying afloat before the minimum wage hike may be less likely make long-term investments in safety. Finally, we analyze the manufacturing sector as an additional placebo test. The minimum wage rarely binds for workers in the manufacturing sector, so we should expect that there is only a weak relationship between the minimum wage and accident inspections.

This paper ties into a long-standing debate about the wisdom of increasing the minimum wage. Most scholars indicate that raising the minimum wage causes a slight decrease in employment, but there are also papers that find no effect or even a positive effect. The present paper uncovers a new benefit to raising the minimum wage and strengthens the argument that it should be increased even if there is a small detriment to employment.

Keywords: Workplace safety, minimum wage, difference-in-differences, restaurant industry

1. Introduction

The American workplace is distressingly dangerous, with 5,333 workplace deaths and 2.8 million nonfatal injuries and illnesses in 2019 (Bureau of Labor Statistics 2019a and 2019b). Academics, government officials, and private sector actors have been attempting to make the workplace safer with some success. Workplace deaths per 100,000 workers fell steadily from

5.25 in 1992 to a low of 3.25 in 2009 but have edged up slightly since (Bureau of Labor Statistics 2019a).

These risks are not distributed equally. Workers earning low wages or the minimum wage are injured at work at a higher rate (Michaels 2015; Leigh, Leigh, and Du 2019), partly because lower wage jobs are more likely to involve physical labor (Bernstein and Gittleman 2003). With that disparity in mind, this paper considers an underexamined question: what is the effect of minimum wage on workplace safety?

The relationship between the minimum wage and workplace safety is not immediately obvious, and the minimum wage could impact safety through several channels influencing both firms and employees. For example, Aaronson et al. (2018) show that an increased minimum wage leads to entry of new restaurants and exit of older ones,[1] and turnover in restaurants may mechanically improve safety because the new restaurants have new equipment that is less likely to fail and cause injury.

Additionally, it is possible that the exiting restaurants tend to be more dangerous. Luca and Luca (2019) show that the restaurants which are driven out of business by minimum wage hikes were those that were already close to the margin of exit, and firms that are barely staying afloat before the minimum wage hike may be less likely make long-term investments in safety. Additionally, Dustmann et al. (2020) demonstrate that minimum wage increases in Germany cause minimum wage workers to shift from smaller firms to larger ones. A literature summarized by Sørensen, Hasle, and Bach (2007) generally finds that larger firms are safer than smaller ones, meaning minimum wage hikes could promote safety by reallocating workers to larger firms.

An increased minimum wage may also improve safety among existing firms. Employees who are unable to work because of an on-the-job injury qualify for workers' compensation, which replaces approximately two-thirds of lost income. The workers' compensation insurance premiums paid by the smallest firms are not affected by worker claims (Bronchetti and McInerney 2012), but larger firms face experience rating and premiums increase based on the benefits received by workers. In fact, the largest firms are almost perfectly experience rated, so in practice they are nearly self-insured (Krueger 1991). Firms considering whether to make an additional investment in safety may be swayed by the difference between replacing two-thirds of a low minimum wage and two-thirds of a more generous minimum wage.

It is also plausible that the minimum wage reduces injuries by influencing workers. Previous studies have shown that turnover is reduced when the minimum wage is increased (Dube, Lester, and Reich 2016, Brochu and Green 2013; Liu, Hyclak, and Regni 2016; Gittings and Schmutte 2016), and newly hired employees are the most likely to be injured (Breslin and Smith 2006). These two findings suggest that raising the minimum wage would promote workplace safety by increasing the tenure of the average employee.

[1] We thank an anonymous reviewer for suggesting this possibility.

We use injury data from the restaurant industry in a difference-in-difference methodology, exploiting staggered changes in prevailing minimum wages. We follow the literature in focusing on restaurant workers (which includes full service as well as limited service, meaning fast food) because the restaurant sector has by far the largest share of minimum wage workers (e.g., Card and Krueger 1994; Dube, Lester, and Reich 2010). Our primary measure of workplace safety is the number of accident inspections carried out by the Occupational Safety and Health Administration (OSHA), which is required to perform an accident inspection any time that two or more workers are hospitalized or one or more workers are killed in the workplace.

The main finding of the paper is that an increase in the minimum wage leads to a reduction in workplace hospitalization and deaths, with an elasticity of between -0.73 and -1.45, depending on the specification. As a robustness check we also limit attention to only those accident inspections that are triggered by the death of an employee to address possible concerns about endogenous inspections by OSHA. Finally, we consider accident data reported by the Survey of Occupational Injuries and Illnesses (SOII). SOII includes relatively minor injuries and is therefore a more complete dataset, but it is possible that minimum wage influences reporting behavior by workers.

We also take some initial steps to identify the channel through which increased minimum wage promotes workplace safety, and we present evidence that the mechanism acts through the employer. The empirical strategy is analogous to our accident inspection regressions, and we show that the number of safety violations per programmed (routine) inspection goes down when the minimum wage goes up. We attribute this change to the employer rather than employee because the most common kinds of safety violations in restaurants are things like improper electrical work and fire extinguisher violations, which fall under the employer's responsibility.

We analyze the manufacturing sector as an additional placebo test. The minimum wage rarely binds for workers in the manufacturing sector, so we should expect that there is only a weak relationship between the minimum wage and accident inspections. Indeed, that is the case, which provides some confidence that the relationship that we observe for restaurant workers is not driven by some omitted state-wide variable.

The current paper contributes to several branches of the literature. There has been enormous attention paid to the impacts of the minimum wage, especially focusing on its effect on employment.[2] Outside of the study of employment, Hashimoto (1982) and Neumark and Wascher (2001) both find that a higher minimum wage decreases the likelihood of job training. Dow et al. (2020) find that suicides are reduced when the minimum wage is higher, and Agan and Makowsky (2021) show that minimum wage increases cause criminal recidivism to fall. Leigh, Leigh, and Du (2019) provide a literature review article that finds that increases in the minimum wage generally improve workers' mental and physical health.

Researchers have also developed a rich literature on the determinants of workplace safety. One paper discovers that managers' desires to meet or beat earnings forecasts lead to more injuries (Caskey and Ozel 2017), which is consistent with other work that finds that increased overtime

[2] See Manning (2021) for an excellent recent review.

schedules also lead to more injuries (Dembe et al. 2005). Several papers have studied the effect of recessions on workplace safety and have found that the workplace injury incidence rate generally falls during times of recession (Ruhm 2000; Boone and van Ours 2006; Asfaw, Pana-Cryan, and Roger Rosa 2011). As mentioned above, data suggests that new (Breslin and Smith 2006) and temporary (Benavides et al. 2006) workers are more likely to suffer injuries, and Johnson, Schwab, and Koval (2021) show that the public policy exception to employment-at-will reduces workplace accidents and deaths.

There is surprisingly little overlap between the minimum wage literature and the workplace safety literature; as far as we are aware, there are only two other papers that do so. Hradil (2018) finds that an increase in the minimum wage leads to an increase in injuries, which contrasts with our results. Merrill-Francis, Porterk, and Vernick (2020) find a (negative) insignificant relationship between workplace fatalities and minimum wage. Both papers include data from all industries, despite the fact that many industries have close to zero minimum wage earners; we discuss further in the data section why including all industries is likely to generate misleading findings.

The rest of the paper is organized as follows: Section 2 presents some background information and describes the data. Section 3 discusses the empirical strategy and results, and Section 4 concludes.

2. Data

The two main datasets for this project are both provided by the United States Occupational Safety and Health Administration (OSHA). The first records the date of accident inspections, which are automatically triggered if an incident results in two or more hospitalizations or at least one fatality.

The agency also conducts routine inspections which are not triggered by an injury or complaint. These are called programmed inspections, and are performed at a higher rate in industries with a higher track record of injuries.[3] Data for both OSHA datasets are available from 1992 to 2016. The primary advantage of the two OSHA datasets is that the same agency is reporting safety results and the violations rates, which together reveal the prevalence of accidents and uncover some of the behind-the-scenes safety behavior.[4]

A researcher faces tradeoffs when considering what type of injuries to include in the analysis. The OSHA accident inspection data includes only serious accidents; in a robustness check, we perform the analysis restricting attention to those inspections that were triggered by a fatality. Accident inspections are relatively rare, occurring at a rate of approximately 0.004 inspections per thousand workers per year, and including minor injuries has the appeal that the sample sizes will be as large as possible. The most comprehensive dataset including minor injuries is the Survey of Occupational Injuries and Illnesses (SOII) series on all reportable injuries, but data on

[3] Twenty-eight states operate their own OSHA-approved state plan, which are required to be at least as stringent as the federal plan, but there have been no changes in which states operate their own plan.

[4] There are some safety inspections carried out by local government agencies; we focus on OSHA inspections to ensure consistency across states and time.

minor injuries relies on the records of employers, which relies in turn on self-reporting by injured employees.

Employees selectively report injuries (Rappin, Wuellner, and Bonauto 2016), and if the decision to report is systematically related to the independent variable of interest, then reporting decisions creates bias in the estimation of the effect of the minimum wage. If workers are more (less) likely to report injuries to their employer when the minimum wage is high, then using the SOII will lead to a positively (negatively) biased estimate of the causal effect of the minimum wage on injuries. There are plausible reasons to believe that high minimum wage could discourage or encourage the reporting of injuries, and it is not immediately clear which factors would predominate. Being laid off is financially more costly when the minimum wage is high, so an employee may be less likely to report an injury. However, higher minimum wages reduce the frequency of layoffs (Dube, Lester, and Reich 2016), so some employees may feel freer to report an injury. The result is that it is unclear whether results generated from the SOII should be considered as upper bounds, lower bounds, or neither, and so in the main analysis we use the accident inspection data as our main dependent variable. In addition, states are not required to participate in the SOII, and only 26 states have data for every year from 2003 to 2016.

Data on the level of employment in the restaurant industry comes from the Quarterly Census of Employment and Wages published by BLS, and data on the minimum wage is from Vaghul and Zipperer (2016).

From these datasets, we construct the following dependent variables: accident inspection rate in the restaurant industry, measured as accident inspections per thousand restaurant workers, and safety violations per programmed inspection in the restaurant industry. The main independent variable in all cases is the prevailing minimum wage (that is, the higher of the state and federal minimum wages), averaged over the course of a year. The dependent variables are winsorized at the 1st and 99th percentiles of the positive values of the dependent variables to reduce the impact of outliers, and all variables are transformed by a natural log so that regression coefficients should be regarded as elasticities.

One noteworthy feature of the data is that nearly 80 percent of state-year observations contain zero accident inspections, because most injuries in the restaurant sector do not lead to hospitalization or deaths. It would be incorrect to drop all observations with zero accident inspections, so in the main specification we calculate the accident rate as $y = ln(accident\ inspections\ per\ thousand\ employees + min)$, where *min* is the minimum positive value observed in the data for accident inspections per thousand employees. In the appendix we test the sensitivity of the main results to this choice by instead defining the accident rate with the arcsine transformation, the logistic transformation, and the inverse hyperbolic sine transformation. Additionally, we estimate the main regressions with Poisson and negative binomial models in recognition of the count nature of the data.

We focus on restaurant workers (NAICS 722) as our primary treatment group, which includes full-service restaurants, limited-service restaurants (fast food), bars, and catering. This group comprises over half of all minimum wage workers, far more than any other industry. This is a common strategy in the minimum wage literature; Card and Krueger (1994), Dube, Lester, and

Reich (2010), and Dube, Lester, and Reich (2016) also study the restaurant industry for this reason. For comparison, while only 2.1% of all hourly workers were paid federal minimum wage in 2018, the restaurant industry paid the federal minimum wage to 13% of their employees (BLS 2018). The federal law and many states provide for a lower cash minimum wage for tipped workers, but in these cases, it is required that such workers' tips, when added to this lower minimum wage, at least equals the non-tipped minimum wage. If employees do not earn enough tips to meet this amount, then the employer is obligated to pay the difference, so the regular minimum wage still impacts their wages.

The other two papers that consider minimum wage and workplace safety, Hradil (2018) and Merrill-Francis, Porterk, and Vernick (2020), include all industries. This is an important distinction between these two papers and our paper, because some industries employ close to zero minimum wage workers. For example, between 1992 and 2016 only 1.2% of manufacturing workers earned at or below the prevailing minimum wage (authors' calculations based on Merged Outgoing Rotation Groups, National Bureau of Economic Research 2020). Hradil (2018) finds a significant positive relationship workplace injuries and minimum wage within manufacturing, but this is hard to reconcile with the small fraction of workers who earn the minimum wage.

Merrill-Francis, Porterk, and Vernick (2020) do not break out individual industries due to data limitations, and they find a negative but insignificant relationship between minimum wage and workplace fatalities. This result is consistent with a negative relationship in those industries with more minimum wage workers that is mostly washed out by those industries with very few.

Summary statistics for some of the main variables are presented in Table 1. Note that accident and death statistics are displayed as per 1,000 workers for readability, but this does not impact the results because of the log-log specification.

3. Empirical strategy and results

3.1 Accident inspections in restaurants

All of the empirical analysis in this paper relies on difference-in-difference methodology with a yearly panel of state data. The first set of regressions considers the effect of the minimum wage on the rate of accident inspections in the restaurant industry. The simplest form of this regression is:

$$y_{st} = \beta * MW_{st} + \delta_s + \delta_t + \epsilon_{st}$$

where *s* indexes U.S. states, *t* indexes years, y_{st} is the natural log of the rate of accident inspections per 1,000 workers, and MW_{st} is the natural log of the prevailing minimum wage in state *s* at time *t*. State and year fixed effects are captured by δ_s and δ_t. This first regression is presented in Column 1 of Table 2. In all regressions we cluster standard errors by state, which allows for heteroskedasticity and for arbitrary patterns of correlation of error terms within a state (Bertrand, Duflo, and Mullainathan 2004). The identifying assumption is that other states

provide a valid counterfactual for what would have happened in a state absent a change in the minimum wage.

There has been widespread debate, especially in the rich literature on the employment effects of the minimum wage, on whether or how to address state-specific trends and spatial heterogeneity. Some scholars have argued that it is important to address spatial heterogeneity (e.g. Allegretto, Dube, and Reich 2011; Allegretto et al. 2017; Dube, Lester, and Reich 2010; Dube, Lester, and Reich 2016), and one strategy to do so is to include region-year fixed effects for the four U.S. Census geographical regions. For example, the only controls for Mississippi in 2000 would be the other 15 states in the South region, all measured in 2000. Others have argued that including region-year fixed effects discards useful information from other states, leaving the researcher with less reliable results (e.g., Neumark, Salas, and Wascher 2014; Neumark and Wascher 2017). A similar debate surrounds whether it is appropriate to include linear state-specific trends to accommodate the possibility that a state has some trend in the dependent variable that is unrelated to the minimum wage.

Given that the field has not reached a consensus, and because we find compelling arguments on both sides, we take the most conservative approach and report regressions with and without state trends and region-year fixed effects. Columns 2 and 4 include state-specific linear trends, and Columns 3 and 4 include region-year fixed effects.

Table 2 presents the results of these regressions. The coefficient on natural log of minimum wage is significant at between the one and the ten percent level in the four specifications, with a coefficient ranging from -0.73 to -1.45, and because all variables are logged, these coefficients can be interpreted as elasticities. Collectively these results provide evidence for our main argument: an increased minimum wage promotes workplace safety.

3.2 Event study

One threat to identification for any difference-in-difference paper is that adoption of the policy (in this case, increased minimum wage) is endogenous, where an omitted variable is driving the correlation between increased minimum wage and reduced accident rates. For example, suppose that the composition of minimum wage workers becomes more highly educated in a state. They may be safer at work, and also more likely to lobby successfully for a minimum wage change, so regressing contemporary injury rates on contemporary minimum wage would show a negative correlation even if the latter did not causally influence the former. An event study would highlight the problem by showing a negative coefficient on lead(s) of minimum wage.

An event study has become a standard tool for addressing timing in a difference-in-difference framework (Freyaldenhoven, Hansen, and Shapiro 2019; Sun and Abraham 2020). It provides for a test of pre-trends as well as allowing the researcher to determine whether the change in policy affects outcomes all at once, with a lag, or gradually over time. Cengiz et al. (2019) pioneered a method to apply the event study methodology to the minimum wage, and we follow their approach and convert the minimum wage data to a binary variable by considering whether the state's prevailing minimum wage increased in a particular year (because of a federal or state increase), without regard to the size of the increase. We consider a minimum wage that went into

effect in the second half of year *t* to occur in year *t* +1 because the increase would affect less than half of year *t*. A list of increases in the prevailing minimum wage can be found in Appendix Table A5.

To implement this approach, we estimate

$$y_{s,t} = \sum_{\tau=-5}^{5} \beta_\tau * I_{s,t-\tau} + \delta_s + \delta_r + \delta_L + \epsilon_{s,t}$$

where $y_{s,t}$ is the natural log of the rate of accident inspections per 1,000 workers, $I_{s,t-\tau}$ is an indicator variable that the minimum wage was increased in state s in year $t - \tau$, δ_s is a state fixed effect, δ_r is a region-year fixed effect, δ_L is a linear state trend. We omit the term with τ = -1 to normalize relative to the period just before treatment (Sun and Abraham 2020) and plot the values of β_τ. The regression includes indicators for minimum wage increases that occur six or more years in the past or present, and these coefficients are not plotted.

Figure 1 shows that the coefficients before a minimum wage treatment are small, which gives some confidence that there are not important pre-trends that threaten identification. The coefficient corresponding to the period of treatment is close to zero, while those after the minimum wage increase are larger and negative. This suggests that there is a short lag between when the minimum wage is increased and when accidents decrease. This delay could be attributed to a variety of factors, such as a lag between when the minimum wage increases and when less safe businesses are driven out of business.

3.3 Safety violations in programmed inspections

Next we turn to safety violations in restaurants, which provides evidence that increased minimum wage causes employers to provide a safer work environment.[5]

The next set of regressions follows the same pattern of fixed effects and state trends, and the dependent variable is the natural log of the number of safety violations per programmed (routine) inspection. These regressions allow us to see the impact of a change of minimum wage on the number of safety violations found per programmed inspection. The most common safety violations relate to matters primarily under the control of employers, like unsafe wiring and expired fire extinguishers, which means that observing the change in the number of safety violations gives us insight into firm behavior. OSHA data are less complete for violations, so sample sizes are reduced compared to previous regressions.

Results are presented in Table 3, and in all four specifications there is a negative relationship between violations and minimum wage, significant at at least the ten percent level. The magnitude varies widely, from -1.72 to -4.82, so we interpret these results as evidence that

[5] Shannon, Mayr, and Haynes (1997) show that a safer work environment significantly reduces accident rates.

minimum wage impacts firm behavior, but we are hesitant to draw conclusions about the size of the effect.

Note that the rate of programmed inspections is strongly positively correlated with the number of safety violations per programmed inspection. The most intuitive explanation is the OSHA state offices that are active enough to carry out a high number of programmed inspections are also able to cite employers for a long list of safety violations once they arrive.

What is the economic importance of the relationship between minimum wage and the number of safety violations? First, we should feel more confident that an increased minimum wage really does improve safety because we can see evidence that employers are improving safety conditions. Second, it provides some indirect evidence of a mechanism. Employers boost their investments in safety as a response to increases in the minimum wage, which is observed as a reduction in safety violations that are primarily under the control of employers. This is entirely consistent with the explanation that an increase in the minimum wage drives reduced workplace accidents by changing the characteristics of restaurants or by increasing the cost to the employer of an injury and incentivizing more investments in safety.

On the other hand, these results are not consistent with an explanation based entirely on the reduction in turnover that is caused by an increased minimum wage. If the primary difference between a low- and high-minimum wage regime is that there are more new employees in the former, why would we see more unsafe wiring or expired fire extinguishers when the minimum wage is low?

3.4 Placebo test: manufacturing

One threat to identification is that there is some unobserved state-wide variable that is driving the relationship between safety and the minimum wage. For example, suppose that increased drug or alcohol use leads to increased accidents and also reduces the likelihood of minimum wage increases (perhaps because of a perception that increased wages would be wasted). Then we would see a spurious negative relationship between minimum wage and accidents the restaurant sector. However, we would also see the same relationship even in an industry that employed very few minimum wage workers, which would be an indication of an important omitted variable.

We consider the manufacturing sector as a placebo test, because very few workers in the manufacturing sector are paid minimum wage. Between 1992 and 2016 only 1.2% of manufacturing workers earned at or below the prevailing minimum wage (authors' calculations based on Merged Outgoing Rotation Groups, National Bureau of Economic Research 2020). Therefore we should expect a very weak relationship between the minimum wage and the accident inspection rate in the manufacturing sector. If there is a significant negative relationship in the manufacturing sector then we would take that as evidence that the negative relationship in the restaurant industry is spurious.

Table 4 reproduces Table 2 but includes both sectors so that we can consider the effect of the minimum wage on both. The coefficients on the minimum wage in the manufacturing sector are insignificant and positive, and we verify via an F-test that coefficient on the restaurant sector is

more negative at the one or five percent significance level with all four combinations of fixed effects and linear state trend. The lack of any negative relationship in the manufacturing sector provides additional reassurance that the results for the restaurant sector are not driven by some omitted state-level variable.

3.5 Sensitivity analysis

In this section we present the following tests of robustness of the main result. First, we estimate a Poisson model instead of ordinary least squares. Second, we add controls for political party of governor and the state unemployment rate. Third, we use the SOII dataset discussed above, which includes a much broader set of injuries compared to the OSHA accident inspection dataset. Finally, we consider a subset of OSHA accident inspections, focusing only on those inspections which are triggered by the death of an employee.

In the appendix we consider three alternate ways to transform the dependent variable and avoid the problem of taking a logarithm of zero, and estimate a negative binomial model.[6]

3.5.1 Estimating a Poisson model

Data on accident inspections and fatalities are count data, so we estimate a Poisson model in addition to the ordinary least squares models above, and these results are shown in Table 5. Employment is included as an exposure variable. The table includes the same four fixed effects specifications as above, and presents data on both accident inspections and fatalities for a total of eight columns. The coefficient on the natural log of minimum wage is slightly positive and not significant in column 1, but has the expected negative sign in the other seven specifications and is significant at least the 10 percent level (and significant at the 1 percent level in four specifications). The magnitude is large compared to the OLS models, as high as -6.02 in Column 7, but the overall results are consistent with the main results.

3.5.2 Controlling for macroeconomic conditions and political party

In Table 6 we modify Table 2 by adding a dummy variable for Democratic control of the governorship as a proxy for the political environment. If Democrats pursue other policies that promote safety, such as more vigorously enforcing existing safety regulations, then we would observe a spurious positive correlation between minimum wage and workplace safety if we do not control for the party in power. We also control for the state unemployment rate as a measure of the macroeconomic conditions.[7] Results are broadly similar to the main results, with coefficients ranging from -0.72 to -1.40 and significant at at least the 10 percent level in three of the four fixed effects specifications.

3.5.3 Alternate injuries dataset: SOII

[6] As an additional unreported robustness check, we also drop states one by one, and the main results are not materially affected.

[7] Boone et al. (2011) find that recessions harm workplace safety.

There are relatively few injuries that are severe enough to prompt an accident inspection by OSHA, while SOII is more comprehensive. The disadvantage of the SOII is that the employee, and to some extent the employer as well, have discretion about whether or not to report an injury. This may lead to underreporting or overreporting of injuries when the minimum wage is high, and it is not clear how to determine the direction of bias. Table 7 presents the same regressions as Table 2, but in place of OSHA accident inspections as the dependent variable, it uses the SOII series on all reportable injuries from 2003 to 2016.

The coefficient in every specification is negative, but not statistically significant. One possible reason for this is that the sample size is relatively small: reporting data is voluntary for states, and only 26 states have data for every year from 2003 to 2016. Although these regressions do not provide strong evidence in support of the claim that higher minimum wage promotes safety, they are consistent with that claim.

3.5.4 Robustness check: OSHA accident inspections with fatalities

OSHA policy is that state OSHA offices are required to record an accident inspection if and only if an accident causes two or more hospitalizations or one or more fatality, but it is possible that some offices do not precisely follow the record-keeping guidelines. If inspectors exercise that discretion in some way that is correlated with the minimum wage then our estimates could be biased, so in order to test for that possibility, we restrict attention in this robustness check to only those accidents that caused a fatality. The likelihood that OSHA would fail to learn about a fatality is low, so these data are more likely to be complete. The regressions are presented in Table 8.

The results are broadly similar to those that include non-fatal accidents, which are in Table 2. There is somewhat more variability in magnitude and significance relative to the more inclusive injury inspection data, with coefficients ranging from -0.98 to -1.81. This increased variation between the specifications may be driven by the small number of fatal accidents in the restaurant sector; the largest number in a state-year is only four. Still these results provide some reassurance that the endogenous inspection choices are not driving results in the accident inspection regressions.

3.3.5 Alternate transformations of the independent variable

In the main specification we define the accident rate as $y = ln(accident\ inspections\ per\ thousand\ employees) + min$), where *min* is the minimum positive value observed in the data for accident inspections per thousand employees. We test the sensitivity of the main results to this choice in the appendix by instead defining the accident rate with the following alternatives: the arcsine transformation of $y = arcsine\ ((accident\ inspections\ per\ thousand)^{1/2})$; the logistic transformation of $y = ln((accident\ inspections\ per\ thousand+min)/(1-accident\ inspections\ per\ thousand+min))$; and the inverse hyperbolic sine transformation, $y = ln(accident\ inspections\ per\ thousand + (accident\ inspections\ per\ thousand + 1)^{1/2})$. In all cases results are directionally the same.

4. Conclusion

This paper uses a difference-in-differences approach to demonstrate that increases in the minimum wage improve workplace safety. The main analysis uses the restaurant industry because that is where the largest group of minimum wage workers is employed, and we find that the elasticity of serious injuries as measured by OSHA accident inspections with respect to the minimum wage is between -0.73 and -1.45, depending on the specification.

Changes in firm behavior or firm characteristics are a likely channel for how the minimum wage improves workplace safety. OSHA reports the number of safety violations per programmed (routine) inspection, and we find that the of elasticity of violations per inspection and the minimum wage is between -1.72 and -4.82. These violations overwhelmingly stem from firm behavior (e.g., faulty electrical work) which suggests that firm behavior or firm characteristics (as opposed to worker behavior or worker characteristics) are responsible for at least some of the relationship between minimum wage and workplace safety.

There are several different explanations for how firm behavior or firm characteristics act as the mechanism of interest, and we do not attempt to disentangle them. Aaronson et al. (2018) show that an increased minimum wage induces both entry and exit of restaurants. These new restaurants are likely to have new equipment, reducing the likelihood of (for example) a malfunctioning fryer injuring employees. Also, Dustmann et al. (2020) show that minimum wage hikes in Germany cause minimum wage workers to move from small restaurants to larger ones. Sørensen, Hasle, and Bach (2007) summarize a rich literature showing that larger firms are generally safer than smaller ones, so this shift may be responsible for the improved safety that is observed after a minimum wage increase.

As a placebo test we conduct the same analysis in the manufacturing industry, where there are almost no minimum wage workers. We do in fact find that the relationship between minimum wage and safety is slightly positive and close to zero in the manufacturing sector, which is a useful placebo test to rule out a state-wide omitted variable.

Scholars have recently begun to expand the range of outcomes when considering the effects of a change in the minimum wage, and the present paper builds upon that progress. Examining all possible effects of a change in minimum wage allows researchers and policy-makers to gain a fuller understanding of whether changing the minimum wage is desirable. In particular, ignoring the improvements in physical safety would cause an overly pessimistic assessment of an increase to the minimum wage.

5. Acknowledgements

We thank Laura Argys, Robert Schwab, Carly Urban, and participants of the College of the Holy Cross Research Seminar, Eastern Economics Association Conference, the Liberal Arts College Labor and Public Economics Conference, and the Western Economics Association International Conference.

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7 Tables and Figures

Table 1: Summary statistics

	mean	sd
Prevailing MW (nominal)	4.784	1.799
Prevailing MW (real)	5.615	0.730
Accident Inspection Rate per 1000 workers: Restaurants	0.004	0.007
Violations per Programmed Inspection: Restaurants	2.435	2.193
Fatality Rate per 1000 workers: Restaurants	0.002	0.003
Accident Inspection Rate per 1000 workers: Manufacturing	0.064	0.094

Please see text for sources.

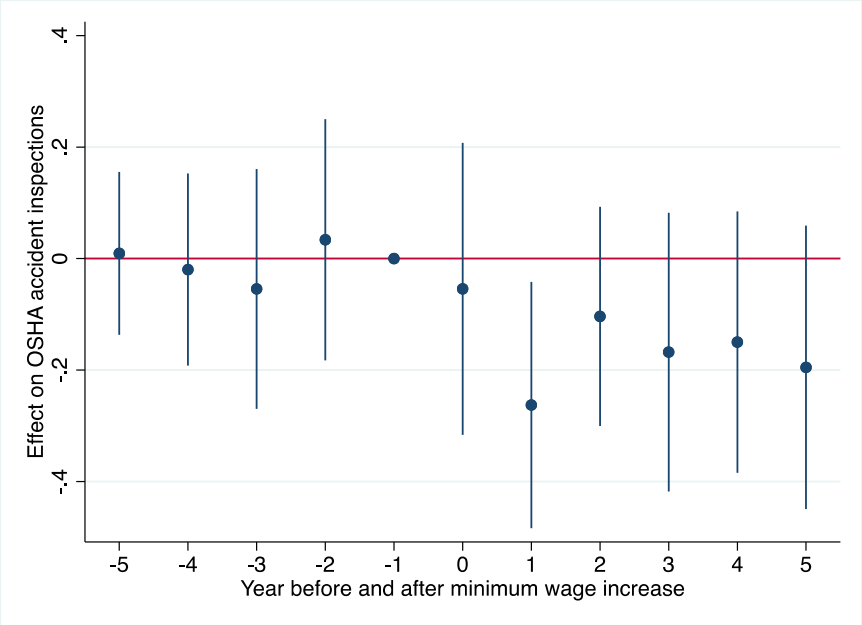
Table 2: Rate of accident inspections in restaurant sector

	(1)	(2)	(3)	(4)
Ln of minimum wage	-1.074**	-0.729*	-1.448***	-1.141**
	(0.500)	(0.401)	(0.485)	(0.565)
Observations	1223	1223	1223	1223
State trend		Y		Y
Region-year FE			Y	Y

The dependent variable is the natural log of the number of accident inspections per thousand employees in the restaurant sector. All specifications include state fixed effects. Specifications without region-year fixed effects include year fixed effects instead. Standard errors are robust and clustered at the state level.

Note: * p < .1 ** p < .05 *** p < .01.

Figure 1: Timing: Workplace Injuries and Increases to the Minimum Wage



The plot shows the effect of a minimum wage increase on workplace safety before and after the increase. Please see text for details. Vertical bars show 95 percent confidence intervals.

Table 3: Violations per programmed inspection in restaurant sector

	(1)	(2)	(3)	(4)
Ln of minimum wage	-1.722*	-2.671*	-3.760**	-4.822***
	(0.859)	(1.333)	(1.408)	(1.657)
Prog. insp. rate	0.358***	0.311**	0.363***	0.327***
	(0.095)	(0.122)	(0.075)	(0.096)
Observations	518	518	518	518
State trend		Y		Y
Region-year FE			Y	Y

The dependent variable is the log of the number of safety violations per programmed inspection in the restaurant sector. All columns include state fixed effects. Columns without region-year fixed effects include year fixed effects instead. Standard errors are robust and clustered at the state level.

Note: * p < .1 ** p < .05 *** p < .01.

Table 4: Rate of accident inspections in manufacturing and restaurant sectors

	(1)	(2)	(3)	(4)
Ln of min. wage – restaurants	-1.074**	-1.433***	-1.448***	-1.524**
	(0.500)	(0.455)	(0.485)	(0.592)
Ln of min. wage – manufacturing	0.736	0.294	0.396	0.274
	(0.768)	(0.467)	(0.565)	(0.575)
Observations	2444	2444	2444	2444
State trend		Y		Y
Sector-region-year FE			Y	Y
F-test p-value	.0095	.0101	.0143	.0283

The dependent variable is the natural log of the number of accident inspections per thousand employees, with both the manufacturing sector and restaurant sector included. The F-test analyzes whether the coefficients on minimum wage for manufacturing and restaurants. All specifications include state fixed effects. Specifications without region-year fixed effects include year fixed effects instead. Standard errors are robust and clustered at the state level.

Note: * p < .1 ** p < .05 *** p < .01.

Table 5: Rate of accident inspections and fatalities in the restaurant sector: Poisson model

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Ln of minimum wage	0.272	-2.421***	-3.667**	-3.715**	-3.642***	-4.077***	-6.024***	-5.336*
	(1.188)	(0.931)	(1.616)	(1.784)	(1.002)	(1.572)	(2.144)	(3.057)
Observations	1223	1223	1223	1223	1223	1223	1223	1223
State trend		Y		Y		Y		Y
Region-year FE			Y	Y			Y	Y
Dep. variable	Accidents	Accidents	Accidents	Accidents	Fatalities	Fatalities	Fatalities	Fatalities
Model	Poisson	Poisson	Poisson	Poisson	Poisson	Poisson	Poisson	Poisson

This table is identical to Tables 2 and 8 except that it uses a Poisson model instead of OLS. Please see text for details.

Note: * p < .1 ** p < .05 *** p < .01.

Table 6: Adding controls to the main specification

	(1)	(2)	(3)	(4)
Ln of minimum wage	-1.062**	-0.721	-1.402***	-1.136*
	(0.476)	(0.455)	(0.500)	(0.583)
Unemployment rate	-0.002	0.000	0.008	0.006
	(0.062)	(0.042)	(0.063)	(0.046)
Democratic governor	-0.012	-0.027	-0.025	-0.077
	(0.088)	(0.083)	(0.079)	(0.071)
Prog. insp. rate	-0.004	-0.024	-0.016	-0.036
	(0.026)	(0.026)	(0.025)	(0.027)
Observations	1223	1223	1223	1223
State trend		Y		Y
Region-year FE			Y	Y

This table is identical to Table 2 except that it adds controls for state unemployment rate, a dummy for democratic governor, and the programmed inspection rate. Please see text for details.

Note: * p < .1 ** p < .05 *** p < .01.

Table 7: Rate of injuries and fatalities in the restaurant sector - SOII

	(1)	(2)	(3)	(4)
Ln of minimum wage	-0.185	-0.172	-0.099	-0.143
	(0.127)	(0.166)	(0.145)	(0.160)
Observations	546	546	546	546
State trend		Y		Y
Region-year FE			Y	Y

The dependent variable is the natural log of the number of injuries and illnesses per thousand employees in the restaurant sector, measured by SOII's series covering all reportable injuries. All specifications include state fixed effects. Specifications without region-year fixed effects include year fixed effects instead. Standard errors are robust and clustered at the state level.

Note: * p < .1 ** p < .05 *** p < .01.

Table 8: Rate of fatal accidents in restaurant sector

	(1)	(2)	(3)	(4)
Ln of minimum wage	-1.698***	-0.983*	-1.812***	-1.074*
	(0.425)	(0.543)	(0.427)	(0.605)
Observations	1223	1223	1223	1223
State trend		Y		Y
Region-year FE			Y	Y

The dependent variable is the natural log of the number of inspections triggered by a fatality per thousand employees in the restaurant sector. All specifications include state fixed effects. Specifications without region-year fixed effects include year fixed effects instead. Standard errors are robust and clustered at the state level.

Note: * p < .1 ** p < .05 *** p < .01.