The Wages of Irregular Tasks: Workers' Compensation Benefits and Occupational Misclassification

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Abstract

As workers' compensation insurance costs increase, firms have incentive to misclassify employees under ostensibly safer job classifications to lower premiums. Using Occupational Safety and Health Agency (OSHA) accident investigations, we measure employee risk of fatality while performing tasks reported to investigators as outside of employee duties. We show that when workers' compensation insurance costs are increased by legislated changes to mandatory benefits, employees are paid higher wage premiums for bearing risk of fatality during these "irregular tasks". Our results offer evidence of widespread evasion of insurance costs through occupational misclassification and advise caution when assuming a consistent relationship between title and tasks.

JEL Codes: J32, J17, J18, J28

Key Words: Workers' Compensation; Compensating wage differentials; misclassification; irregular tasks; OSHA

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1 Introduction

Insight into a worker's wages begins with knowing their job. Researchers rarely have any choice but to take occupational codes in their data at face value and assume they correspond with the tasks undertaken by employees. Recent work has added granularity to our understanding of occupations, better identifying and measuring wage compensation for specific job tasks and skills (Acemoglu & Autor, 2011; Autor & Handel, 2013; Cortes, Jaimovich, & Siu, 2021; David, 2013; Deming, 2017; Guvenen, Kuruscu, Tanaka, & Wiczer, 2020; Stinebrickner, Stinebrickner, & Sullivan, 2019). What has not previously been considered, however, are contexts where formal occupational title may purposely misdirect observers from the actual tasks being undertaken.

In this paper we consider mandatory workers' compensation benefits and the incentives they can create for firms to misclassify employees, assigning them occupational titles that will obscure the physical risk of their job tasks and, in turn, lower employer insurance premiums. If cost-reducing misclassification is both successful and represented within the recorded data, then correspondence between title and tasks would be endogenous to state laws that mandate workers' compensation benefits. In this context, misclassification is no longer just a source of measurement error (Sullivan, 2009), but of systematic bias in our understanding of the allocation of labor and the compensating wage differentials received for risk. For workers' compensation and other similar labor regulations, systematic misclassification would represent a mechanism directly undermining policy goals.

We test our hypothesis that firms are motivated to reduce costs from workers' compensation insurance premiums by misclassifying employees using records from Occupational Safety and Health Agency (OSHA) accident investigations. OSHA investigated 35,104 male fatal accidents between 1990 to 2009, 15% of which were reported to investigators as having occurred while the victim was performing a task that should not have been a part of their regularly assigned duties. These fatal accidents are recorded as happening during an "irregular" job task. To test our hypothesis requires variation in insurance costs that is exogenous to the physical risk of job tasks demanded by firms. Using a decomposition of the underlying sources of year-to-year changes in state insurance premiums we are able to separately measure the changes in the costs faced by firms attributable to benefit mandate legislation. Combined with measurements of risk created using OSHA investigation records, we are able to estimate the compensating wage differentials paid for irregular tasks, and identify the relationship between those differentials with the insurance costs faced by employers.

As would be expected, we find wages consistently increase with regular task risk, and that those wage differentials have no significant relationship with insurance costs. In stark contrast, we only observe positive wage differentials for *irregular* task risk where employers must pay comparatively high insurance premiums, and that these differentials increase hand-in-hand with insurance costs. The average worker in our sample earns between $47 and $53 a year as compensation for job task risk. While the majority receive no significant compensation for irregular task risk, employees in the the 20% of state-years with the highest insurance costs from mandated workers' compensation benefits earn in excess of $100 per year for risk of suffering a fatal accident while performing tasks that should not be expected of them under their formal occupational title. Wages of US-born Mexican workers are especially sensitive to irregular task risk, receiving between 2- and 4-times the annual irregular task compensation as US-born non-Latino[1] workers.

Proving that elements within data are a product of purposeful misdirection or fraud will always present a challenge, particularly when there is little choice but to use the data in question (Duggan & Levitt, 2002; Jacob & Levitt, 2003; Luh, 2019). We hypothesize that evasion of insurance costs is motivating employee occupational misclassification based on observable patterns within the data and hedonic wage model estimates. When workers' compensation insurance is costlier, the composition of formal job titles reflects ostensibly safer jobs while a larger share of fatal accidents occur when the victim is performing a task outside of their occupational duties. Risk during these "unexpected" duties is being compensated, and at a rate *at least* as high as expected task risk. Workers are getting paid for the tasks they perform and the risk they bear, just not while holding the jobs we think they have.

2 Workers' Compensation and Employer Insurance

Workers' compensation provides employees with coverage of medical expenses and reimbursement of lost wages in the event of a work-related injury or illness. In 2017 it covered 87% of jobs and nearly $8 trillion in wages, paying out $62 billion in benefits, half of which was received as a cash benefit (Weiss, Murphy, & Boden, 2017).[2] Regulated through a network of independent state programs, employers are required to carry insurance to cover their potential liabilities for medical expenses and lost wages. This compensation serves as a key component of the US social safety coverage provided through independent state programs.

[1] Given that our analysis exclusively focuses on the wages of male workers, we will use the traditionally gendered "Latino", rather than the gender-neutral "Latinx", throughout the paper.

[2] For excellent histories of the origins of workers' compensation insurance, see Kantor and Fishback (1996) and Fishback and Kantor (1998).

Employer costs for workers' compensation exceeded $97 billion in 2017, primarily in the form of insurance premiums. These costs vary greatly by occupation and industry. Within logging firms workers' compensation costs are roughly $40 per $100 of wages, compared with banking, where the rate is $1 per $100 of wages (Weiss et al., 2017). While this a purposefully extreme comparison, it is clear that a firm that manages to classify a handful of their loggers as drivers or other support personnel would stand to enjoy considerable cost savings on insurance premiums. Providing as it so often does its own singular example, Texas remains the only state that does not require employers to carry no-fault insurance. In doing so, Texas also illustrates the incentives facing employers everywhere: Jinks, Kniesner, Leeth, and Sasso (2020) found that Texas firms that opted out of carrying workers' compensation insurance reduced their workplace injury-related costs by 46%.[3]

2.1 Insurance premiums depend on mandated benefits

Employers pay for workers' compensation by purchasing insurance from a private-carrier or state insurance fund, or by self-insuring.[4] Four states offer exclusive state insurance funds from which all employers are required to purchased insurance. Seventeen states offer competitive state insurance funds as an alternative to private insurance. Insurance premiums are calculated using the procedures put in place by the National Council of Compensation Insurance (NCCI). The NCCI sets a rate for each classification reflecting the average risk expected for employees within the subset similar firms. A premium is then calculated for the firm based on its employee payroll. Small firms will simply pay "manual payroll" premiums, accounting for more than 80% of firms, but less than 20% of employment. For these firms, premiums will be largely a function of their industry and the occupational classifications of their employees. Firms sufficiently large, such that they exceed a specified threshold, are "experience rated." In such cases, premiums reflect the firm's own history, adjusting for losses accounted for in claims made by employees of the firm from the previous three years (Ruser 1985). For these larger firms, experience rating can be expected to eventually limit the long-run gains from misclassification. The possibility for reduced premiums via misclassifica-

[3] According to the Texas Workforce Commission, firms in Texas may opt-out of the workers' compensation system, but this leaves them responsible for total costs borne by employees injured on the job. It also leaves them especially vulnerable to personal injury lawsuits, where claims of "assumption of the risk"; contributory negligence; and co-worker negligence are not allowed as legal defenses for employers who do not subscribe to workers' compensation coverage. See https://www.twc.texas.gov/news/efte/workers_compensation.html for more information.

[4] "Self-insuring" here means that the employer assumes the financial risk of providing workers' compensation benefits to its employees. Roughly 6,000 firms choose to self-insure in the United States according to The Self Insurance Institute of America https://www.siia.org/i4a/pages/Index.cfm?pageID=4547 (site accessed 4/20/21)

tion, however, will remain until their rates are increased by one or more fatal accidents[5] or an auditor-initiated classification adjustment. Both remain relatively low-frequency events, leaving ample opportunity for short- and medium-run gains.

While insurance requirements are fairly uniform and all state laws require nearly 100% coverage of medical expenses, there is in any given year considerable variation in the cash benefits mandated. For example, in our analytic sample the ceiling on weekly cash payouts for temporary total disability varies between $259 and $1,390 (mean=$680.09, sd = $214.39, 2009 dollars). Cash disability benefits are paid to workers either unable to work while they recover from injury or those who have sustained a permanent, and at least partially disabling, injury. The preponderance of variation is found in the percentage of the injured worker's wages payable, the maximum duration of payments, and minimum and maximum weekly benefit amounts.

Differences in benefits, both between and within states over time, lead to differences in the premiums employers must pay to the insurers underwriting their workers' compensation liabilities. In a simple model where compensation includes a bundle of wages and insurance, and labor markets are regulated to include minimum amounts of insurance, we expect the dollar wages within employee compensation bundles to decline relative to the unregulated equilibrium prediction (Arnould & Nichols, 1983; Moore & Viscusi, 2014; Viscusi & Moore, 1987). A potential unintended consequence of higher mandated benefits is the opportunity for workers and firms to benefit from evading regulated coverage. If a worker is willing to perform higher-risk job tasks while carrying the job title—and reduced workers' compensation benefits—of an ostensibly lower-risk occupational classification, they can negotiate a higher wage while the firm enjoys a smaller insurance premium.[6]

In the event of an accident, an employee can collect temporary total disability until their treating doctor clears them to return to work, where clearance will depend on the physical demands of the occupation. Hence, if the employee has been misclassified as an occupation with lesser physical demands and risk, their window for receiving temporary total disability payments may be shortened. Most importantly, any cash compensation made "under the table" (to allow the employer to escape higher premiums) will not be recognized when calculating cash benefits.[7] There is evidence that the

[5]Non-fatal accidents could similarly change experience ratings, but are far more likely to go unobserved than fatal accidents.

[6]An Employer "knowingly misrepresenting an employee's job classification to obtain insurance at less than a proper rate" is a class A misdemeanor and is punishable by a fine of up to $10,000. (Missouri Division of Workers' Compensation `https://elara.com/wp-content/uploads/2020/10/Missouri-WC-Posting-2020-2-English.pdf`).

[7]If the worker is misclassified as any form of independent contractor, they will not be able to file a workers' compensation claim. OSHA investigation records do not include the contract status (i.e., employed or independent), forcing us to be agnostic about contractor misclassification rates.

rate of injuries which merit a compensation claim exceeds the rate of claims filed (Glazner et al., 1998; Leigh, Marcin, & Miller, 2004; Probst, Brubaker, & Barsotti, 2008). A workers' compensation claim made by a worker in an ostensibly safe job may also alert the insuring company and prompt an occupation classification audit that would jeopardize not only the standing of the firm, but also whether any additional wage premium captured by the worker remains tenable.

3 A Simple Theory of Occupational Misclassification

Firms employing workers in dangerous occupations will wish to compensate their employees in the most cost effective means possible. This entails offering the cost-minimizing combination of wages and insurance in the bundle of compensation. If the market is forced to clear with a single, uniform amount of insurance for employees in risky occupations and workers are heterogeneous in their preferences for insurance, then some employees may prefer to be misclassified under "safe" occupational titles in return for higher wages, shifting the balance from insurance to wages in their compensation bundle. If this misclassification reduces insurance premiums paid by a firm more than it increases the wage, then firms will minimize costs with some non-zero number of misclassified employees.

Consider a single, cost-minimizing firm that acts as a price taker in the labor market and for which labor is the only input. Workers are compensated with a bundle of wages, W, and insurance, $I = [0, 1]$, where worker wages are completely insured against occupational injury if $I = 1$, and worker utility, $U(W, I)$, is continuous and quasiconcave in both arguments. The firm faces costs from wages and insurance premiums, P, that monotonically increase with insurance, such that $C = P(I) + W(I)$. The wage in the market clearing compensation bundle is always decreasing with amount of insurance. The firm is left to minimize $C[V(I)]$, where $V(I)$ is the workers indirect utility from the amount of insurance offered in the equilibrium compensation bundle. In this manner, the equilibrium indirect utility is exogenous to the firm and serves as the constraint on its cost minimization exercise. This minimization yields

$$\frac{\partial C[V(I)]}{\partial I} = \frac{\partial P}{\partial I} + \frac{\partial W}{\partial I} \tag{1}$$

which set equal to zero leads to the first order condition:

$$\frac{\partial P}{\partial I} = -\frac{\partial W}{\partial I} \tag{2}$$

Workers may contract with firms to perform jobs within a spectrum of risk, $j = j^S ... j^R$, bounded by a "safe" (i.e., minimal risk) job and the high risk job, paying wages W_S and W_R, respectively. The wage for a high-risk job $W_R = W_S$ if compensation includes complete insurance ($I = 1$). The premiums paid by firms if $I = 1$ are equivalent to the compensating wage differentials that workers would receive for the high-risk job without insurance:

$$W_R \mid_{(I=0)} - W_S = P \mid_{(I=1)}, \tag{3}$$

Henceforth referring to Figure 1, the firm will compensate workers in the high risk job with $\{W_R^*, I^*\}$ in the unregulated equilibrium. If a minimum insurance floor, $\overline{I}$, is introduced, then there exist a range of cost reducing wage and insurance combinations between $\overline{I}$ and $\underline{I}$, such that $C[V(\overline{I})] = C[V(\underline{I})]$. The shaded area in Figure 1 represents all of the cost-reducing combinations of wages and insurance available to firms who do not comply with minimum insurance requirements. Firms can offer a cost-reducing compensation bundle, where $\{W_R^m(I < \overline{I}), I^m < \overline{I}\}$, by misclassifying the employee under any job title that incurs a lower minimum insurance requirement, but in doing so will incur misclassification costs m, where m includes potential fines from regulatory auditors and administrative costs. If $m = 0$, firms will misclassify high risk workers under any occupation that incurs a minimum insurance floor equal to I^*. If the costs of misclassification $m < C[V(\overline{I})] - C[V(I^*)]$, some non-zero portion of workers will be misclassified.[8]

Firms will negotiate with some fraction of workers the compensation bundle $\{W_R^m, I^m\}$, where $W_R^m > W_R^*$ and $\underline{I} < I^m < \overline{I}$. This cost minimizing subset will consist of the workers, and, in turn firms, for whom incomplete insurance generates the least cost. Making no additional assumptions beyond heterogeneous worker costs of risk exposure, our model offers the following hypothesis:

Hypothesis: Given a binding insurance floor $\overline{I} > I^*$, firms will misclassify some subset of workers if $m < C[V(\overline{I})] - C[V(I^*)]$

This is a partial equilibrium model, and does not include potential general equilibrium behavior. Perhaps most importantly, it does not allow for investments in safety that firms are likely to make in response to higher insurance premiums. As these insurance floors increase, the future stream of higher premiums increase the cost of each accident incurred, and subsequently increase in experience ratings, giving the firm incentive to invest in worker safety (Moore & Viscusi, 1989). Within the

[8] If the costs of misclassification $m \geq C[V(\overline{I}) - C[V(I^*)$, firms will not misclassify any employees.

model we assume consistent worker preferences for safety, an assumption that is admittedly tenuous given the observed behavioral asymmetries in what workers are willing to pay for greater safety versus their willingness to accept for less safety (Horowitz & McConnell, 2002).

The incidence of mandatory workers' compensation benefits is shared by both employers and employees (Danzon & Harrington, 2001; Krueger & Burton Jr, 1989), with the greater portion falling on the wages of employees (Gruber & Krueger, 1991; Meng & Smith, 1999). Our model makes no prediction regarding the *quantity* of regular and irregular task accidents, nor who receives the greater benefit from misclassification. We posit only that the incentive to misclassify employee occupations will change the wages paid for workers, and that these changes in wages will manifest as compensation for job tasks outside of the domain of their formal occupational classification. The shared incidence of mandatory benefits and, in turn, shared benefits to misclassification, lends itself to the possibility of mutual participation in occupational misclassification. Mutual participation in benefits should ease coordination between parties, lowering the costs of misclassification, m, and increasing the subset of workers for whom misclassification will lead to a net reduction in costs.

4 Data Assembly and Empirical Strategy

To test our model and analyze the compensating wage differentials for risk exposure received by misclassified employees, we use the sample of employed males from the Current Population Survey (CPS) outgoing rotation groups and merged them with measures of employee task risk we created using records from OSHA audits of fatal accidents. Individual audit record details of the context surrounding each accident allow the separate measurement of fatal accident risk based on the relationship of job tasks to an employee's formal occupational duties. We combined the sample with records of workers compensation insurance premiums by state and year. By compiling annual reports from the National Council of Compensation Insurance (NCCI) and National Association of Social Insurance (NASI), we are able to decompose insurance premiums, including the separate measure of costs directly attributable to legislated changes in mandated benefits. Within our final analytic sample we estimate a within-state difference-in-difference hedonic wage model, identifying the effect of exogenous increases in workers' compensation insurance premiums on the elasticity of wages to risk while performing task outside of a worker's formal occupation. A more detailed discussion and mapping of the linkages in the data is provided in Appendix A. What follows in the rest of this section is detailed explanation of each key component of our analysis, how the associated data was constructed, and how it contributes toward our causal identification strategy.

4.1 Regular and Irregular Task Risk

To create our measures of risk exposure, we use of the records of the OSHA investigation reports from 35,104 male work fatalities and 41,536 non-fatal accidents that resulted in hospital admission (where the worker's sex is unknown to the researchers) from 1990 to 2009 (Table 1). These administrative records, to the best our knowledge, account for the universe of investigations into accidents[9] during this window. OSHA investigators report the key characteristics of an accident, the context in which it occurred, the task performed by the victim, and outcomes for all victims.[10]

For our analysis we will focus on the assessment of whether the victim of a fatal accident died during a work activity regularly associated with the tasks of their occupation. Investigators assessed and recorded whether a fatal injury occurred during a task that could be considering a regular part of the employee's job or work day. An "irregular task" is something that was done on behalf of the employer but was not regularly associated with the duties of the victim's occupation. Of the 35,104 fatal accident investigation records we analyze, 5,277 occurred while the victim was performing an irregular task.[11]The rates of fatal task risk in our sample by task type are reported in Table 2.

Fatal injuries come in a variety forms. OSHA audits record the broad context of the injury. While the official reports include a narrative section that record the more specific, macabre details, the results are distilled into relatively sterile accident types. The most common injuries are resultant of accidents such being struck by an object, falling from elevation, or being caught between something. The percentage of each fatal accident type that occurred while performing an "irregular" task is relatively consistent (mean = 19%, sd = 0.05), with no type characterized by greater than 28% occurring during irregular tasks. A breakdown of work fatalities by accident type and the share occurring during irregular tasks is included in appendix Figure D.1.

We create separate measures of accident risk by occupation and industry, creating occupation-

[9] To be clear, we believe our data constitute the universe of all accident *investigations*, not the universe of all accidents.

[10] While the strictness of assessment penalties and safety outcomes have been found to be, in part, a function of institutional variation across OSHA, the content of audit reports has been found to be exogenous (Bradbury, 2006; Jung & Makowsky, 2014).

[11] Current publicly available records do not include assessments of "regular or irregular" tasks. The data used in this project was acquired via a Freedom of Information Act request for data in 2011. In the 1995 and 2009 OSHA's Field Operations Manual, the assessment of regular or irregular task context is not directly referenced, only that the investigator ask "How often the employee performed this task" ("OSHA Field Operations Manual, Directive CPL 02-00-148", 1995, 2009). The codebook with the OSHA data describes regular vs irregular task as indicative of whether the "Task working on at time of incident as 'A = Regularly assigned task' or 'B = Task other than regularly assigned'.

state-year (osy) and industry-state-year (ksy) panels of rates of fatal accidents (total, regular, and irregular) per 100 full-time equivalent (FTE) male workers. The total measurements of FTE workers that serve as the denominators in our risk measures measured using the Current Population Survey (CPS). Industries are compiled using 3-digit industry codes used in both the CPS and OSHA records. Due to sampling limitations from the CPS, we are able to match three digit employment codes in OSHA records with three digit occupation census codes in the CPS, and collapse them into 80 occupation categories. [12]

This panel of risk measurements were merged with the CPS microdata sample. To simplify our analysis the sample is restricted to male[13] employees between 1990 and 2009 working at least 15 hours a week and who report earning more than \$2 an hour (2009 dollars). All individual worker-level variables incorporated in our regression analysis come from the CPS, including hourly wages for each respondent.

4.2 Are Irregular Task Accidents Evidence of Occupational Misclassification?

Our model predicts that, *ceteris paribus*, as workers' compensation insurance costs increase, firms will have incentive to misclassify workers under safer classifications to lower their premiums. If a misclassified worker is fatally injured while performing dangerous duties ostensibly unrelated to their job, then the employer has two choices during any subsequent OSHA investigation: they can either report to the investigator that the employee was performing an irregular task or reveal that they were performing what was for them a regular task, which is, at the very least, *adjacent* to confessing to insurance fraud. As such, it is our assumption that when a misclassified employee is injured at the workplace, the injury is more likely to be recorded as having occurred during the performance of an irregular task (as the task in question is likely associated with their true occupational duties rather than their formal classification).

While misclassification may change what is recorded in official records, it does not free a firm from market demands to compensate their employees for risk. We hypothesize that misclassification will result in wage premiums paid for irregular task risk, and that these premiums will increase with the cost of insurance. As with any study of purposeful falsification within data, we are

[12]The 80 occupational categories are based on documentation from the NLSY. We drop three occupations: "Police and Detectives" and "Firefighting and Fire Prevention Occupations", given the specific type of risk associated with these occupations, as well as "Precision Inspectors, Testers, and Related Workers", since we do not observe employment for these occupations across the majority of our sample.

[13]Women accounted for less than 3% of the fatalities investigated in our sample, making any separate analysis intractable.

limited in what we can and cannot observe. We cannot distinguish within our analysis whether misclassification occurs at the individual level (i.e. hiring 10 workers to shingle roofs and then insuring them as 10 painters) or in the aggregate (i.e. hiring 20 people as painters, 0 as roofers, and then distributing the roofing work fractionally among the painters). From the point of view of an insurance company the distinction is largely irrelevant. From the point of view of most researchers analyzing wage data both scenarios produce the same fraction of "roofing" job tasks being incorrectly assessed as "painting". More importantly, the fraction of painting that is actually more dangerous roofing work is endogenous to the workers compensation benefits of a given state.

We also cannot adjudicate whether any particular irregular task fatal accident victim was misclassified in their occupation. What we can do is estimate a causal relationship between insurance costs and the wages paid for irregular task risk. The internalization into wages of risk while performing a task a worker is not expected to perform is evidence that, at the very least, that occupational classifications are incomplete. Observation of a causal relationship between insurance costs and the internalization of irregular task risk into wages, however, is strong evidence that evasion of higher workers' compensation insurance premiums is motivating employers to misclassify employees.[14]

4.3 Identifying the Effect of Misclassification on Wages

To test our hypothesis that employees are being occupationally misclassified when it is costlier to insure employees taking on risky job tasks, we focus on identifying the internalization of irregular task risk into wages. An accident occurring while performing an irregular task does not, unto itself, constitute evidence of a misclassified employee. With little doubt some of these accidents occurred while employees were helping a coworker or performing a task that did not fall neatly under any job description. The rate at which these "true" irregular task accidents occur, however, should be idiosyncratic and only weakly internalized into wages, if at all. More importantly, the rate of "true" irregular task accidents should be uncorrelated with the political and economic forces determining the legislation changing workers' compensation benefits and insurance premiums.

A naive estimate of the relationship between irregular task fatalities and workers' compensation premiums would be potentially biased by the endogeneity of risk to insurance costs. This is partly mitigated by focusing on the elasticity of wages to irregular task risk, but there remains the concern that insurance premiums will reflect changes in employee risk exposure. To address this omitted

[14] Additional discussion of the share of fatal accidents involving an irregular task and its correspondence to publicly available descriptive analysis of occupational misclassification by insurance auditors is included in Appendix section B.

variable, we decompose insurance premiums by state and year, separately measuring the portion of costs that are attributable to state legislation changing workers' compensation benefits and, in turn, is exogenous to the risk experienced by workers on the job. This allows us to identify the relationship of the irregular task risk elasticity of wages to exogenous changes in insurance costs faced by firms.

The National Council on Compensation Insurance (NCCI) is the largest and most relied upon source for information used to set prices within workers' compensation insurance. Insurers subscribe to their data and services to estimate accurate loss costs and calculate experience rating modifications. The NCCI provided advisory rate-making and statistical services in 35 states as of 2010.[15].

In their annual statistical bulletin, the NCCI estimates the changes in workers' compensation insurance premiums across years for every state (including states within which they do not currently provide advisory services). They disaggregate these changes into two primary components, "Benefit Change" and "Experience Change," plus a third catch-all category, "Miscellaneous Change," for the remainder. "Experience Change" refers to changes in premiums derived from analysis of collected premiums and liabilities, as well as changes in taxes and other expenses experienced by underwriters in the state. These are essentially the inputs into firms' "experience ratings." "Benefit Change", on the other hand, refers to "adjustments in premium level to account for legislated changes in mandated benefits, as well as medical fee and hospital rate changes." The changes in mandatory benefits include increases and decreases in the maximum weekly cash wage benefits and the total weeks cash benefits can be received, but just as importantly account for changes in the nuance of required medical reimbursements. Using changes in insurance premiums attributable to changes in mandatory benefits allows us to effectively leverage NCCI's capacity to account for the multitudes of legislation that are internalized into the costs facing employers and distill it into a dollar cost that is exogenous to the safety record of firms in a state.

The National Association of Social Insurance calculated the average cost of carrying workers' compensation insurance per $100 wages in each state from 2006 to 2010 (Table 3). Using these

[15] NCCI customers: Alabama, Iowa, New Mexico, Alaska, Kansas, Oklahoma, Arizona, Kentucky, Oregon, Arkansas, Louisiana, Rhode Island, Colorado, Maine, South Carolina, Connecticut, Maryland, South, Dakota, District of Columbia, Mississippi, Tennessee, Florida, Missouri, Utah, Georgia, Montana, Vermont, Hawaii, Nebraska, Virginia, Idaho, Nevada, West Virginia, Illinois, and New Hampshire. Eleven states use their own rate-making advisory (California, Michigan , North Carolina, Delaware, Minnesota, Pennsylvania, Indiana, New Jersey, Texas, Massachusetts, New York, Wisconsin) and four have an exclusive state fund (North Dakota, Wyoming, Ohio, Washington). West Virginia had an exclusive state fund until 2006, at which point they began using NCCI's advisory services

costs as a baseline, we used NCCI estimates of changes in the total cost of workers' compensation insurance to work backwards from 2006 to impute the total cost of carrying workers' compensation insurance, P_{sy}, between 1990 and 2006.[16] Imputed costs for carrying workers' compensation insurance across states in this window average \$1.72 per \$100 wages (sd=0.81) and are right-skewed, with maximum of \$6.13 observed in Montana in 1994.[17]

Using these estimates we are able to separately identify the portions of workers' compensation premiums attributable to changes since 1990 by state and year: those attributable to legislated changes in mandatory benefits, (P^B_{sy})[18], experience rating changes (P^E_{sy}), miscellaneous changes (P^M_{sy}), as well as the baseline workers' compensation premium at the beginning of our sample in 1990 ($P_{s,y=1990}$). In the lower histogram of (Figure 2), we can see that the distribution of P^B_{sy} is relatively symmetric around a mean of \$0.01 (sd=0.24), with a minimum of \$-1.12 in California in 2007, and a max of \$1.10 in Hawaii in 2008-09.

Figure 3 depicts this decomposition of the underlying sources of workers' compensation premiums paid by firms, including the portion attributable to legislated changes in benefits, in 1990, 2000, and 2009. Visual inspection of Figure 3 reveals four attributes that support our identification strategy. First, similar average premiums across states are often products of very different underlying compositions, including differing changes in the experience ratings of firms within the state which are representative of the day to day risk faced by their employees. Second, the costs of mandated benefits vary greatly, both within and between states, often between states with otherwise similar total average premiums. Third, there is no immediately obvious relationship between the portion of premiums attributable to experience rating changes versus the portion attributable to benefit legislation (correlation coefficient = -0.28). Fourth, the sample includes not just increases, but decreases in each subcomponent of insurance costs, including substantial decreases in costs from benefit reductions.

This separation of the workers' compensation premiums allows us to identify off of the interaction of exogenous variation in premiums and irregular accident risk, $Risk^{Irregular}_{ksy} \times P^B_{sy}$, while simultaneously controlling for changes in occupational risk via changes in workers' compensation

[16] We also carried out the same exercise using the data from each year, 2007 to 2010, to separately validate the imputed values.

[17] All workers' compensation costs, including disaggregated components, are expressed as fractions of nominal dollars. Out of an abundance of caution for concerns over secular wage stagnation, we confirmed that results are unchanged if values per \$100 wages are additionally deflated to 2009 dollars, but we believe operating in nominal dollars to be the correct decision.

[18] $P^B_{sy} = \sum^{y}_{1990} \Delta P^B_{sy}$, where ΔP^B_{sy} is the one-year change in insurance costs in a given year and state that is attributable to legislated changes in benefits.

premiums from experience ratings. For the purposes of our analysis, we will focus on accumulated benefit changes P^B_{sy} within our sample. For the sake of transparency and robustness, however, we will also estimate our model using single-year changes from recent benefit legislation, ΔP^B_{sy}.

5 Exploratory analysis using within-industry irregular task risk

Observing misclassification is made no less difficult by that fact that a worker can be classified under a wide variety of occupations. At a minimum, however, if firms are sufficiently responsive to the costs imposed by mandated benefits, then we would expect to observe the occupational share of a state's workforce in high risk jobs to decrease with mandated benefits. In Figure 4 we compare states in the upper and lower quartile of mandated workers' compensation benefits, plotting the differences in the share of the male state workforce that is classified under each occupational code (upper quartile share minus lower quartile share).[19] The riskiest jobs have considerably smaller footprints in the high benefit states. Most prominently Construction Trades account for 11 percentage points less of state workforces in "high benefit" states. At the same time, we also observe higher shares of middling-risk occupations, such as Personal Service, Guards, and Water Transportation.[20]

We don't have a causal identification strategy for these "missing occupations"' —any decline in regular task shares of fatal accidents from misclassification is indistinguishable from personnel changes or investments made by firms to increase safety. Further, work opportunities are, with little doubt, endogenous to the benefit mandates across states. The pattern of occupational shares observed in Figure 4, however, suggests that workers' compensation benefits have a nontrivial correlation with the distribution of occupational classification within a state, and that the observed patterns fits within the predictions of our hypothesized framework.

Employees may be systematically misclassified, but the process by which they are assigned misleading job titles will have a large component that is random and unobservable. To mitigate this problem, we focus on the rate of irregular fatal accidents within an *industry*, state, and year, $Fatal^{Irregular}_{ksy}$. While the job tasks of an employed individual may be relatively straight-forward to obscure under a false occupational title, it would be considerably more difficult (in our context)

[19]The rubric in question assigns all occupations one of 81 occupational codes. Government employees, including military, police, and firefighters, are excluded from the analysis, leaving 78 codes analyzed. Only the 40 highest risk occupational codes are reported in the figure.

[20]Water Transportation includes dockworkers in the shipping and distribution industry, an occupational category observed by David Weil, in his time as Administrator of the U.S. Department of Labor's Wage and Hour Division, to be frequently misclassified as independent contractors to avoid paying benefits (Weil, 2017)

to credibly misclassify the industry of the entire firm in the records of OSHA, the CPS, and the workers' compensation insurance underwriters.[21]

In Figure 5, we plot the relationship between irregular task fatal accidents by industry and the total premiums attributable to mandatory benefits (P^B_{sy}) as binned scatterplots. The two subfigures represent the relationship between insurance costs and the (a) share of accidents that are classified as irregular and (b) the rate of irregular accidents per FTE. To produce the analogue of a two-way fixed effects panel regression, the both are residualized by industry and year. The relationships of both the irregular share and rate of accidents with insurance costs are positive and significant ($p < 0.05$). While these correlations do not constitute an estimation of a causal model, they do constitute the first-order relationship our model would predict.

6 Empirical Model and Estimation

While both occupational distributions and industry irregular accident share offer preliminary evidence of systematic misclassification, the focus of the rest of the paper will be on estimating a causal empirical model. Our core regression specification identifies the compensating wage differentials paid to employees for exposure to fatal accident risk while doing tasks outside of their formal job description. The focus will be on the effect of within-state differences in industry level irregular task risk ($Fatal^{Irregular}_{ksy}$) and its relationship to workers' compensation insurance costs directly attributable to changes in mandatory benefits since 1990. We apply our core specification to both the entire sample of male workers in the CPS and several subsets of the data, stratifying the sample by average industry risk as well as worker education, race, and nativity.

To test our predictions we estimate a series of hedonic regression models of the form:

$$\begin{aligned} \log \text{Wage}_{ioksy} = &\alpha + \beta_1 \mathbf{Fatal} + \beta_2 \text{Nonfatal}_{osy} \\ &+ \beta_3 P_{sy} + \beta \mathbf{X_i} + \delta_o + \gamma_k + \sigma_s + \theta_t + \epsilon_{ioksy}. \end{aligned} \tag{4}$$

where **Fatal** includes one or measure of fatal accident risk and Wage_{ioksy} is the real hourly wage

[21] In a now older analysis of a special supplement to the 1977 CPS, Mellow and Sider (1983) noted that employees and their respective employers reported concurring 3-digit SIC industrial classifications in 84% of pairings, but found agreement on 3-digit occupational classification only 58% of the time. No doubt some portion of this is standard measurement error borne of coarseness of occupational codes and unfamiliarity with it (particularly for employees), but there would seem to remain ample room for strategic misclassification.

rate of an individual with occupational code, (o); in industry, (k); state, (s); and year, (y).[22] We include a vector of control variables from the CPS, $\mathbf{X_i}$, that include birth outside of the United States of foreign parents, union membership, marital status interacted with number of children, residence in an urban metro area, and separate indicators for Black and Hispanic identity.[23] All specifications include fixed effects for state, s; year, y; industry, k; and occupational o. All specifications also include state-specific quadratic time trends. Standard errors are clustered by state.

Baseline estimates of compensating wage differentials paid for fatal accident risk are identified are estimated using within-ocupation measure of fatal accident risk. To test our core predictions, the within-industry measure of irregular task risk, $Fatal_{ksy}^{Irregular}$, will serve as our primary variable of interest (as noted in section 5, because industry classification is far more difficult to falsify).[24] To better reflect year to year changes in the workers' compensation, $Fatal_{ksy}^{Irregular}$ is included as a single year value for each industry and state (as opposed to a three-year moving average). All measures of risk are rates of male occupational fatalities per 100 male FTE.[25] We separate measurements by both task type (regular, irregular, all) and worker context, including the occupational code, (o); industrial code, (k); state, (s); and year, (y) recorded in the accident report. Our analysis, in turn, starts with the traditional hedonic regression of wages over the 3-year moving average rate of male fatal accidents, $Fatal_{osy}$, per 100 FTE male workers within a given occupation, state, and year. The use of 3-year moving averages for regular task risk allows for the best possible measure of expected risk at the occupation-state-year level, improving the precision of the separate estimation of irregular task wage elasticity.[26] We then run the identical regression using separate measures of regular and irregular risk. All regressions also include the rate of nonfatal accidents investigated

[22]Wages are imputed from responses regarding yearly income and hours regularly worked, and calculated as 2009 dollars. Both Moore and Viscusi (1988) and Shanmugam (1997), in their estimation of flexible forms models, come to the conclusion that the semi-log form generated results closest to those found with an unrestricted flexible forms model. Nominal values are converted to real dollars using the using the Personal Consumption Expenditure (PCE) price index from the St Louis Federal Reserve Bank. We omit from our analysis observations with imputed real wages less than \$2 per hour or who reported working less than 15 hours per week.

[23]Union status, is identifiable for less than 10% of our sample. All specifications separately identify if the individual operates under a union contract and whether union status is known.

[24]The denominators (FTE male workers) of our risk variables are always measured within the same construct as the numerator i.e. *occupation-state-year* or *industry-state-year*.

[25]Fatal accidents per 100,000 is more common in the literature, but the use of a smaller denominator makes interpretation of interaction terms easier.

[26]Our primary analysis hinges on variation in benefit mandates at the state-year level and variation in risk at the occupation/industry-state-year level. This necessarily cuts measures of risk relatively thin and more prone to random variation. Using 3-year moving averages for regular task risk allows for a more stable measurement of expected task risk and, in turn, a better identification of irregular task risk wage elasticities which, necessarily, must be measured at the single-year level. Fortunately irregular task risk is measured at the industry-state-year level, a "thicker" cut affords less random variation. Our core results are not sensitive to the use of 3-year moving averages, but the increased precision of some coefficients is notable in the stratified analysis of smaller populations.

by OSHA that resulted in hospital admission, $Nonfatal_{osy}$, as a quadratic term.[27]

In our core regression specification we will identify the wage differentials attributable to irregular task fatality rates within industries and their relationship to the legislated changes in the costs of workers' compensation insurance premiums. We estimate,

$$
\begin{aligned}
\log \text{Wage}_{ioksy} =& \alpha + \beta_1 \text{Fatal}^{Regular}_{osy} + \beta_2 \text{Fatal}^{Irregular}_{osy} \\
&+ \beta_3 \text{Fatal}^{Irregular}_{ksy} + \beta_4 \text{Fatal}^{Irregular}_{ksy} \times \mathbf{P}^B \\
&+ \beta_5 P^{Total}_{sy} + \beta \mathbf{X_i} + \delta_o + \gamma_k + \sigma_s + \theta_t + \epsilon_{ioksy},
\end{aligned} \tag{5}
$$

where $\mathbf{P}^B \in [\Delta P^B_{sy}, P^B_{sy}]$. To first validate the positive elasticity of wages to fatal accident risk and then test our core hypothesis regarding the insurance premium-conditional elasticity of wages to irregular task risk, we will focus on linear specifications of risk. For the sake of consistency and ease of comparison, our reported estimations of average marginal effects on wages, annual compensation, and the implied value of statistical life will all use a linear model. Plots of average marginal effects of our key specification using first-, second-, third-, and fourth-order polynomials of irregular risk are included in the appendix in Figure D.3. While higher-order polynomial models of irregular risk offer a smoother set of estimation across the values of $\mathbf{P}^B$, with slightly smaller confidence intervals, observed average marginal effects are almost entirely insensitive to functional form imposed on irregular fatal accident risk.

We are often asked why we do not estimate the effect of mandated benefits on accident rates or use the cost of benefits as an instrument for irregular task risk in a two-stage least squares estimation. Our model predicts that when mandatory benefits raise the minimum amount of insurance (non-wage) compensation above the unregulated market equilibrium, firms and employees will have incentive to misclassify workers, shifting wage compensation from regular task risk to irregular task risk. Whether or not the number of accidents per worker will increase in general equilibrium, given the range of options firms have to invest in safety or reduce reliance on risky tasks, is ambiguous. The inclusion of an interaction term in the specification allows us to identify the irregular task risk elasticity of wages and its relationship to workers' compensation benefits; to observe whether the internalization of irregular task risk into contracted wages is dependent on

[27] While we include nonfatal accidents as a controlling covariate that is likely to impact wages, we do not explore their relationship to wages in detail because nonfatal accidents involving misclassified workers are unlikely to be reported and, in turn investigated, at the same rate as fatal accidents, which should be nearly impossible to hide.

state-mandated benefits.

7 Results

The coefficients in Table 4 serve as evidence that our data generate standard relationships between risk and wages while also providing a baseline for comparison of our primary results. Regressing log wages on total fatal accident risk ($Fatal_{osy}$) measured at the occupation-state-year (osy) level, yields estimates comparable to the prior literature. In column 1 we do not include industry code fixed effects, only occupation, state and year, along with the full battery of individual covariates from the CPS. A one standard deviation increase in male occupational fatalities per 100 male FTE leads to a 1% in wages ($p < 0.05$). Adding "coarse" indicators for 7 broad industrial categories yields estimates of similar magnitude and precision. In column 3, and all subsequent regressions, we include finer-grain codes 227 different industries. The estimated coefficient on fatal accident risk is somewhat attenuated, but this should be expected given the use of fine-grained fixed effects.

In columns 4 through 6 of Table 4, we replicate the first three regressions, but separate within-occupation measures of risk into $Fatal_{osy}^{Regular}$ and $Fatal_{osy}^{Irregular}$. The coefficients on regular risk display a similar pattern to what is observed for total fatal accident risk, albeit with slightly larger magnitudes. The estimated coefficient on regular fatal task risk with the inclusion of fine grained industrial fixed effects is only marginally significant ($p < 0.10$). We do not interpret this as evidence of limited compensating differentials for regular risk —we should expect the inclusion of 70 occupational dummies , 227 industry dummies, state and year fixed effects, and state polynomial time trends to account for the bulk of compensating wage differentials regularly contracted into wages for accurately classified occupations. Specifications using coarse, rather than fine, industry fixed effects are necessary to allow for enough within-occupation risk to estimate wage compensation for task risk (Viscusi, 2004).

As expected, the estimated coefficients on irregular task risk by the formally classified occupation, $Fatal_{osy}^{Irregular}$, are small, with large standard errors, consistent with an interpretation of relatively minor, idiosyncratic risk. Observation of compensation for systematic irregular task risk should be attentuated if occupations were are fact misclassified, motivating our use of irregular risk measured at the industry level in subsequent estimates.

7.1 Compensation for Irregular Task and Workers' Compensation Benefits

The results in Tables 5 and 6 support the prediction that compensating wage differentials are being paid to workers for taking on irregular task risk, but that this compensation is entirely conditional on the insurance costs faced by their employers. In Table 5, column 1 we observe wages decreasing with industry irregular task risk, $Fatal_{ksy}^{Irregular}$, leaving the coefficient on $Fatal_{osy}^{Regular}$ little changed from the baseline results in Table 4. When $Fatal_{ksy}^{Irregular}$ is interacted with the cost of insurance attributable to changes in mandated workers' compensation benefits since 1990, P_{sy}^{B}, the standalone coefficient on $Fatal_{ksy}^{Irregular}$ decreases in magnitude and loses significance. The coefficient on the $Fatal_{ksy}^{Irregular} \times P_{sy}^{B}$ interaction term, on the other hand, is positive and significant ($p < 0.05$). In observations where benefit increases accounted for \$0.25 per \$100 wages, or one-seventh of the mean total insurance costs in our sample, employees received wage premiums for irregular task risk roughly equivalent to those they received for regular task risk. This pattern persists in columns 3 through 5, which reduce the sample to industries in the higher quantiles of total fatal accident risk within the full sample (ρ_k).[28]

In a complementary analysis and robustness check, regressions presented in Table 6 replace the total portion of insurance costs attributable to benefit increases since 1990 with the one-year changes in costs, ΔP_{sy}^{B}. The coefficient on $Fatal_{ksy}^{Irregular} \times \Delta P_{sy}^{B}$ is positive and significant ($p = 0.05$) over the entire sample (column 2). In observations where benefit costs increased \$0.08 per \$100 wages (one standard deviation above the mean change), workers received additional wage compensation for irregular task risk equivalent to 15% of what they received for regular task risk.

7.1.1 Worker Education and Industry Risk

Irregular task risk is not exclusively a product of misclassification—accidents remain random events and job tasks will inevitably appear within work contexts that do not fall under the rubric of any defined occupation or contract. True irregular task risk, however, is sufficiently low and outside the bounds of expectations that any non-zero transaction costs would be prohibitive to contracting inclusive of it.[29] As such, comparisons across the strata of industry-wide risk and between "white collar" and "blue collar" employees offer additional means of testing our hypothesis. Given that

[28] In our primary specifications we only interact irregular task risk with benefit costs. In Appendix C we replicate the main tables and marginal effects estimations including interaction terms for both regular and irregular task risk. The results are consistent with both our primary results and the predictions of our model.

[29] Irregular task risk, in this way, presents an excellent example of "Knightian Risk" (Lopomo, Rigotti, & Shannon, 2011).

the cost-reductions to misclassifying white collar workers should be trivial, our model predicts that irregular task risk wage elasticities for blue collar workers will be conditional on mandatory benefits, while wage elasticities for white collar workers should remain unconditionally zero. Both predictions are supported by our results.[30]

In Table 7, we run identical regressions to those presented in Tables 6 and 5 on separate subsamples of employed male CPS respondents based on maximum level of educational attainment. When the sample is restricted to exclude workers with postsecondary education (middle panel), the coefficients on the interactions with both ΔP_{sy}^{B} and P_{sy}^{B} (columns 1 - 8) are significant across all industries and within each industry risk subsample.

When the sample is limited to male employees who did not complete high school (n=53,162), the results are noisier than the full sample, with statistically significant coefficients only observed with the still narrower subset of those working in the riskiest 10% industries (n=15,167). For these workers with the least education in the most dangerous industries, we observe the large largest sensitivity within our analysis of wages to the interaction of irregular task risk and the costs of mandatory benefits.

Conversely, we find no evidence that the wages of employees with education beyond the high school level are ever increasing with exposure to irregular task risk in any context observed in our data. While industry risk and worker education are coarse means of distinguishing "blue-" and "white-"collar work, the results in Table 7 can be reasonably interpreted to indicate that wages paid for irregular task risk as compensation for evading workers' compensation insurance costs is a blue collar labor market phenomenon.

7.2 Marginal Effects

In Figure 6 and all subsequent estimation of marginal effects, we plot the average marginal effects of $Fatal_{ksy}^{Irregular}$ for each educational attainment subsample. The average marginal effect of $Fatal_{ksy}^{Irregular}$ on log wages increases monotonically with P_{sy}^{B} —marginal effects are negative in the lower quartile of P_{sy}^{B}) and positive in highest decile. For men without a high school diploma, we

[30]We can only observe the union status of a limited subsample of the CPS (n=76,575). Replications of the keep specifications from Tables 6 and 5 using this subsample are presented in Appendix Table E.1. Within this subsample, we find that baseline wage differentials for irregular task risk are positive for workers operating under a union-negotiated contract and negative for those who do not (neither coefficient is statistically significant). At the same time, the coefficients on the interaction terms with neither ΔP_{sy}^{B} nor P_{sy}^{B} are significant determinants of wages for union workers. The coefficients for non-union workers, however, fit the pattern of the full sample. This limited evidence suggests that occupational misclassification is less prevalent for union workers while, at the same time, ambient-level irregular task risk may be better internalized in their wages.

observe positive average marginal effects for nearly the entire sample, but the reduction in sample size is such that that none of the effects are quite statistically significant ($p < 0.10$) in any of the individual bins. When we expand the subsample to only exclude those with at least some postsecondary education, the average marginal effect of $Fatal_{ksy}^{Irregular}$ is positive and significant ($p < 0.05$) in the upper 50% of the distribution of P_{sy}^{B}, while also being negative in the lower 15%. Average marginal effects are always negative for men with any postsecondary education.

The importance of education is further highlighted in Figure 7. Stratifying by both industry risk and education, we observe consistent patterns across each subset. The confidence intervals surrounding observed effects are always narrowed by restricted the sample to those without post-secondary education. While the shape remains consistent, the magnitude of effects is always larger for workers in industries with higher rates of fatal accidents.

These mappings of marginal effects offer some insight into why the wage differentials paid to irregular-task risk are unobserved if the cost of workers' compensation benefits are only included as an independent covariate. The observed effects are negative and significant in lower quantiles of P_{sy}^{B}, and positive and significant in the upper quantiles of P_{sy}^{B}. In the middle of the distribution, however, around the median and mean, the effects are small and often statistically indistinguishable from zero.

7.3 Race, Ethnicity, and Nativity

Nonwhite Hispanics suffer higher rates of fatal accidents at work than any other racial or ethnic group in the United States (Byler, 2013). Leeth and Ruser (2003) find that Hispanic men are compensated for these greater levels of risk at rates similar to those received by white workers. There is evidence that immigrants receive less compensation for risk in the US, and that Mexican immigrants receive less compensation for risk than similarly stratified racial or ethnic group (Hersch & Viscusi, 2010; Lanier, Baker, & Sum, 2015; Orrenius & Zavodny, 2009). While this may be product of racial discrimination or heterogeneity in preferences, there stands the alternative hypothesis that some workers face lower opportunity costs to being misclassified and forgoing some level of access to workers' compensation benefits, making them especially attractive to firms looking to reduce costs from workers' compensation insurance.

Undocumented workers have the legal option to file claims for workers' compensation in as many as 49 states, Wyoming being the lone definitive exception. There is, however, some legal uncertainty in at least a dozen states.[31] Even when undocumented workers have the legal right to make a claim, it remains uncertain, whether such a claim would place them at too great a risk for deportation (Grabell & Berkes, 2017). Any differences in opportunity costs to misclassification would likely correspond not only with worker nativity but also potentially the nativity of their family as well, allowing for correlation within broader ethnicity as well.

In Table 8, we separately estimate effects for the portion of the sample that self-identifies as broadly White, Black, and Latino workers, where Latino includes Mexican, Chicano, Puerto Rican, Cuban, Dominican, Central American, and South American. In the top panel of Table 8, we observe consistently positive coefficients on the un-interacted $Fatal_{ksy}^{Irregular}$ term for Latino workers that are non-trivial in magnitude. They are never statistically significant, but in comparison to the other racially/ethically stratified samples, the larger and consistently positive baseline magnitudes suggest that irregular task risk is more likely to be salient to Latino men than other groups, but also that it may be be harder to identify within our relatively saturated specification. The coefficient on the interaction with ΔP_{sy}^{B} is marginally significant across all Latino workers, while being significant ($p < 0.01$) for workers in the upper decile of industry risk. The coefficients on the interaction with P_{sy}^{B} are less consistent. We observe large coefficients on the relevant interaction terms for Black workers, but none are statistically significant, likely reflecting much smaller sample sizes, particularly in high risk industries. Coefficients for White workers are consistent with the full sample.

In Figure 8, the average marginal effect on Latino wages is larger than the effect on White wages in the upper half of the distribution of P_{sy}^{B}, but with larger confidence intervals. Whether this is purely a function of sample size or noise from omitted variables in the market for Latino labor market is ambiguous.[32] If we limit the analysis to the Mexican CPS respondents (roughly 2/3 of self-identified Latinos), we observe similar estimates, albeit with slightly more precision ($p < 0.05$) in the highest quantiles of P_{sy}^{B} (Figure D.2 can be found in the appendix) .

In Figure 9 we compare US born workers without postsecondary education to those born outside of the US, stratifying by Mexican, Latino, and non-Latino ethnicity. The wage differentials paid for irregular task risk are always attenuated for foreign-born workers compared to native-born. At the same time, we observe that US-Born Mexican workers receive greater compensation for irregular

[31] A breakdown by state written by the partners of Matthieson, Wickert, and Lehrer, S.C. can be found at https://www.mwl-law.com/wp-content/uploads/2018/02/WORKS-COMP-CLAIMS-BY-UNDOCUMENTED-EMPLOYEES-CHART.pdf, last accessed 8/7/2020).

[32] We do not have enough observations to calculate the average marginal effect for all racial and ethnic subgroups for workers solely within upper quartile or decile risk industries.

task risk in states with high workers' compensation benefits than any other stratified subsample we analyze, receiving between 2- and 4-times the annual total compensation for irregular task risk as US-born non-Latino workers. This result may serve to partially explain why Leeth and Ruser (2003) find that Hispanic workers receive larger compensating wage differentials for risk than non-Hispanics—misclassified US-Born Mexican workers are incurring greater fatal accident risk than their occupational titles would otherwise indicate.

7.4 Annual Compensation for Risk and the Value of Statistical Life

Systematic occupational misclassification introduces complexity, and a potential source of bias, in the estimation of risk compensation and value of statistical life (VSL), both of which serve as key stylized facts within insurance markets and for labor regulation (Viscusi, 1996, 2010; Viscusi & Moore, 1987). Viscusi (2004) compares a variety of estimates VSL, noting that estimates based on within-industry differences in risk are consistently twice the magnitude of those based on within-occupation differences, attributing it to measurement error at the industry level. Our results offer an alternative explanation—that intentional worker misclassification dampens observed differences in within-occupation wage elasticities.[33]

The average marginal effects of regular and irregular fatal accident risk can be translated into annual compensation for risk and an implied VSL.[34] Across our analytic sample, annual compensation for fatal accident risk is between \$47 and \$53, corresponding to a VSL of \$2.7 to \$3.2 million. Restricting the calculation to only regular task risk, estimates climb to a VSL of \$3.1 and \$3.7 million. These estimates are smaller than some, but remain roughly in line with previous estimates of VSL based on within-occupation differences in risk (Kniesner, Viscusi, Woock, & Ziliak, 2012; Lee & Taylor, 2019; Viscusi, 2004).

The upper portion of Figure 10 plots the annual compensation for risk for workers without college education implied by the average marginal treatment effect from Table 5.[35] Compensation estimates are plotted for the 5th to 95th% ventile bins of P^B_{sy}. Annual compensation for irregular

[33]Misclassification may still cause some dampening of within-industry effects, depending on how wages are recorded and whether they are likely to include "under the table" cash compensation, but this effect should nonetheless be weaker than effects on within-occupation observations.

[34]Risk Compensation $= (e^{\beta(Fatal^R_{ksy})} - 1) \times \overline{w}_{osy} \times 2000 \times \overline{Fatal}^R_{ksy}$,

VSL $= (e^{\beta(Fatal^R_{ksy})} - 1) \times \overline{w}_{osy} \times 2000 \times 100$,

where $\overline{w}_{osyv}$ is the average wage (by occupation, state, and year) within benefit premium ventile v, and $R \in \{Regular, Irregular\}$.

[35]Plots comparing the underlying average marginal effects of regular and irregular task risk are included in the appendix as Table C.1

risk is negative until the 40th percentile of P^B_{sy}, and is statistically significant below the bottom quintile and above the median. The estimated annual compensation for irregular task risk exceeds \$100 beyond the 80th percentile of P^B_{sy}, which is greater than any of our estimated compensation for total or regular task fatal accident risk under any specification in Table 4.

The lower portion of Figure 10 separately plots the VSL implied by estimated wage differentials for regular and irregular task risk for workers without college education using the estimated average marginal treatment effects from Table 5. Estimates and their 95% CIs are plotted by quintiles of P^B_{sy}.

Our estimates of VSL from irregular task risk should be interpreted with caution. Our estimates of regular task risk wage differentials are heavily attenuated by the inclusion of fine grained fixed effects. If irregular task risk is, as we hypothesize, indicative of occupational misclassification, then their estimated coefficients will not reflect the same level of attenuation from our inclusion of fine grained occupation and industry fixed effects that understate compensation of regular task risk (Viscusi & Aldy, 2003). We are, unfortunately, unable to estimate the degree to which misclassified workers have to abstain from workers' compensation and other similar benefits in the event of an accident.[36] An additional concern is the individual characteristics upon which acceptance of misclassification will select on. Preferences for "under the table cash" compensation in lieu of better workers' compensation benefits, for example, will likely correlate with a variety of attributes unaccounted for in our model. Kniesner et al. (2012) demonstrate how such things can be included in estimations of VSL within longitudinal data, but our data do not allow for similar analysis.

Accepting these limitations, we take the view that our estimates of the compensation attributable to irregular task risk serve to recover the true underlying VSL in state-years with the largest mandated benefits. They also serve to contextualize the value of risk contracted under misclassified occupations against previous estimates in the literature, under assumptions of proper classification, of compensation for total risk. Our estimates, however, do make a strong case that wage differentials paid for irregular task risk are *at least comparable to*, and are likely larger than, that received for regular task risk in settings where the costs of mandated workers' compensation benefits are sufficiently large to incentivize the misclassification of worker occupations.[37]

[36] In Table E.2 we estimate a linear probability model of whether an individual received cash benefits via workers' compensation in the previous year. The consistently negative coefficients on P^B_{sy} offer some suggestive evidence that misclassification reduces claims, but the coefficients are never statistically significant, likely reflecting in the small number of survey respondents who ever received a workers' compensation benefits (¡2%)

[37] There is a body of research (Horowitz & McConnell, 2002) identifying discrepancies in the wages workers were willing-to-accept for greater risk versus what they were willing to pay for additional safety. Kniesner, Viscusi, and Ziliak (2014) address this discrepancy specifically in the context of VSL estimates. While they find no statistically

8 Conclusion

Gruber and Krueger (1991) found that the incidence of workers' compensation mandates falls predominantly on workers, a result that, while disappointing to advocates who would prefer the burden fell on employers, is consistent with Summers's (1989) economic framing of mandate benefits programs. Using data in the two decades subsequent to Gruber and Krueger's analysis, we find that while the incidence may still predominantly fall on workers, there is sufficient heterogeneity in the preferences for workers' compensation benefits that employers are able to misclassify a subset of workers and lower costs by changing the composition of compensation bundles.

Our data and analysis have important limitations. The market for labor with weakened employee benefits through misclassification likely overlaps with the market for informally-contracted fringe laborers and undocumented immigrants (Bobba, Flabbi, Levy, & Tejada, 2021; Meghir, Narita, & Robin, 2015) whose employment might have gone entirely without record save a tragic accident that necessitated hasty and immediate record making. Regulatory and liability burdens may push stigmatized groups, such as those with criminal records, into labor markets for similarly uncontracted and informally contracted work. Accounting for these labor pools and other types of occupational misclassification would require greater reach and precision beyond the records analyzed here.

The assumption that an employee's occupation is correctly identified within a given data set is sufficiently taken for necessity that it rarely merits acknowledgment as an assumption. Errors in such records would typically be considered a form of measurement error, a nuisance inherent to data work that is unavoidable and, hopefully, trivial. Rarely would the researcher be concerned that such errors might be endogenous to institutions and incentives facing employers and employees. Our results offer further evidence of the merits of more granular, task-level analysis of labor markets, particularly when those tasks vary in their risk, physical or otherwise. Perhaps more disconcerting, they remind us of the dangers sometimes lurking behind even the most banal of assumptions.

significant difference, estimates of VSL based on wages workers were"willing-to-accept" were, on average, 17% larger than those based on "willing-to-pay" estimates. Given that misclassification is likely framed against a "higher insurance, lower wage" bundle, it stands to reason that compensation for irregular task risk compensating wage differentials are is buoyed by underlying unwillingness to pay for reduced risk.

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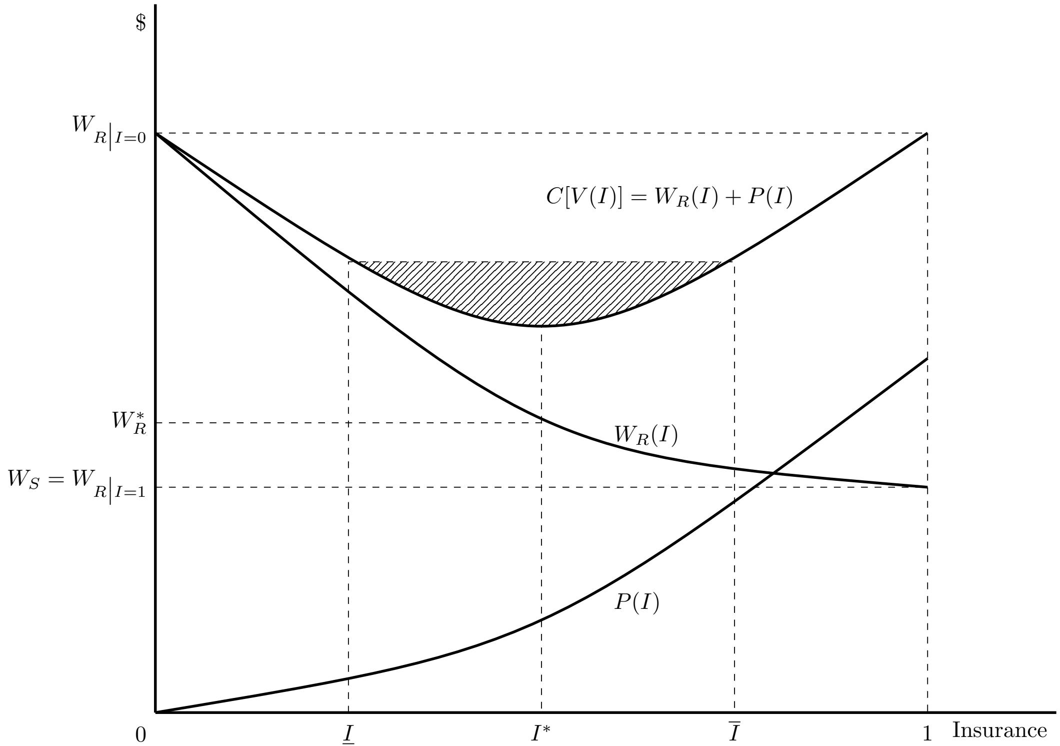
9 Figures

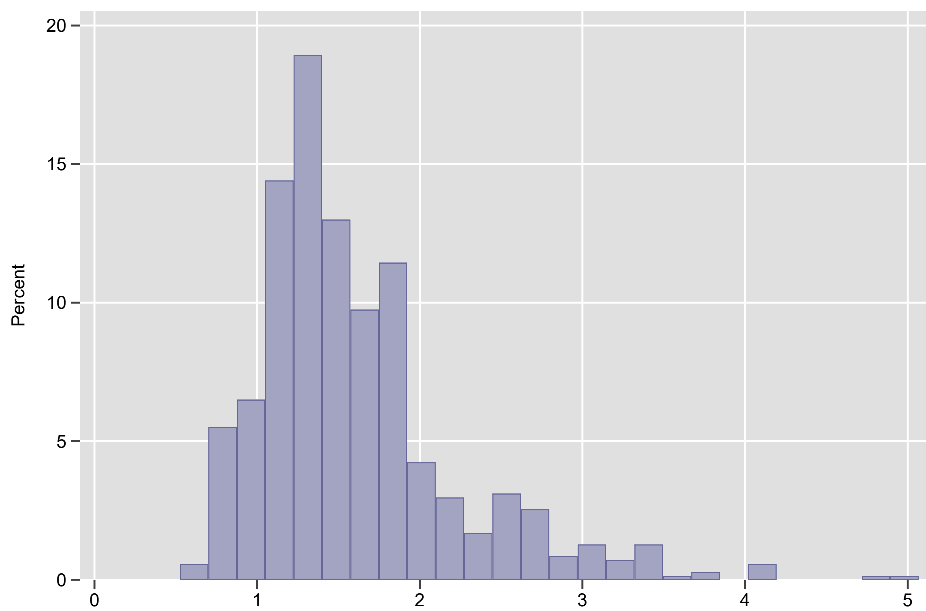
Figure 1: Optimal Wage and Insurance Bundles



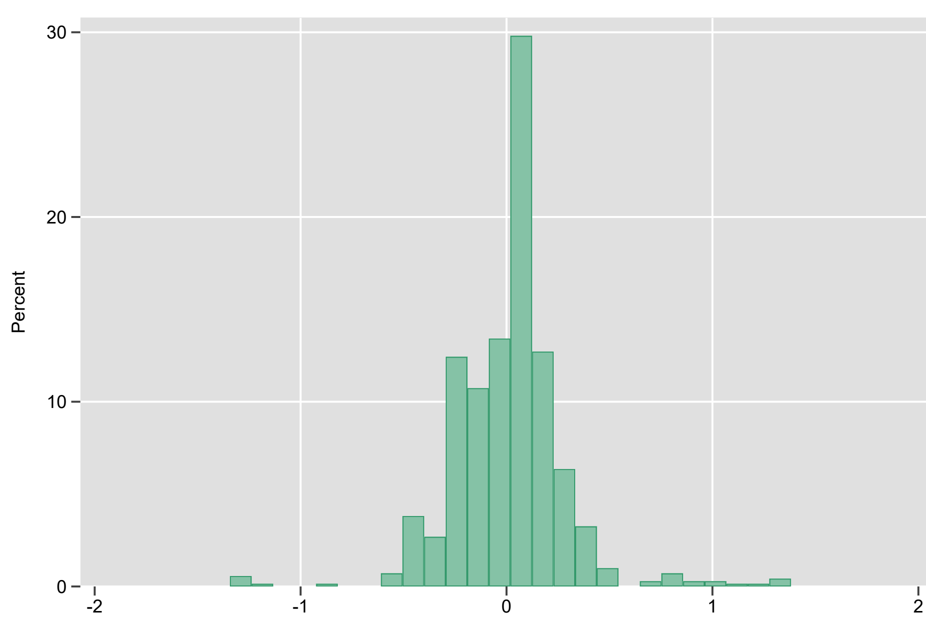
Note: $C[V(W,I)]$ is the total cost to the firm given the maximization of indirect utility $V(W,I)$. W_S is the market wage for a "safe" (i.e. riskless) job. The wage for a higher risk job $W_R(I=1) = W_S$ when compensation includes complete insurance ($I = 1$). The premiums paid by firms if $I = 1$ are such that $W_{R|(I=0)} - W_S = P_{|(I=1)}$. Firm costs are minimized at I^*. If a minimum insurance level, $\overline{I}$, is introduced, then $C[V(W_R(\overline{I}), \overline{I})] = C[V(W_R(\underline{I}), \underline{I})]$. The shaded area represents all of the cost-reducing combinations of wages and insurance available to firms and employees who evade minimum insurance requirements through occupational misclassification if misclassification costs $m = 0$.

Figure 2: Workers' Compensation Insurance Premiums

Average WC Insurance Premium per \$100 wages (P_{sy}^{Total})



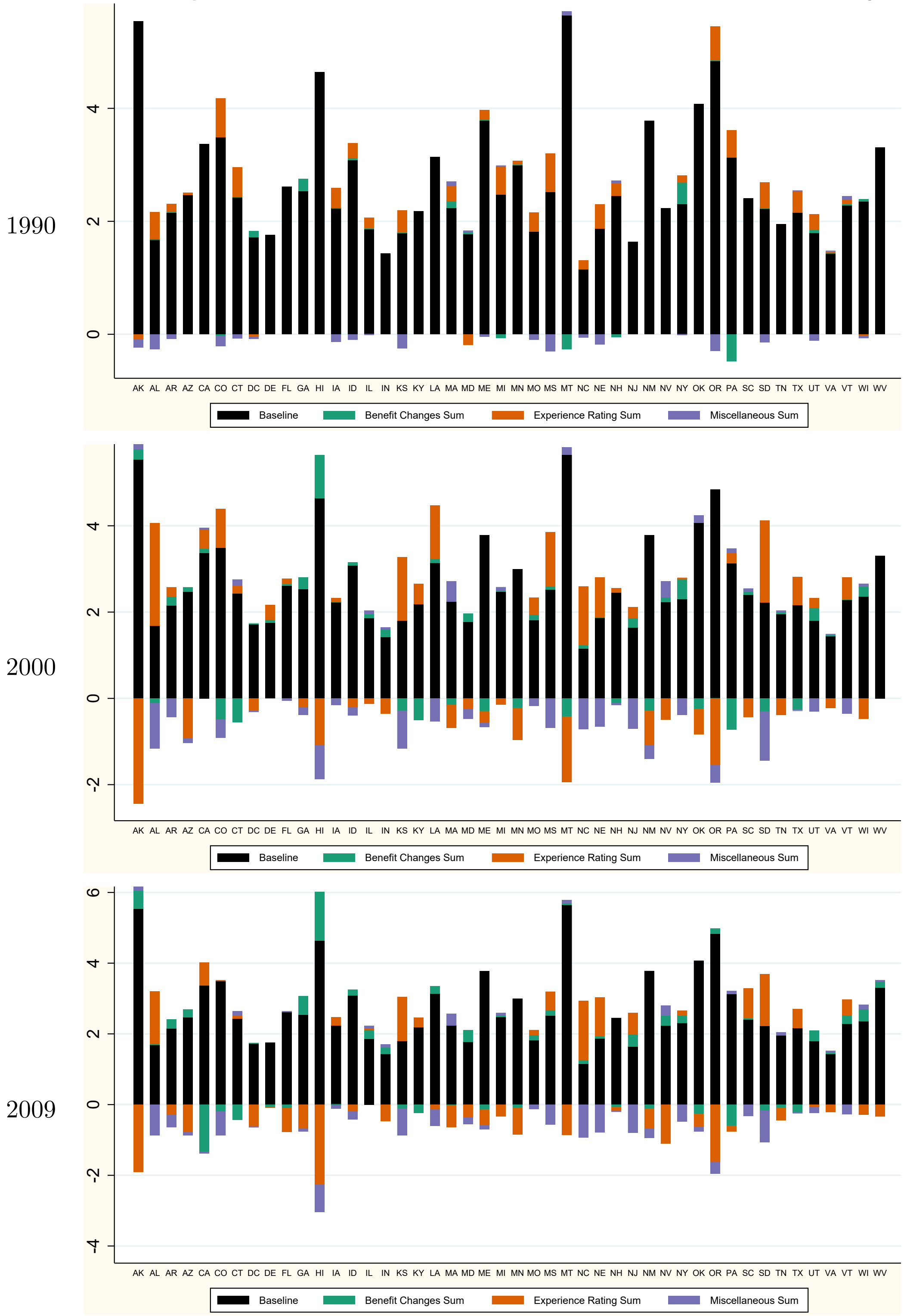
Portion of WC Premiums Attributable to Legislated Benefit Changes (P_{sy}^{B})



Nominal Dollars

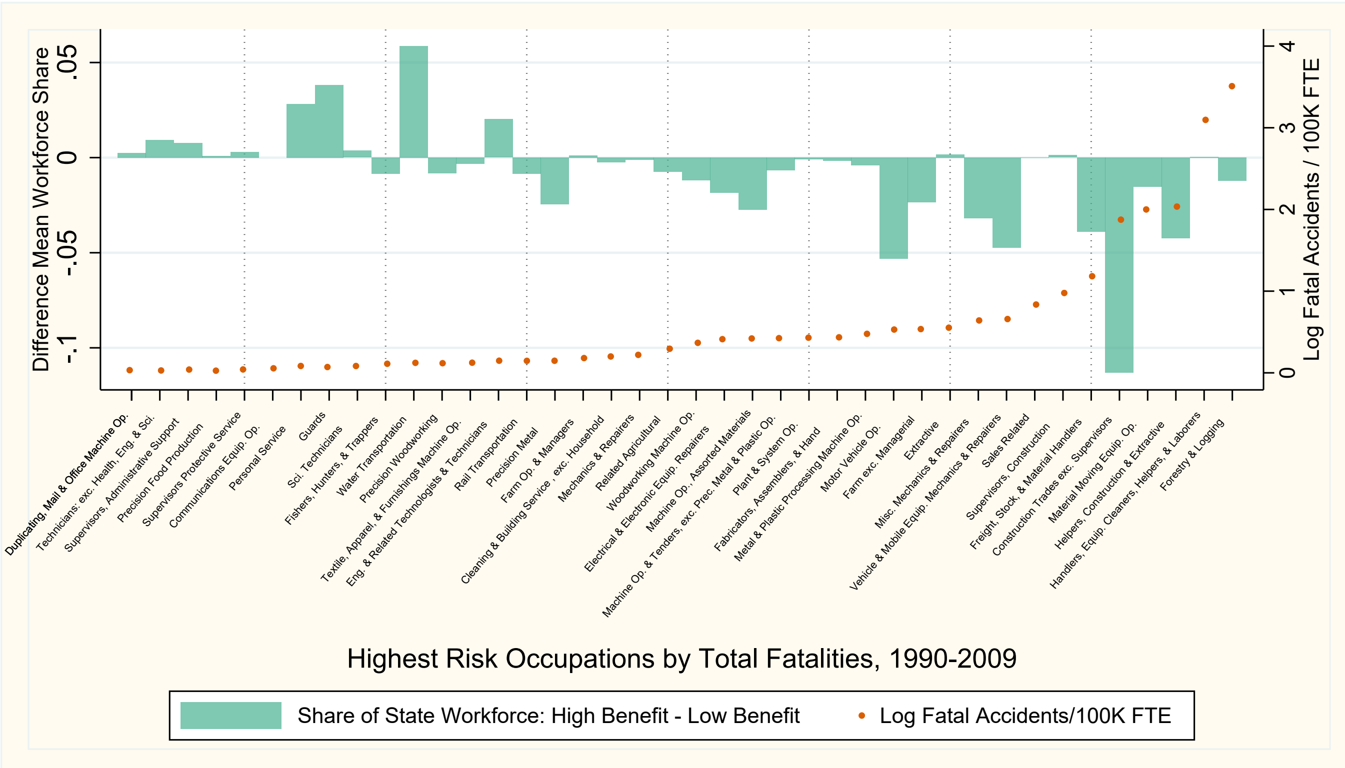
Note: Mean workers' compensation insurance costs by state and year, 1990 to 2009 (n=708) (upper) Histogram of mean workers' compensation insurance premiums paid by employers as \$ cost per \$100 wages paid to employees, (lower) the dollar value of those premiums attributable to state-legislated changes in mandatory workers'compensation benefits (P_{sy}^{B}). Negative values in lower subfigure account for states whose reductions in mandatory benefits resulted in net decreases in premiums after 1990.

Figure 3: Workers' Compensation Insurance Premiums per $100 Wages



Note: Decomposition of workers' compensation insurance using National Council of Compensation Insurance (NCCI), 1990-2009, and National Association of Social Insurance (NASI), 2005-2010, data. Negative values are observed in states where a source of changes in insurance premiums resulted in net decreases in premiums from 1990 until the year in question. Components sum to mean workers' compensation insurance premiums paid by employers as $ cost per $100 wages within a state and year. Components include: The baseline premiums in 1989 and the portions attributable to changes in mandatory benefits, employer experience ratings, and miscellenous sources.

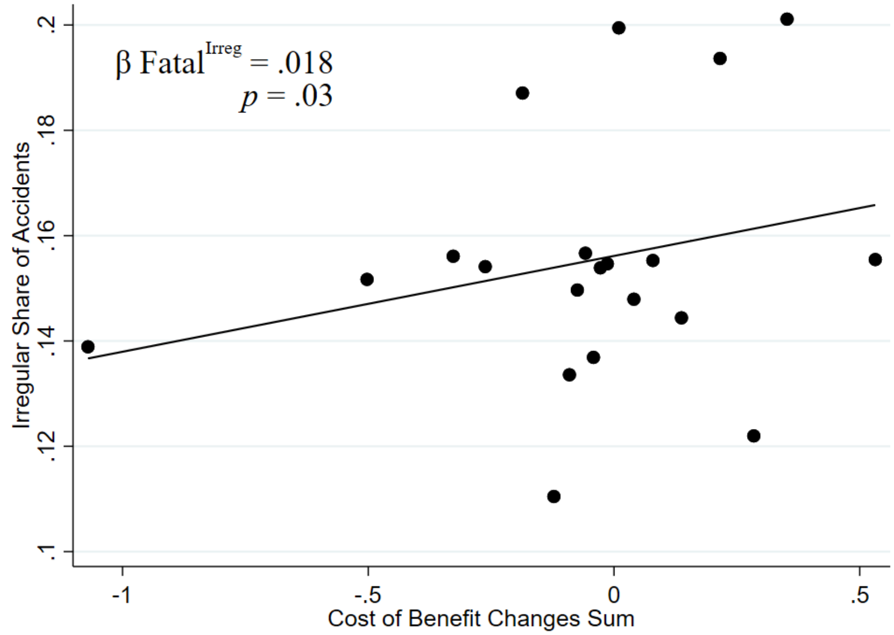
Figure 4: Employment Composition, Top 40 Occupations By Risk



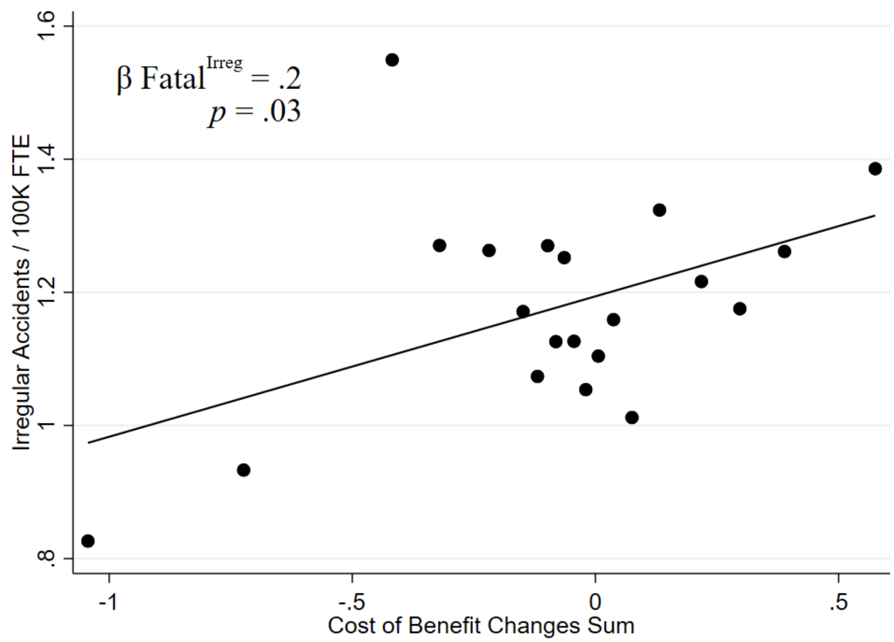
Note: Male FTE Density denotes the portion of total male employment within the 40 occupational codes with the most OSHA investigated fatalities within our sample (1990-2010). Fatal Accidents (RHS) includes only those investigated by OSHA. Upper (High Benefit) and Lower (Low Benefit) quartiles of the dollar cost of insurance premiums attributable state-legislated changes in mandatory workers' compensation benefits between 1990 and 2009 (P^B_{sy}) . Wages in 2009 dollars (PCE-adjusted).

Figure 5: Irregular Task Fatalities per 100K FTE over workers' compensation Benefit Costs

Irregular Share of All Accidents

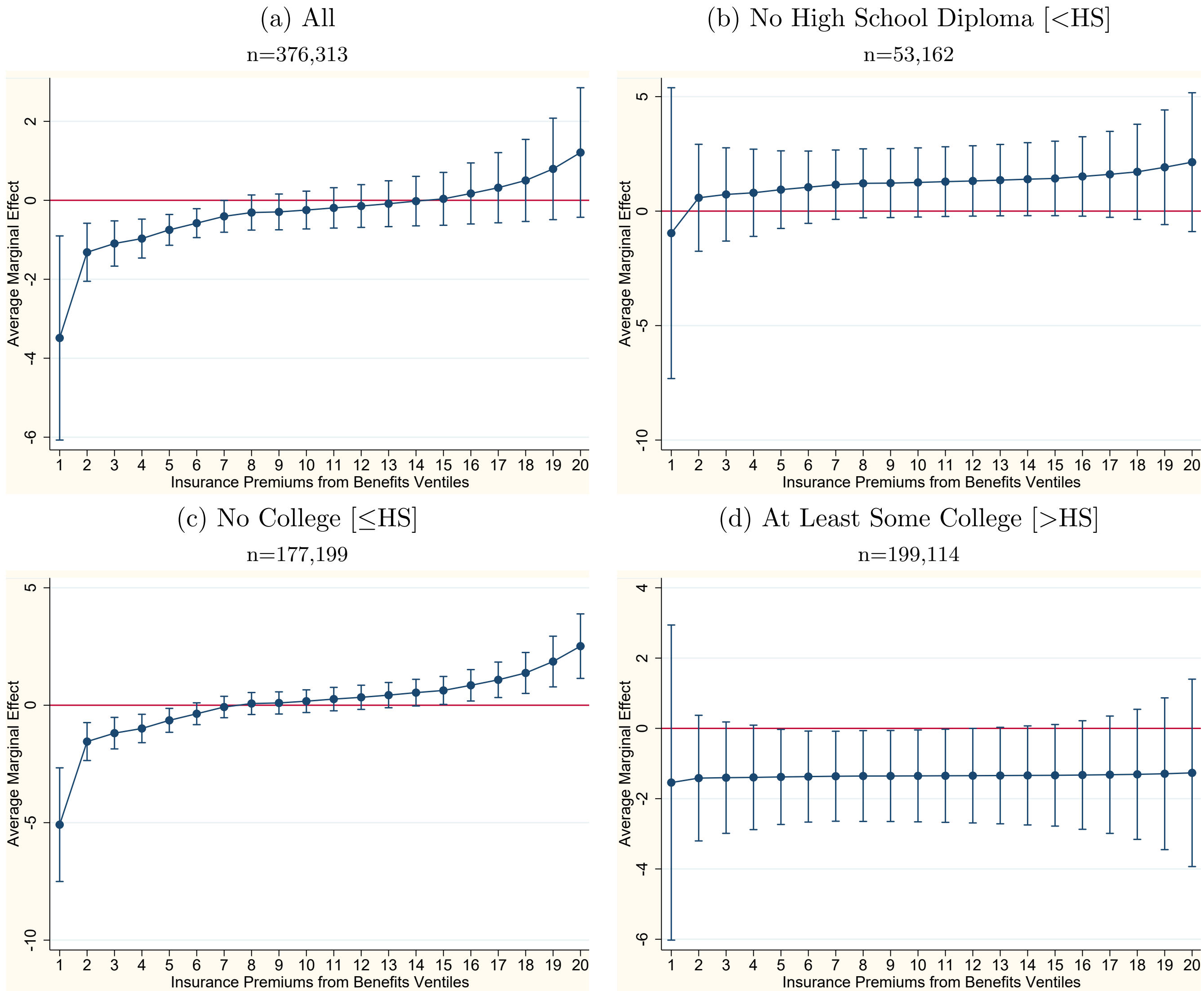


Irregular Accidents per 100K FTE



Note: Binscatters of within-industry effects of legislated changes in mandatory workers' compensation benefits. (upper) $\frac{Fatal^{Irregular}_{ksy}}{Fatal^{Total}_{ksy}}$, and (lower) $\text{Fatal}^{Irregular}_{ksy}$, residualized by state and year. Bins plotted over the over the dollar cost of insurance premiums attributable state-legislated changes in mandatory workers' compensation benefits in state s between 1990 and year y (P^B_{sy}). Estimated coefficients and p values are from the corresponding two-way fixed effects panel regression. Observations reflect only males working private sector jobs.

Figure 6: By Education: Average Marginal Effects of Irregular-Task Fatalities per 100 Male FTE

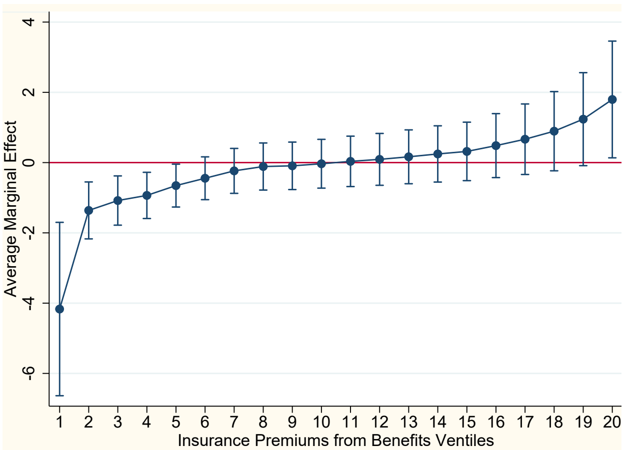


Note: Marginal effect of Irregular Fatal Accidents per 100 male FTE on log wages, with 95% confidence intervals. Underlying regression specifications are identical to column 2 in Table 5. X-axes are ventile bins of P^B_{sy}. Observations include only males working private sector jobs. All regressions include year, state, industry, and occupational code fixed effects, and state-specific quadratic time trends, as well as the quadratic rate of non-fatal accidents resulting in hospital admission. Additional covariate controls include U.S. Born, married (1/0), full-time (1/0), urban metro region (1/0), union participation (1/0), experience, and experience squared. Robust standard errors are clustered by state and shown in parentheses. Wages in 2009 dollars (PCE-adjusted).

Figure 7: By Industry Risk: Average Marginal Effects of Irregular-Task Fatalities per 100 Male FTE

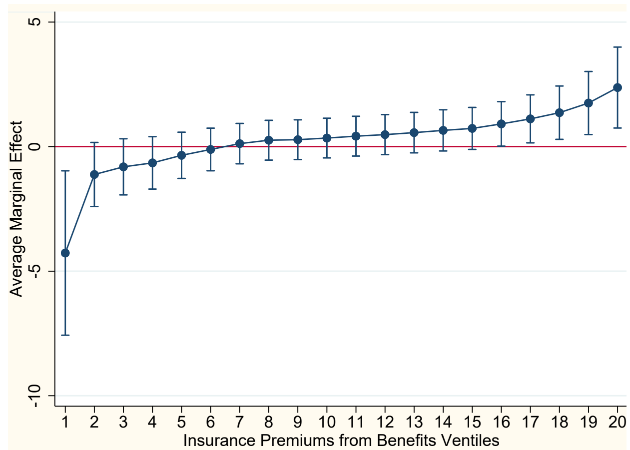
(a) All Workers, $\rho_k > 25$

n=103,755



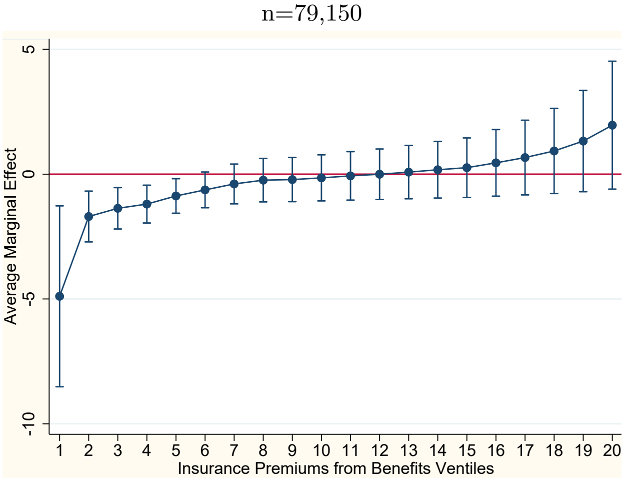
(b) Workers w/o College, $\rho_k > 25$

n=59,909



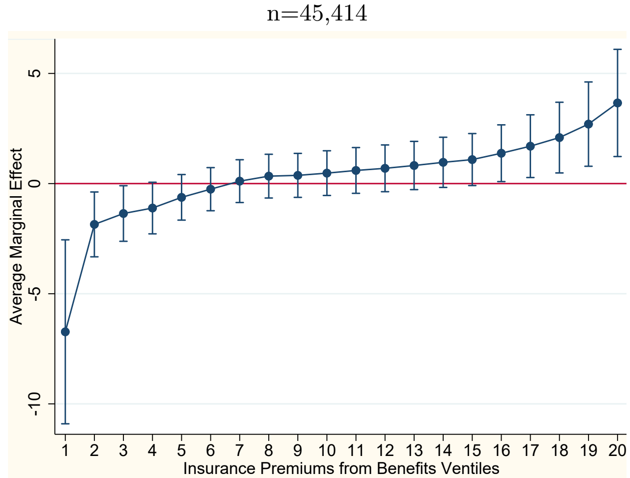
(c) All Workers, $\rho_k > 10$

n=79,150



(d) Workers w/o College, $\rho_k > 10$

n=45,414

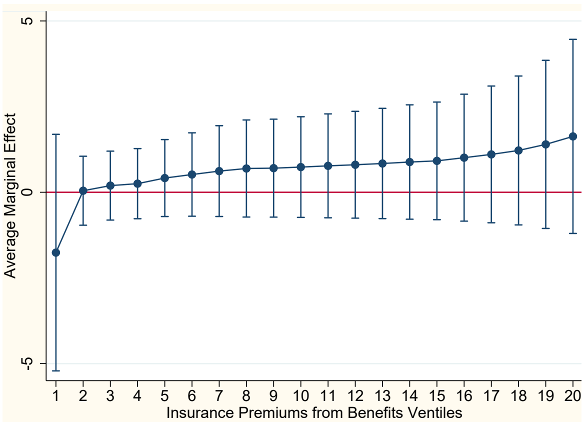


Note: Marginal effect of irregular-task fatalities per 100 male FTE on log wages, with 95% confidence intervals. Underlying regression specifications are identical to column 2 in Table 5. X-axes are ventile bins of P^B_{sy}. Observations include only males working private sector jobs. All regressions include year, state, industry, and occupational code fixed effects, and state-specific quadratic time trends, as well as the quadratic rate of non-fatal accidents resulting in hospital admission. Additional covariate controls include U.S. Born, education categories, married (1/0), full-time (1/0), urban metro region (1/0), union participation (1/0), experience, and experience squared. Robust standard errors are clustered by state and shown in parentheses. Wages in 2009 dollars (PCE-adjusted).

Figure 8: By Race and Ethnicity: Average Marginal Effects of Irregular-Task Fatalities per 100 Male FTE

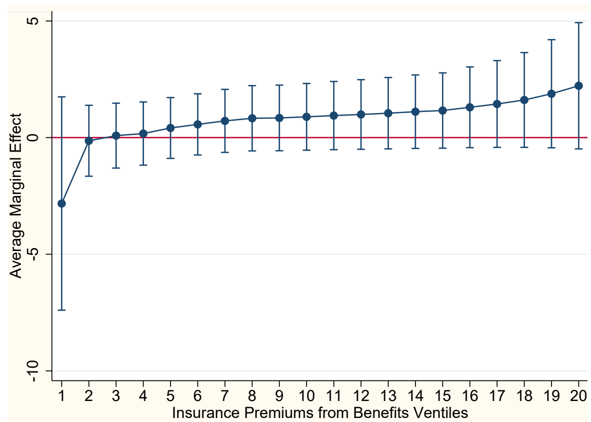
(a) all Latino

n=50,250



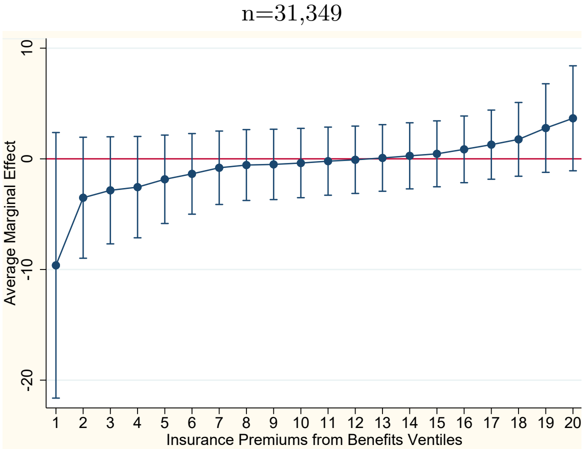
(b) Latino w/o college

n=69,446



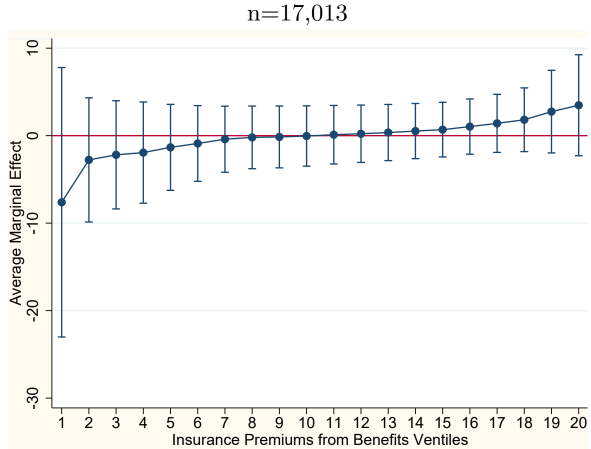
(c) all Black

n=31,349



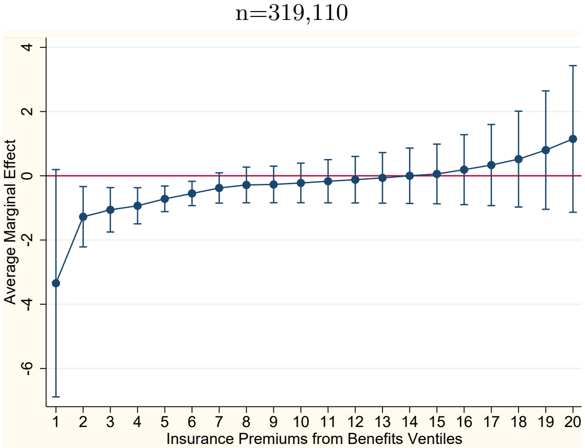
(d) Black w/o college

n=17,013



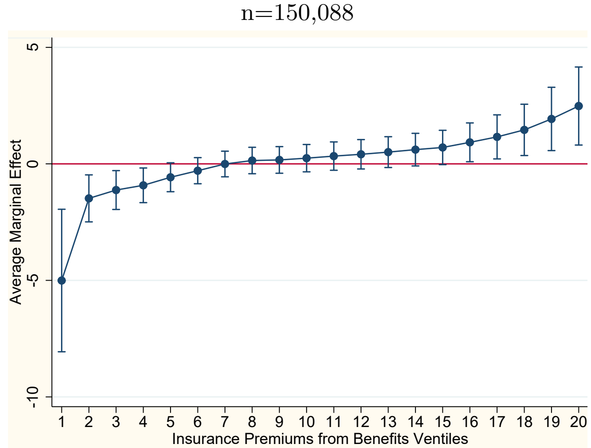
(e) all White

n=319,110



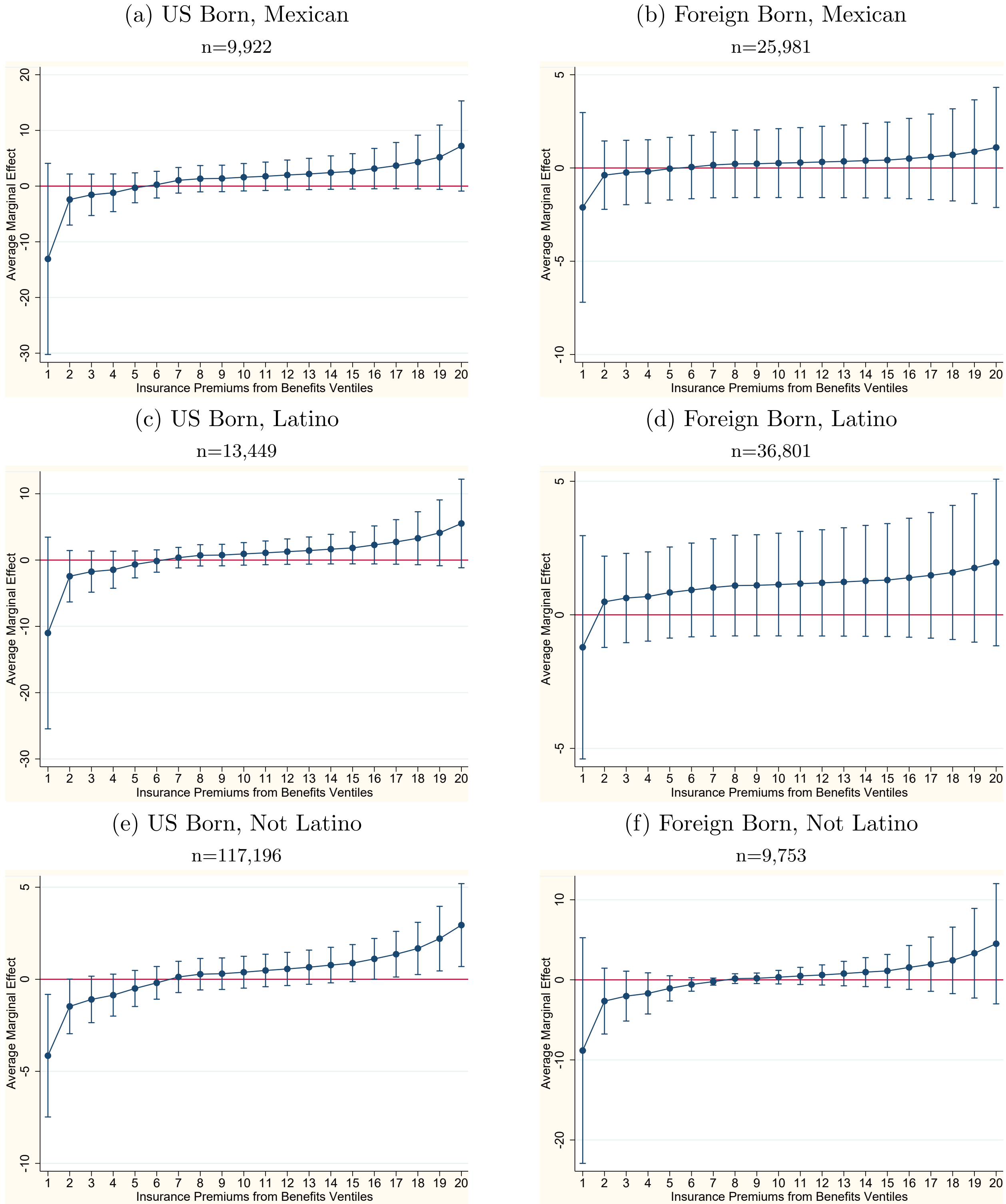
(f) White w/o college

n=150,088



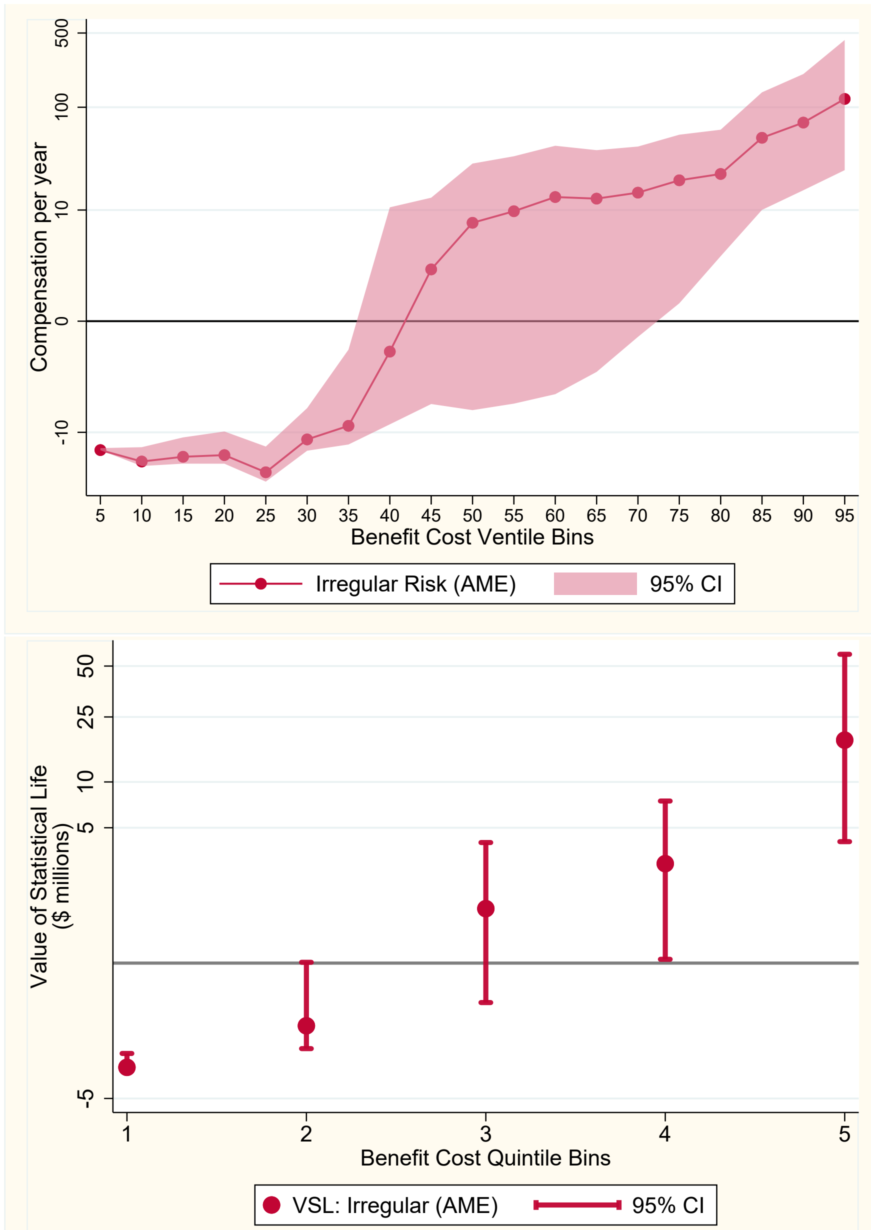
Notes: Marginal effect of irregular-task fatalities per 100 male FTE on log wages, with 95% confidence intervals. Underlying regression specifications are identical to column 2 in Table 5. X-axes are ventile bins of P^B_{sy}. Observations include only males working private sector jobs. All regressions include year, state, industry, and occupational code fixed effects, and state-specific quadratic time trends, as well as the quadratic rate of non-fatal accidents resulting in hospital admission. Additional covariate controls include U.S. Born, education categories, married (1/0), full-time (1/0), urban metro region (1/0), union participation (1/0), experience, and experience squared. Robust standard errors are clustered by state and shown in parentheses. Wages in 2009 dollars (PCE-adjusted).

Figure 9: Foreign vs Domestic Born Workers Without College Education: Average Marginal Effects of Irregular Task Fatalities per 100 Male FTE



Notes: Marginal effect of irregular-task fatalities per 100 male FTE on log wages, with 95% confidence intervals. Underlying regression specifications are identical to column 2 in Table 5. X-axes are ventile bins of P^B_{sy}. Observations include only males working private sector jobs. All regressions include year, state, industry, and occupational code fixed effects, and state-specific quadratic time trends, as well as the quadratic rate of non-fatal accidents resulting in hospital admission. Additional covariate controls include education categories, married (1/0), full-time (1/0), urban metro region (1/0), union participation (1/0), experience, and experience squared. Robust standard errors are clustered by state and shown in parentheses. Wages in 2009 dollars (PCE-adjusted).

Figure 10: Average Irregular Risk Compensation and estimated VSL by Benefit Cost: Workers without College Education



Notes: n=177,199. Total yearly wages received for physical risk, separately estimated for regular and irregular task risk. Underlying regression specifications are identical to column 2, middle panel, in Table 7. Wages in 2009 dollars (PCE-adjusted).

Risk Compensation $= (e^{\beta(Fatal^{Irreg}_{ksy})} - 1) \times \overline{w}_{osy} \times 2000 \times \overline{Fatal}^{R}_{ksy}$

VSL $= (e^{\beta(Fatal^{Irreg}_{ksy})} - 1) \times \overline{w}_{osy} \times 2000 \times 100$, where $\overline{w}_{osyv}$ is the average wage (by occupation, state, and year) within benefit premium ventile v. Estimates of VSL are collapsed to quintiles for ease of comparison.

10 Tables

Table 1: OSHA investigated accidents, 1990-2009

	All	Regular	Irregular
Fatal Accidents	36,357	30,919	5,438
Male Fatal Accidents	35,104	29,827	5,277

Table 2: Male Fatal Accident Rates per 100 FTE Workers, by Occupation, Industry, State, and Year

	Mean	SD	Min	Max
Fatal_{osy}	0.0016	0.0068	0.0000	1.2146
$\text{Fatal}_{osy}^{Regular}$	0.0013	0.0062	0.0000	1.2146
$\text{Fatal}_{osy}^{Irregular}$	0.0002	0.0021	0.0000	0.7439
Fatal_{ksy}	0.0032	0.0128	0.0000	2.3537
$\text{Fatal}_{ksy}^{Regular}$	0.0027	0.0117	0.0000	2.3537
$\text{Fatal}_{ksy}^{Irregular}$	0.0005	0.0039	0.0000	0.7333
Observations	376312			

Notes: These values are based on the universe of records from OSHA investigations of fatal accidents (numerators) and the full sample of male employees in the Current Population Survey (denominators) between 1990 and 2009. Estimates of occupation (o) and industry(k) fatalities are both within state-year panels (sy). Law Enforcement and Military employees are excluded from the sample. Sample limited to observations with sufficiently complete date to be included in our analytical sample. One full-time equivalent (FTE) worker represents 2000 hours of work hours imputed from responses in the CPS.

Table 3: State workers' compensation Premiums, Changes and Source Decomposition, 1990-2009

workers' compensation Premiums: Price per \$ 100 Wages

	Mean	Std Dev	Min	Max
Mean Premium (P_{sy}^{Total})	1.721	0.809	0.407	6.131
- Attributable to Legislated Benefit Changes (P_{sy}^{B})	0.001	0.244	-1.118	1.098
- Attributable to Firm Experience Rating Changes (P_{sy}^{E})	0.213	0.716	-2.059	2.401
- Attributable to Miscelleneous Sources (P_{sy}^{M})	-0.168	0.275	-1.079	0.401
Observations	865			

1-Year Changes in workers' compensation Premiums: Price per \$ 100 Wages

	Mean	Std Dev	Min	Max
1-Year Change in Mean Premium (ΔP_{sy}^{Total})	-0.014	0.189	-1.248	0.881
- Attributable to Legislated Benefit Changes (ΔP_{sy}^{B})	0.002	0.079	-1.198	0.721
- Attributable to Firm Experience Rating Changes (ΔP_{sy}^{E})	0.001	0.218	-1.307	1.597
- Attributable to Miscelleneous Sources (ΔP_{sy}^{M})	-0.013	0.065	-0.490	0.313
Observations	851			

Notes: (upper table) Workers' Compensation Premiums (as \$ cost/ per \$100 wages) by state and year, 1990 to 2009. Source decomposition imputed from reported year over year changes from benefit legislation, firm experience ratings, and miscellenous sources. (lower table) Imputed dollar-value of year over year changes by category. Values and Imputations based on National Council of Compensation Insurance (1990-2009) and National Association of Social Insurance (2005-2010) data Wages in 2009 dollars (PCE-adjusted).

Table 4: Baseline Estimates: Log Wages over Risk

	(1)	(2)	(3)	(4)	(5)	(6)
Fatal_{osy}	0.492**	0.509**	0.451**			
	(0.229)	(0.237)	(0.222)			
Fatal_{osy}^{Reg}				0.575**	0.501*	0.557*
				(0.280)	(0.275)	(0.280)
$\text{Fatal}_{osy}^{Irreg}$				0.107	0.047	0.115
				(0.805)	(0.854)	(0.826)
P_{sy}^{Total}	-0.001	-0.003	-0.004	-0.003	-0.004	-0.002
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
VSL (millions)	3.024	3.150	2.709	3.691	3.092	3.544
Mean Risk Comp.	52.7	54.9	47.2	.	.	.
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes
Ind FE	None	Coarse	Fine	None	Fine	Coarse
Occ FE	Yes	Yes	Yes	Yes	Yes	Yes
R^2	.422	.429	.444	.422	.444	.429
N	376312	376312	376312	376312	376312	376312

Notes: Standard errors in parentheses * (p <0.10),** (p <0.05), *** (p <0.01). Results are baseline estimates of wages on risk measured at the occupation-state-year level. Risk in Columns 3 and 4 separates regular and irregular fatal accident risk. Coefficients on iorregular task risk measured at the occupation level are expected to be small given their rarity and the expectation of misclassification. Observations include only males working private sector jobs. All regressions include year, state, industry, occupational code fixed effects, and state-specific quadratic time trends, as well as the quadratic rate of non-fatal accidents resulting in hospital admission. Additional covariate controls include U.S. Born, education categories, married (1/0), full-time (1/0), urban metro region (1/0), union participation (1/0), experience, and experience squared. Robust standard errors are clustered by state and shown in parentheses. Wages in 2009 dollars.

$\text{VSL} = (e^{\beta(Fatal_{ksy}^{R})} - 1) \times \overline{w}_{osy} \times 2000 \times 100$

Mean Risk Compensation $= (e^{\beta(Fatal_{ksy}^{R})} - 1) \times \overline{w}_{osy} \times 2000 \times \overline{Fatal}_{ksy}^{R}$, where $\overline{w}_{osyv}$ is the average wage (by occupation, state, and year) within benefit premium ventile v, and $R \in \{All, Regular\}$.

Table 5: Irregular Risk Wages Differentials by Summed Insurance Premiums Attributable to Mandated Workers' Compensation Benefits

	(1) All	(2) All	(3) ρ_k > 50	(4) ρ_k > 75	(5) ρ_k > 90
$\text{Fatal}_{ksy}^{Irreg}$	-0.359*	-0.310	-0.297	-0.111	-0.370
	(0.208)	(0.221)	(0.279)	(0.333)	(0.409)
$\text{Fatal}_{ksy}^{Irreg} \times P_{sy}^{B}$		3.395**	3.016	4.194***	4.516**
		(1.492)	(1.883)	(1.375)	(2.108)
Fatal_{osy}^{Reg}	0.507*	0.505*	0.328	0.459	0.257
	(0.260)	(0.260)	(0.294)	(0.322)	(0.331)
P_{sy}	-0.004	-0.004	-0.009***	-0.001	-0.009
	(0.003)	(0.003)	(0.003)	(0.007)	(0.009)
Year FE	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes
Ind FE	Fine	Fine	Fine	Fine	Fine
Occ FE	Yes	Yes	Yes	Yes	Yes
R^2	0.444	0.444	0.401	0.414	0.332
N	376312	376312	169481	103755	59777

Notes: Standard errors in parentheses * (p <0.10),** (p <0.05), *** (p <0.01). P_{sy}^{B} is the dollar portion of premiums attributable to state-legislated changes in mandatory workers' compensation benefits between 1990 and 2009. Observations include only males working private sector jobs. Columns 3 - 5 include only workers employed in industry k whose rate of fatal accidents per male FTE between 1990 and 2009 is greater than the ρ percentile of all industries. All regressions include year, state, industry, and occupational code fixed effects, and state-specific quadratic time trends, as well as the quadratic rate of non-fatal accidents resulting in hospital admission. Additional covariate controls include U.S. Born, education categories, married (1/0), full-time (1/0), urban metro region (1/0), union participation (1/0), experience, and experience squared. Robust standard errors are clustered by state and shown in parentheses. Wages in 2009 dollars (PCE-adjusted).

Table 6: Irregular Risk Wages Differentials by 1-Year Premium Changes Attributable to Mandated Workers' Compensation Benefits

	(1) All	(2) All	(3) ρ_k > 50	(4) ρ_k > 75	(5) ρ_k > 90
$\text{Fatal}_{ksy}^{Irreg}$	-0.359*	-0.351*	-0.330	-0.106	-0.371
	(0.208)	(0.206)	(0.257)	(0.343)	(0.382)
$\text{Fatal}_{ksy}^{Irreg} \times \Delta P_{sy}^{B}$		5.247*	6.475***	6.465***	7.164***
		(2.963)	(2.295)	(1.823)	(2.199)
Fatal_{osy}^{Reg}	0.507*	0.506*	0.327	0.455	0.249
	(0.260)	(0.261)	(0.294)	(0.322)	(0.328)
P_{sy}	-0.004	-0.004	-0.009***	0.000	-0.008
	(0.003)	(0.003)	(0.003)	(0.007)	(0.008)
Year FE	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes
Ind FE	Fine	Fine	Fine	Fine	Fine
Occ FE	Yes	Yes	Yes	Yes	Yes
R^2	0.444	0.444	0.401	0.414	0.332
N	376312	376312	169481	103755	59777

Notes: Standard errors in parentheses * (p <0.10),** (p <0.05), *** (p <0.01). ΔP_{sy}^{B} is the change in average workers' compensation premiums per $100 wages paid created directly by legislated changes in mandated workers' compensation benefits. Observations include only males working private sector jobs. Columns 3 - 5 include only workers working in industry k whose rate of fatal accidents per male FTE between 1990 and 2009 is greater than the ρ percentile of all industries. All regressions include year, state, industry, occupational code fixed effects, and state-specific quadratic time trends, as well as the quadratic rate of non-fatal accidents resulting in hospital admission. Additional covariate controls include U.S. Born, education categories, married (1/0), full-time (1/0), urban metro region (1/0), union participation (1/0), experience, and experience squared. Robust standard errors are clustered by state and shown in parentheses. Wages in 2009 dollars (PCE-adjusted).

Table 7: Irregular Risk Wage Differentials by Education

Highest Educational Attainment < High School (no diploma)

	(1) All	(2) All	(3) ρ_k > 50	(4) ρ_k > 50	(5) ρ_k > 75	(6) ρ_k > 75	(7) ρ_k > 90	(8) ρ_k > 90
$\text{Fatal}_{ksy}^{Irreg}$	1.270*	1.213	0.675	0.653	0.747	0.698	0.734	0.434
	(0.749)	(0.748)	(0.631)	(0.643)	(0.717)	(0.739)	(0.906)	(0.874)
$\text{Fatal}_{ksy}^{Irreg} \times \Delta P_{sy}^{B}$	3.356		1.797		5.384		19.601***	
	(4.972)		(5.652)		(6.160)		(5.288)	
$\text{Fatal}_{ksy}^{Irreg} \times P_{sy}^{B}$		2.111		0.899		0.441		8.000***
		(2.977)		(2.750)		(2.868)		(2.530)
Fatal_{osy}^{Reg}	0.455	0.460	0.528	0.531	0.575	0.577	-0.078	-0.048
	(0.612)	(0.613)	(0.645)	(0.645)	(0.745)	(0.746)	(0.894)	(0.899)
R^2	0.232	0.232	0.212	0.212	0.200	0.200	0.178	0.178
N	53162	53162	31940	31940	21315	21315	15167	15167

Highest Educational Attainment ≤ High School (no college)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\text{Fatal}_{ksy}^{Irreg}$	-0.033	0.072	-0.056	0.039	0.369	0.257	0.367	0.221
	(0.285)	(0.233)	(0.301)	(0.236)	(0.345)	(0.396)	(0.406)	(0.479)
$\text{Fatal}_{ksy}^{Irreg} \times \Delta P_{sy}^{B}$	8.221***		10.522***		11.592***		15.694***	
	(2.466)		(3.421)		(2.833)		(2.823)	
$\text{Fatal}_{ksy}^{Irreg} \times P_{sy}^{B}$		5.457***		4.577***		4.629***		6.450***
		(1.309)		(1.458)		(1.598)		(2.229)
Fatal_{osy}^{Reg}	0.327	0.325	0.274	0.276	0.374	0.380	0.135	0.145
	(0.233)	(0.233)	(0.288)	(0.288)	(0.293)	(0.294)	(0.308)	(0.310)
R^2	0.312	0.312	0.289	0.289	0.286	0.286	0.269	0.269
N	177198	177198	96884	96884	59909	59909	40833	40833

Highest Educational Attainment > High School (at least some college)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\text{Fatal}_{ksy}^{Irreg}$	-1.357**	-1.356**	-1.561*	-1.592*	-1.479*	-1.444*	-2.727**	-2.711**
	(0.643)	(0.641)	(0.918)	(0.905)	(0.830)	(0.819)	(1.091)	(1.099)
$\text{Fatal}_{ksy}^{Irreg} \times \Delta P_{sy}^{B}$	-2.091		-1.695		-0.213		-2.245	
	(5.026)		(3.293)		(2.870)		(2.751)	
$\text{Fatal}_{ksy}^{Irreg} \times P_{sy}^{B}$		0.200		1.232		3.085		2.944
		(2.392)		(2.960)		(2.606)		(3.078)
Fatal_{osy}^{Reg}	0.412	0.412	0.296	0.296	0.662*	0.663*	0.426	0.432
	(0.430)	(0.430)	(0.476)	(0.476)	(0.384)	(0.383)	(0.515)	(0.515)
R^2	0.415	0.415	0.384	0.384	0.391	0.391	0.321	0.321
N	199114	199114	72597	72597	43846	43846	18944	18944

Notes: Standard errors in parentheses * (p <0.10),** (p <0.05), *** (p <0.01). Observations include only males working private sector jobs. Columns 3 - 5 include only workers employed in industry k whose rate of fatal accidents per male FTE between 1990 and 2009 is greater than the ρ percentile of all industries. All regressions include year, state, industry, occupational code fixed effects, and state-specific quadratic time trends, as well as the quadratic rate of non-fatal accidents resulting in hospital admission. Additional covariate controls include U.S. Born, education categories, married (1/0), full-time (1/0), urban metro region (1/0), union participation (1/0), experience, and experience squared. Robust standard errors are clustered by state and shown in parentheses. Wages in 2009 dollars (PCE-adjusted).

Table 8: No College, by Race and Ethnicity: Irregular Risk Wage Differentials

Latino

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	All	All	ρ_k > 50	ρ_k > 50	ρ_k > 75	ρ_k > 75	ρ_k > 90	ρ_k > 90
$\text{Fatal}_{ksy}^{Irreg}$	0.741	0.828	0.860	0.983	1.244	1.109	1.081	1.268
	(0.607)	(0.694)	(0.682)	(0.773)	(0.840)	(0.856)	(1.460)	(1.464)
$\text{Fatal}_{ksy}^{Irreg} \times \Delta P_{sy}^{B}$	8.266*		8.508*		7.360*		16.134***	
	(4.779)		(5.035)		(4.334)		(4.402)	
$\text{Fatal}_{ksy}^{Irreg} \times P_{sy}^{B}$		3.242		3.958*		-0.329		3.008
		(2.154)		(2.099)		(2.232)		(3.284)
Fatal_{osy}^{Reg}	0.107	0.108	0.211	0.224	0.193	0.179	-0.675	-0.689
	(0.449)	(0.448)	(0.375)	(0.373)	(0.520)	(0.523)	(0.564)	(0.569)
R^2	0.222	0.222	0.207	0.207	0.202	0.202	0.180	0.180
N	50250	50250	29589	29589	20148	20148	14289	14289
Black								
$\text{Fatal}_{ksy}^{Irreg}$	0.605	-0.198	-0.707	-0.899	-1.089	-1.913	-1.905	-2.782
	(1.695)	(1.776)	(1.439)	(1.516)	(1.235)	(1.642)	(1.827)	(1.978)
$\text{Fatal}_{ksy}^{Irreg} \times \Delta P_{sy}^{B}$	7.685		10.136		5.975		18.390	
	(22.409)		(21.014)		(26.534)		(29.982)	
$\text{Fatal}_{ksy}^{Irreg} \times P_{sy}^{B}$		8.663		2.112		8.606		13.769
		(7.731)		(7.738)		(7.752)		(13.895)
Fatal_{osy}^{Reg}	0.129	0.128	0.343	0.346	0.634	0.640	0.763	0.765
	(1.100)	(1.101)	(1.218)	(1.218)	(1.428)	(1.431)	(1.414)	(1.417)
R^2	0.219	0.219	0.195	0.195	0.179	0.179	0.145	0.145
N	17013	17013	8344	8344	4717	4717	2698	2698
White								
$\text{Fatal}_{ksy}^{Irreg}$	-0.016	0.144	-0.020	0.119	0.445	0.396	0.409	0.298
	(0.315)	(0.282)	(0.335)	(0.286)	(0.380)	(0.442)	(0.449)	(0.565)
$\text{Fatal}_{ksy}^{Irreg} \times \Delta P_{sy}^{B}$	7.390***		8.887***		10.321***		14.064***	
	(2.469)		(3.170)		(2.812)		(3.443)	
$\text{Fatal}_{ksy}^{Irreg} \times P_{sy}^{B}$		5.484***		4.761***		4.217**		5.368**
		(1.669)		(1.655)		(1.872)		(2.613)
Fatal_{osy}^{Reg}	0.439	0.437	0.334	0.335	0.394	0.399	0.128	0.136
	(0.268)	(0.268)	(0.307)	(0.308)	(0.306)	(0.307)	(0.363)	(0.365)
R^2	0.326	0.326	0.301	0.301	0.300	0.300	0.283	0.283
N	150087	150087	83969	83969	52316	52316	36327	36327

Notes: Standard errors in parentheses * (p <0.10),** (p <0.05), *** (p <0.01). Observations include only males working private sector jobs. Columns 3 - 5 include only workers employed in industry k whose rate of fatal accidents per male FTE between 1990 and 2009 is greater than the ρ percentile of all industries. All regressions include year, state, industry, occupational code fixed effects, and state-specific quadratic time trends, as well as the quadratic rate of non-fatal accidents resulting in hospital admission. Additional covariate controls include U.S. Born, education categories, married (1/0), full-time (1/0), urban metro region (1/0), union participation (1/0), experience, and experience squared. Robust standard errors are clustered by state and shown in parentheses. Wages in 2009 dollars (PCE-adjusted).

11 Appendices

A Dataset Assembly

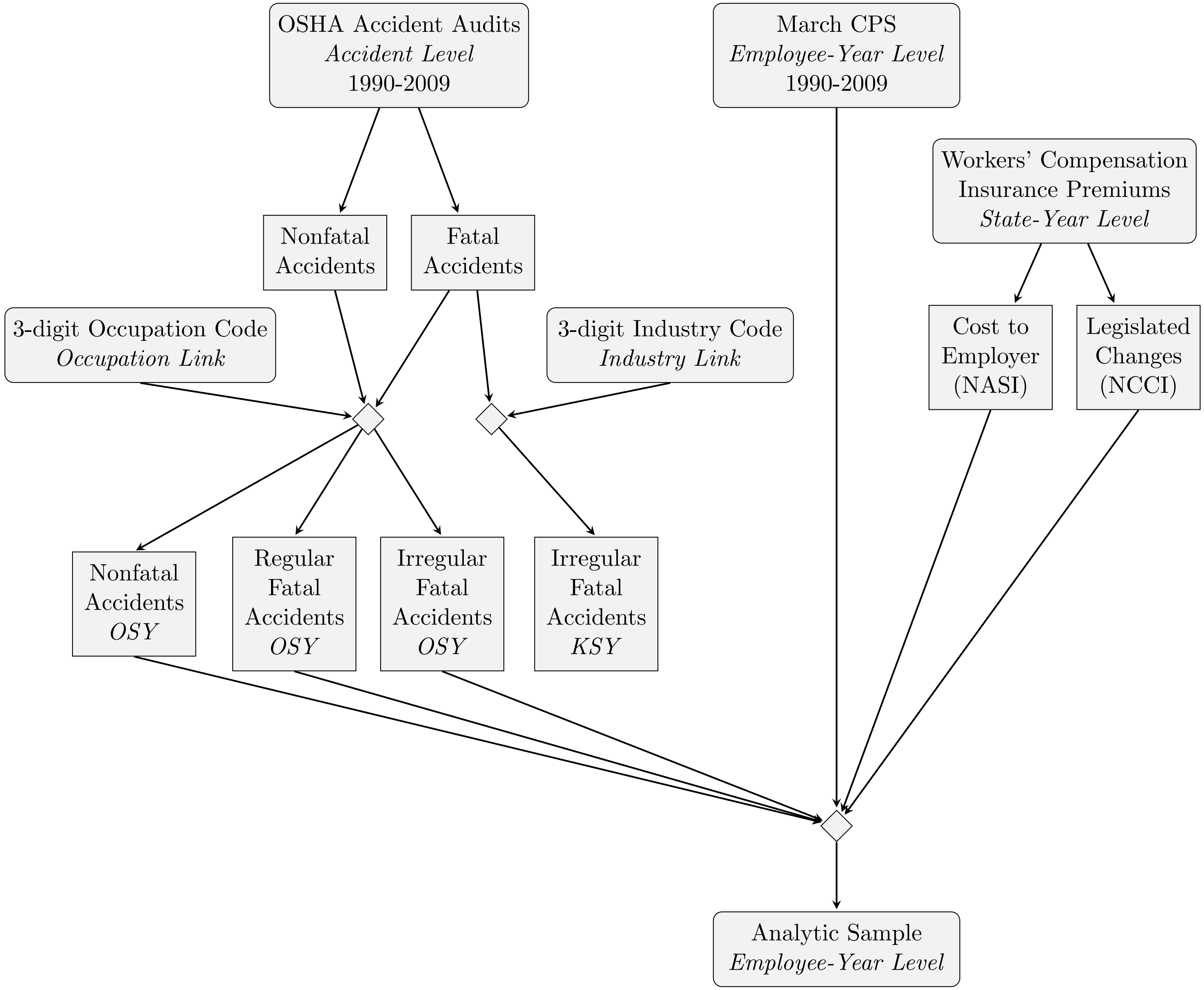
Our final dataset at the core of our analysis is contructed from 1) records from OSHA audits of reported accidents, 2) National Association of Social Insurance (NASI) records of workers compensation costs, 3) the Council of Compensation Insurance (NCCI) decomposition of those worker compensation costs into source components, and 4) the outgoing rotation groups of the Current Population Survey from 1990 to 2009. Below we include both a quick summary of the sources, the variables over which they are conjoined, and the levels at which panels are collapsed.

Occupational Safety and Health Agency (OSHA) records of audits of reported accidents were obtained directly from the agency. Each record includes the state and year in which the event occurred, the three-digit standard industrial code (SIC) of the employer and the three-digit Census occupation code of individuals injured in the accident. The records also allow for the separate counting in each event those who suffered a fatal injury or a non-fatal injury sufficiently serious that at least one person was admitted to a hospital. Each audit record also classifies the associated accident as having occurred during a regular or irregular employee task.

Given these variables within each accident record, we are able to create 2 separate counts aggregated 2 different ways: Regular and Irregular Fatal task accidents by *Occupation*-State-Year, Regular and Irregular Fatal task accidents by *Industry*-State-Year. The counts of fatal and non-fatal accidents were aggregated over 80 occupational categories using a crosswalk of occupational 3-digit Census occupation codes provided by the National Longitudinal Survey of Youth. The full list is included in Appendix E. Industry level risk measures were aggregated over 227 separate codes.

The foundation of our sample is microdata of individual respondents in outgoing rotation groups of the Current Population Survey from 1990 to 2009. Measures of risk were merged with individuals by occupation-state-year and industry-state-year. Insurance cost data assembled from the NCCI and NASI were merged by state and year. Details of insurance costs and decomposition can be found in Section 4.3. The result of these efforts is a final analytic sample of 387,679 respondents to the CPS from 46 states, 1990-2009, each with estimates of their employment exposure to fatal accident risk based on their industry, occupation, state, and year.

Figure A.1: Data Assembly Process



B Occupational misclassification, miscoding, and fraud

Misclassifying (or "miscoding") an employee under an incorrect, ostensibly safer, occupational title to lower their workers' compensation insurance premiums is a form of insurance fraud.[38] The NCCI and state Departments of Labor conduct on-site inspections of policyholder's business operations to assess whether businesses and their employees are being properly classified. Inspectors are charged with documenting "the type of work being conducted (e.g., process, materials, equipment, final product), or the employees or other personnel performing the work", quoted from NCCI's description of their "Classification Inspection Service".[39]

According to publicly available documentation, the most common incorrect employee classifications in 2015 and 2016 included salespersons, clerical positions, and janitorial services. Improper classification often involves labeling employees using generic "Not Otherwise Classifiable" (NOC) subcategories within broad occupational categories (i.e Retail NOC, Restaurant NOC, etc.[40]

In Figure B.1, we rank occupational categories by rate of fatal accidents per full time equivalent employee and then calculate within each occupational category the share of those fatal accidents that occurred while performing an irregular job task. Figure B.1 only includes bars for occupational categories where OSHA investigated at least 10 fatal accidents within our sample (1990 to 2009). While the occupational classification categories used by the NCCI and the (far coarser) census occupational codes reported by OSHA in their inspections do not match up perfectly, there are some similarities in Figure B.1 in the irregular share of fatal accidents for the relevant categories most frequently identified as misclassified by NCCI site inspectors. We observe varied irregular shares, with a notable spike for "Sales Representatives - Commodities except Retail.", which, along with "Cleaning and Building Services, except Household", constitutes two of the four occupational codes within the 3rd and 4th quartiles of fatal accident risk to exceed a 25% irregular share.

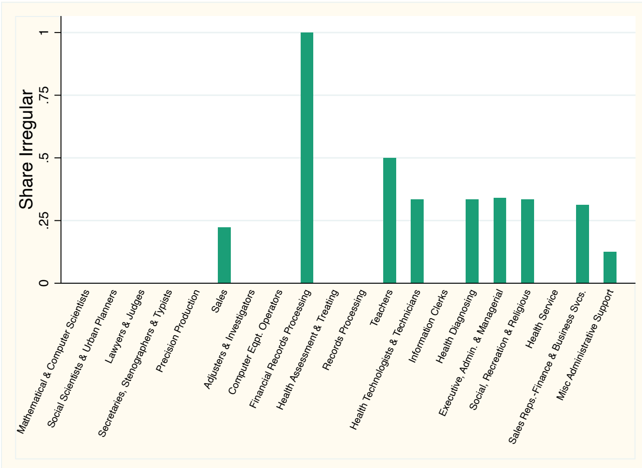
54% of OSHA's 32,900 male fatal accident reports from 1990 to 2009 include the industry code, by not the occupation of the victim. Records without occupation codes report the accident occurring during an irregular task 9.1pp more often (15.6% of accidents versus 14.3%). The fraction of reports without an occupational code for the victim increases with insurance costs from benefits in the state (P^B_{sy}), which is consistent with the hypothesis that worker misclassification makes it more difficult for inspectors to record a proper occupation for the victim, but we are unable to evaluate that hypothesis beyond the level of speculation. The positive relationship between unclassified fatal accident victims and insurance premiums lends some support to prior hypotheses that employers misclassify employees as "independent contractors" to avoid responsibility for workers' compensation coverage (Donahue, Lamare, Kotler, Fred, et al., 2007; Leberstein et al., 2012).

[38] "Knowingly misrepresenting an employee's job classification to obtain insurance at less than a proper rate" is a class A misdemeanor and is punishable by a fine of up to $10,000.Missouri Division of Workers' Compensation https://elara.com/wp-content/uploads/2020/10/Missouri-WC-Posting-2020-2-English.pdf

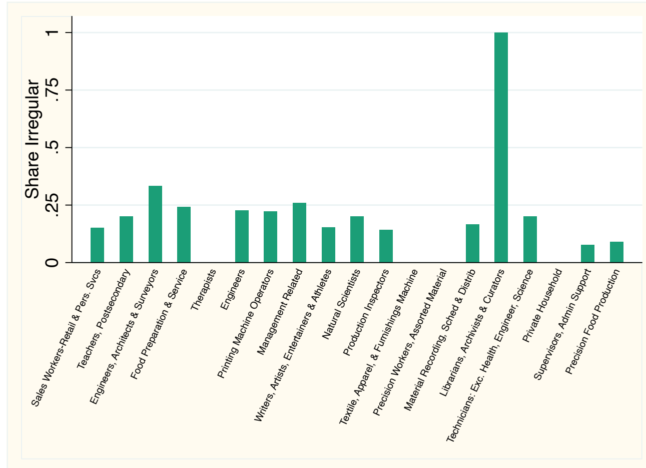
[39] https://www.ncci.com/ServicesTools/Pages/RAIS.aspx, accessed on 2/6/2020.

[40] (https://www.ncci.com/Articles/Pages/UW_2015ClassInspectionProgramUpdate.aspx and https://www.ncci.com/Articles/Pages/UW_2016-Class-Inspection-Program-Top-5-Reclassified-Codes.aspx, each accessed on 4/5/2018)

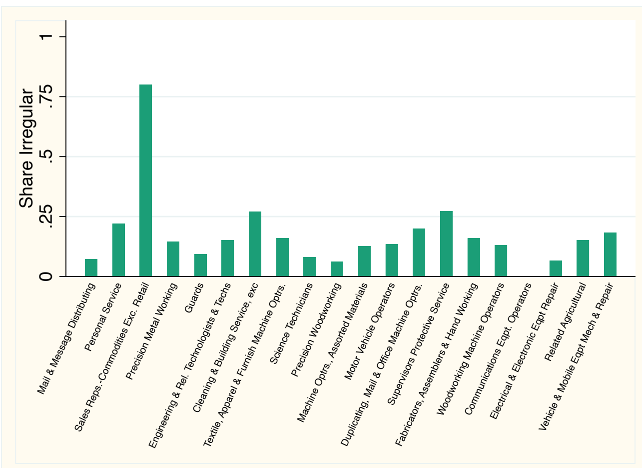
Figure B.1: Share of Irregular Deaths within Occupation, FTE weights



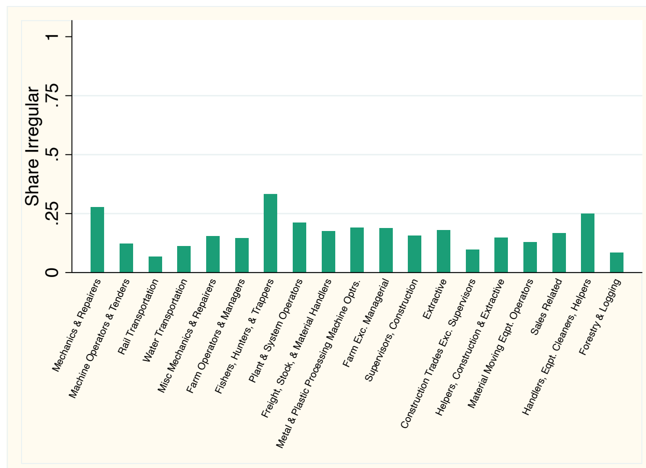
(a) First Quartile



(b) Second Quartile



(c) Third Quartile



(d) Fourth Quartile

Note: The calculated rates include all males in the CPS from 1990-2009. Quantile rankings defined by the total male death rate in the occupation over the full time period, weighted by full-time equivalent worker. Share irregular is defined for each occupation as the irregular fatality rate in that occupation divided by the normal fatality rate in that occupation.

C Regular Risk Compensation over Benefit Costs

The paper focuses on coefficients produced by a regression model of wages that includes both regular and irregular task risk as key right-hand side covariates, where irregular task risk is interacted with the costs of workers' compensation insurance attributable to legislated changes in benefits. For the sake of parsimony and more transparently interpretable coefficients, we do not include an interaction term for *regular* task risk with insurance costs. Our motivating theoretic model presented in section 3, however, predicts that in the absence of misclassification wages will decrease with mandatory benefits as the compensation bundle is shifted from wages towards benefits. If the costs of misclassification are sufficiently low that firms can evade minimum insurance requirements, however, this negative effect should be be dampened, though the net predicted effect on compensation for regular task risk is ambiguous.

In Table C.1 we replicate the specifications from Table 5, with addition of interaction terms between Fatal_{osy}^{Reg} and ΔP_{sy}^{B} or P_{sy}^{B}. In the short term, we observe negative coefficients on the $\text{Fatal}_{osy}^{Reg} \times \Delta P_{sy}^{B}$ interaction term ($p < 0.01$). In the longer term, however, this relationship appears to dissipate, resulting much smaller (sometimes trivial) coefficients on $\text{Fatal}_{osy}^{Reg} \times P_{sy}^{B}$, none of which are significant.

Plots of the marginal effects of the interaction between regular task risk with insurance benefit costs are even more telling of the weakness of observed effects. Figure C.1 tells a story congruent with our model and main results. Wages for irregular task risk are steadily increasing with the costs of mandatory benefits, while the wages paid for regular task risk are largely insensitive. The only exception observed is the higher wages paid for regular task risk in the lowest quantiles of ΔP_{sy}^{B}, which we interpret to indicate that the wages paid for regular task risk are increasing in the years subsequent to large *decreases* in the costs of mandatory benefits. The biggest takeaway from Figure C.1, in our opinion, is that the wage elasticity of regular task risk is insensitive to the costs of benefits, and the inclusion of $\text{Fatal}_{osy}^{Reg} \times P_{sy}^{B}$ only adds more noise than benefit to the estimation.

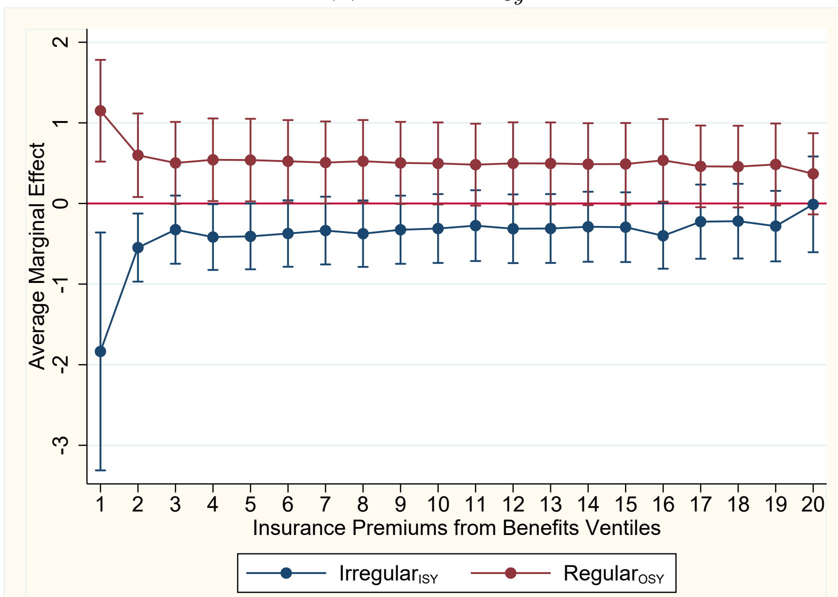
Table C.1: Irregular Risk Wages Differentials by Summed Insurance Premiums from Mandated workers' compensation Benefits

	(1) All	(2) All	(3) ρ_k > 50	(4) ρ_k > 50	(5) ρ_k > 75	(6) ρ_k > 75	(7) ρ_k > 90	(8) ρ_k > 90
$\text{Fatal}^{Irreg}_{ksy}$	-0.347	-0.310	-0.326	-0.297	-0.077	-0.110	-0.320	-0.365
	(0.207)	(0.221)	(0.259)	(0.279)	(0.343)	(0.334)	(0.385)	(0.413)
$\text{Fatal}^{Irreg}_{ksy} \times \Delta P^B_{sy}$	6.518*		7.492***		7.985***		8.853***	
	(3.281)		(2.465)		(1.819)		(2.139)	
$\text{Fatal}^{Irreg}_{ksy} \times P^B_{sy}$		3.387**		3.015		4.245***		4.592**
		(1.448)		(1.892)		(1.410)		(2.177)
Fatal^{Reg}_{osy}	0.512**	0.504*	0.343	0.328	0.488	0.469	0.291	0.289
	(0.253)	(0.276)	(0.288)	(0.318)	(0.313)	(0.336)	(0.325)	(0.348)
$\text{Fatal}^{Reg}_{osy} \times \Delta P^B_{sy}$	-2.794***		-2.237***		-3.067***		-3.007***	
	(0.649)		(0.575)		(0.505)		(0.536)	
$\text{Fatal}^{Reg}_{osy} \times P^B_{sy}$		0.048		0.008		-0.326		-0.982
		(1.449)		(1.630)		(1.486)		(1.562)
R^2	0.444	0.444	0.401	0.401	0.414	0.414	0.333	0.332
N	376312	376312	169481	169481	103755	103755	59777	59777

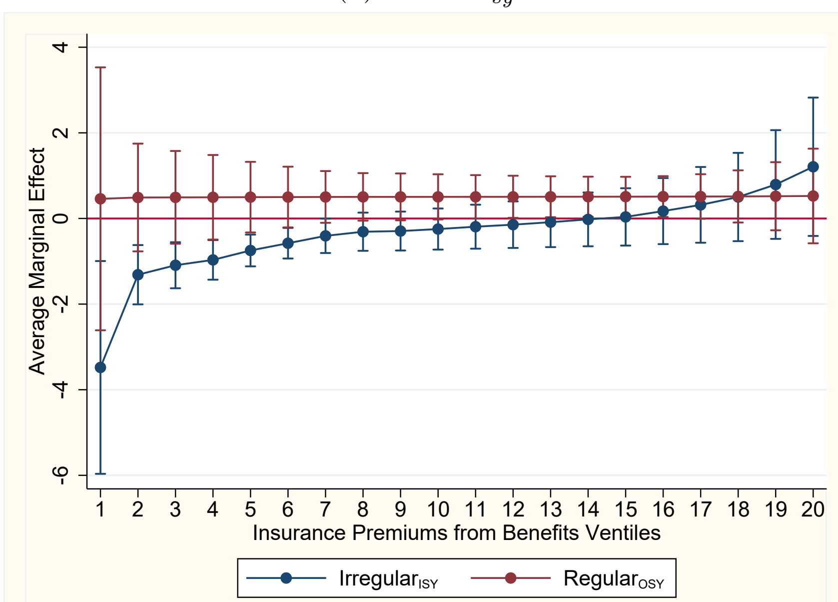
Notes: Standard errors in parentheses * (p <0.10),** (p <0.05), *** (p <0.01). P^B_{sy} is the dollar portion of premiums attributable to state-legislated changes in mandatory workers' compensation benefits between 1990 and 2009. Observations include only males working private sector jobs. Columns 3 - 5 include only workers working in industry k whose rate of fatal accidents per male FTE between 1990 and 2009 is greater than the ρ percentile of all industries. All regressions include year, state, industry, and occupational code fixed effects, as well as the quadratic rate of non-fatal accidents resulting in hospital admission. Additional covariate controls include U.S. Born, education categories, married (1/0), full-time (1/0), urban metro region (1/0), union participation (1/0), experience, and experience squared. Robust standard errors are clustered by state and shown in parentheses. Wages in 2009 dollars (PCE-adjusted).

Figure C.1: Regular vs Irregular Task Risk: Average Marginal Effects of Fatalities per 100 Male FTE

(a) Risk $\times \Delta P^B_{sy}$



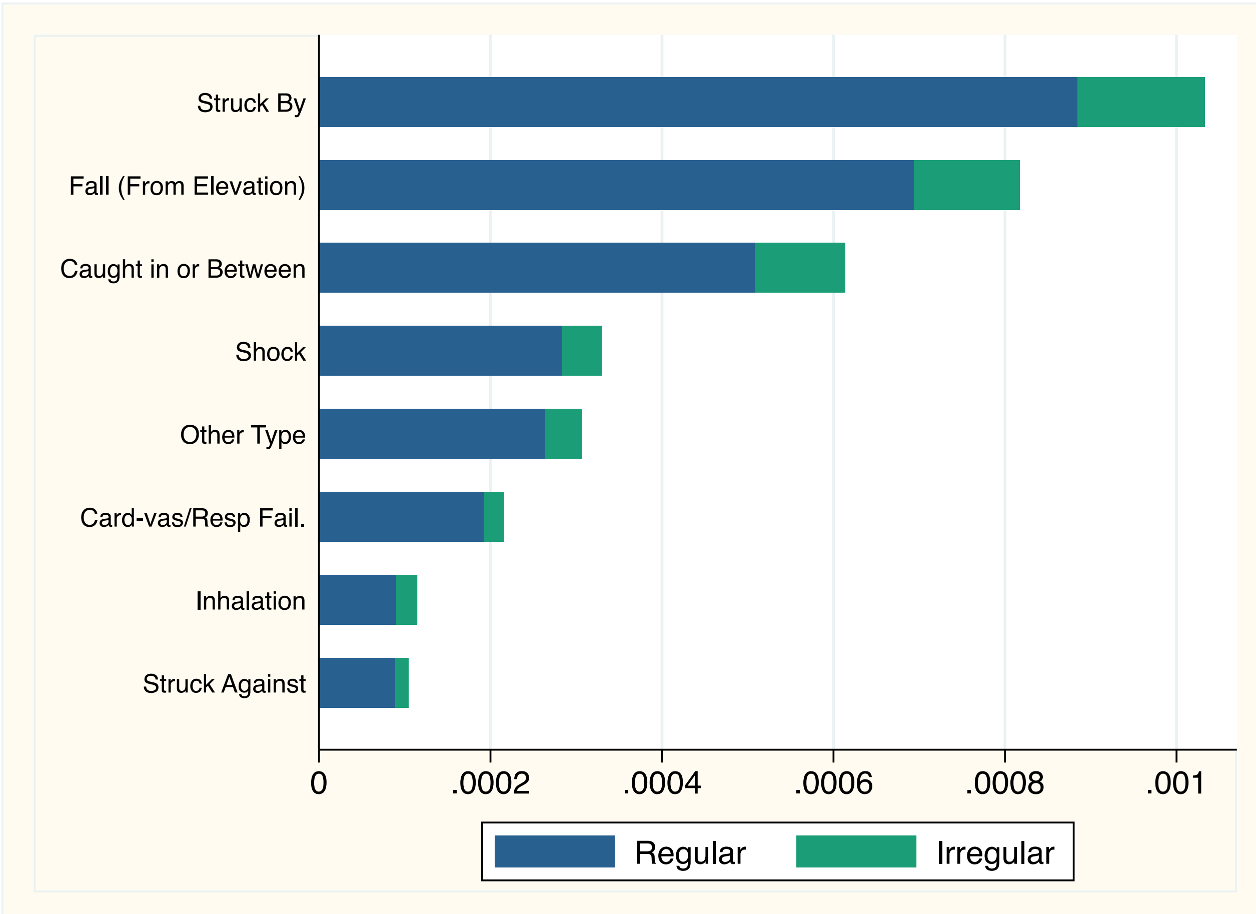
(b) Risk $\times P^B_{sy}$



Notes: Marginal effect of Irregular Fatal Accidents per 100 Male FTE on Log Wages. Underlying regression specifications are identical to column 2 in Table 5. Wages in 2009 dollars (PCE-adjusted).

D Additional Figures

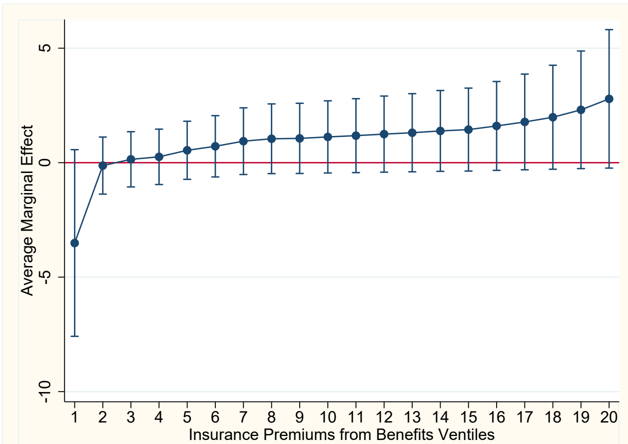
Figure D.1: Death Rates by Injury Type, Task, and Race



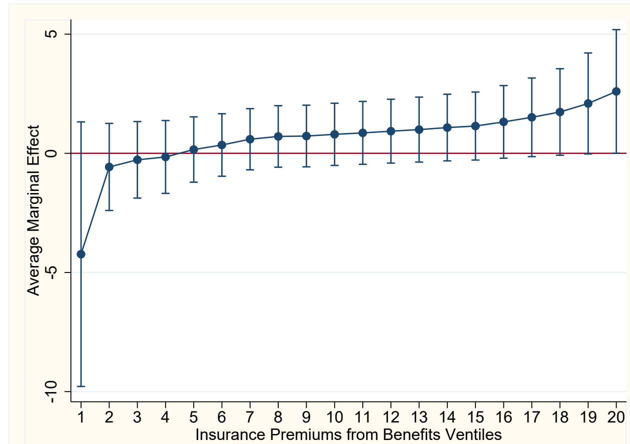
Note: Pictured are the eight most frequent injury types in all occupations. Rates are calculated as the fraction of male employees who die by the nature of injury out of 100,000 same ethnicity, male, full-time equivalent employees.

Figure D.2: Mexican Workers Only: Average Marginal Effects of Irregular Task Fatalities per 100 Male FTE

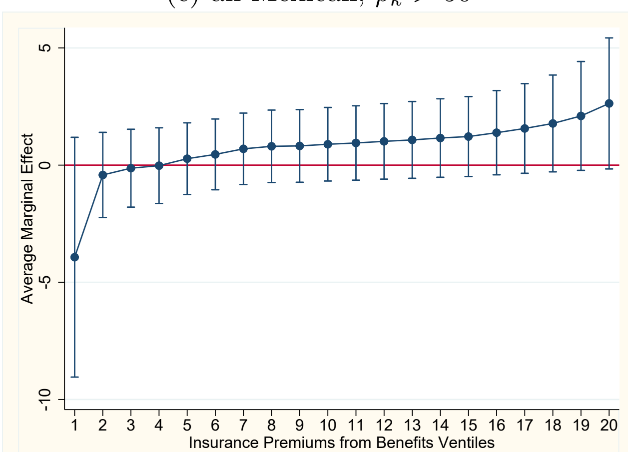
(a) All Mexican, All Industries



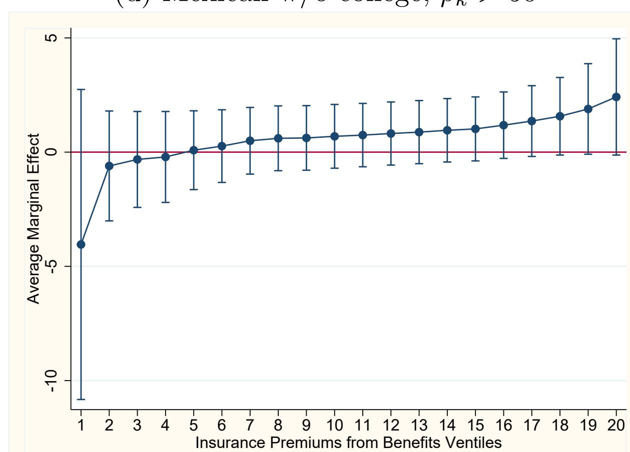
(b) Mexican w/o college, All Industries



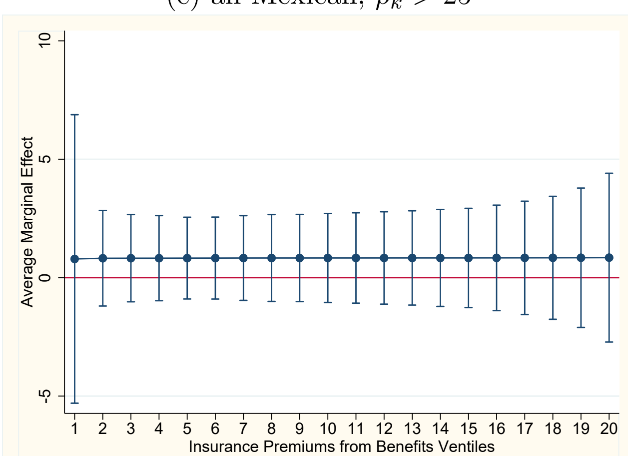
(c) all Mexican, $\rho_k > 50$



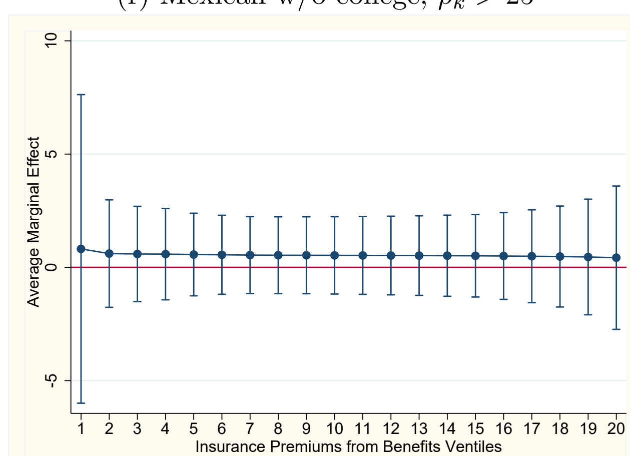
(d) Mexican w/o college, $\rho_k > 50$



(e) all Mexican, $\rho_k > 25$



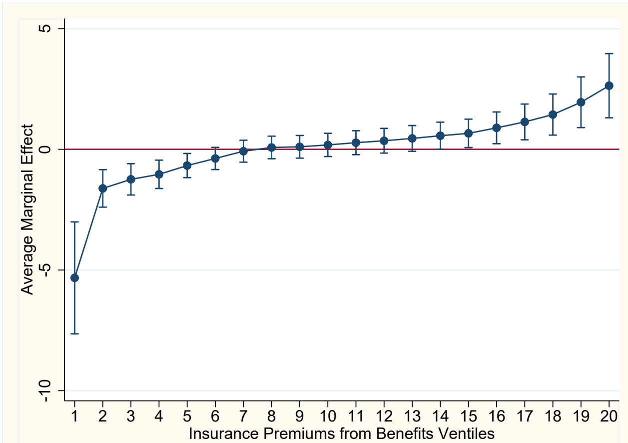
(f) Mexican w/o college, $\rho_k > 25$



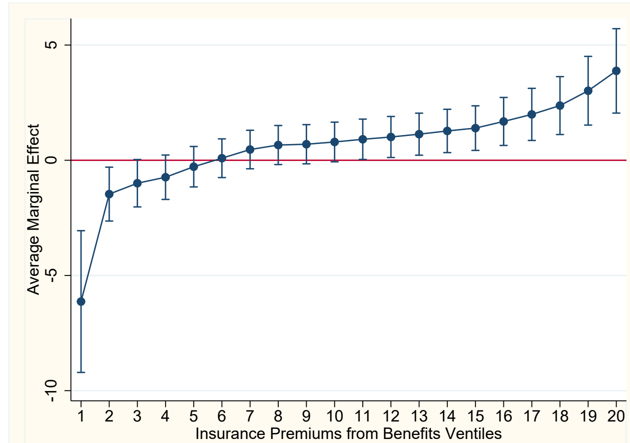
Notes: Marginal effect of Irregular Fatal Accidents per 100 Male FTE on Log Wages. Underlying regression specifications are identical to column 2 in Table 5. Wages in 2009 dollars (PCE-adjusted).

Figure D.3: Functional Form Variations: Average Marginal Effects of Irregular Task Fatalities per 100 Male FTE, Workers w/o College

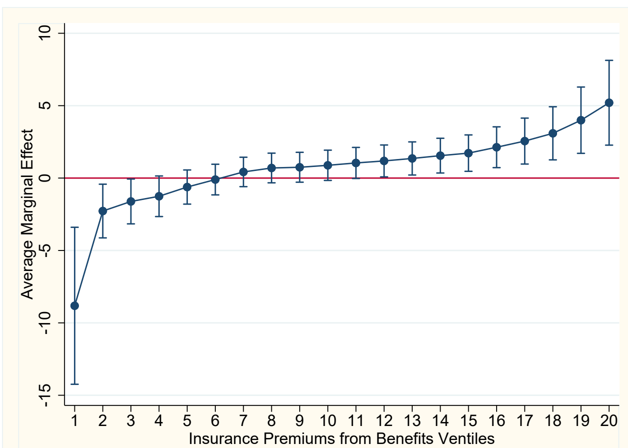
(a) Linear



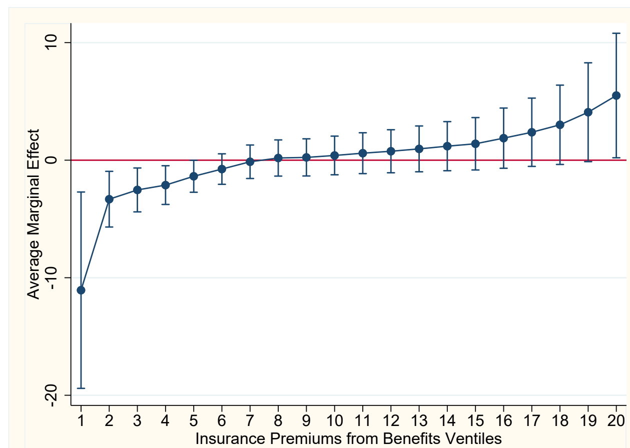
(b) Quadratic



(c) Cubic



(d) 4th-order Polynomial



Notes: Marginal effect of Irregular Fatal Accidents per 100 Male FTE on Log Wages. Underlying regression specifications are identical to column 2 in Table 5. Wages in 2009 dollars (PCE-adjusted).

E Additional Tables

Table E.1: Union Coverage: Irregular Risk Wage Differentials

	(1) Non-Union	(2) Non-Union	(3) Union	(4) Union
$\text{Fatal}^{Irreg}_{ksy}$	-0.015	-0.221	1.842	1.633
	(0.521)	(0.452)	(2.821)	(2.520)
$\text{Fatal}^{Irreg}_{ksy} \times \Delta P^{B}_{sy}$	17.610**		12.115	
	(7.931)		(10.704)	
$\text{Fatal}^{Irreg}_{ksy} \times P^{B}_{sy}$		3.585		4.592
		(3.546)		(10.733)
Fatal^{Reg}_{osy}	0.411	0.422	-0.254	-0.259
	(0.570)	(0.571)	(1.335)	(1.332)
$\text{Fatal}^{Irreg}_{osy}$				
P_{sy}	-0.024***	-0.025***	0.022	0.022
	(0.007)	(0.007)	(0.015)	(0.016)
Year FE	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes
Ind FE	Fine	Fine	Fine	Fine
Occ FE	Yes	Yes	Yes	Yes
R^2	0.464	0.464	0.324	0.324
N	66313	66313	10262	10262

Notes: Standard errors in parentheses * (p <0.10),** (p <0.05), *** (p <0.01). Restricted to the outgoing rotation group "Earner Study", observations are stratified by whether the worker was operating under a union covered contract. Include only males working private sector jobs. Columns 1 and 3 correspond to those found in Table 6, columns 2 and 4 to Table 5. All regressions include year, state, industry, occupational code fixed effects, and state-specific quadratic time trends, as well as the quadratic rate of non-fatal accidents resulting in hospital admission. Additional covariate controls include U.S. Born, education categories, married (1/0), full-time (1/0), urban metro region (1/0), union participation (1/0), experience, and experience squared. Robust standard errors are clustered by state and shown in parentheses. Wages in 2009 dollars.

Table E.2: Cash Benefits Received (=1/0) via Workers' Compensation

	All	ρ_k > 50	ρ_k > 75	ρ_k > 90
$\text{Fatal}_{ksy}^{Irreg}$	0.020	0.009	0.144	0.140
	(0.059)	(0.054)	(0.146)	(0.192)
$\text{Fatal}_{ksy}^{Irreg} \times P_{sy}^{B}$	-0.313	-0.247	-0.693	-0.563
	(0.388)	(0.421)	(0.609)	(0.814)
Fatal_{osy}^{Reg}	0.065	0.092	0.097	0.079
	(0.071)	(0.073)	(0.074)	(0.078)
P_{sy}	-0.002*	-0.002*	-0.001	-0.002
	(0.001)	(0.001)	(0.001)	(0.002)
Year FE	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes
Ind FE	Fine	Fine	Fine	Fine
Occ FE	Yes	Yes	Yes	Yes
R^2	0.012	0.013	0.013	0.015
N	177198	96884	55328	40833

Notes: Standard errors in parentheses * (p <0.10),** (p <0.05), *** (p <0.01). Estimates are for a linear probability model of whether the recipient received Workers' Compensation cash benefits in the past year. Observations include only males working private sector jobs. Columns 1 and 3 correspond to those found in Table 6, columns 2 and 4 to Table 5. All regressions include year, state, industry, occupational code fixed effects, and state-specific quadratic time trends, as well as the quadratic rate of non-fatal accidents resulting in hospital admission. Additional covariate controls include U.S. Born, education categories, married (1/0), full-time (1/0), urban metro region (1/0), union participation (1/0), experience, and experience squared. Robust standard errors are clustered by state and shown in parentheses. Wages in 2009 dollars.

Table E.3: Male Death and Employment Counts by Occupation

Occupation No.	Name	Risk Quantile	Fatality Count Total	All Regular	Irregular	Non-Hispanic Total	Hispanic Total	Employment All	Fatality Rate All
50	Forestry and Logging Occupations	4	740	678	62	697	39	1250937	59.156
79	Handlers, Equipment Cleaners, Helpers, and Laborers	4	277	208	69	223	49	524529	52.809
25	Sales Related Occupations	4	18	15	3	18	0	114057	15.782
78	Material Moving Equipment Operators	4	881	767	114	760	111	7540094	11.684
80	Helpers, Construction and Extractive Occupations	4	1579	1345	234	1154	384	15949229	9.900
57	Construction Trades Except Supervisors	4	3862	3485	377	3192	610	65782875	5.871
58	Extractive Occupations	4	134	110	24	111	22	2356404	5.687
56	Supervisors, Construction Occupations	4	428	361	67	385	38	9698237	4.413
48	Farm Occupations Except Managerial	4	360	292	68	151	191	10274199	3.504
68	Metal and Plastic Processing Machine Operators	4	63	51	12	47	16	1820372	3.461
81	Freight, Stock, and Material Handlers	4	1325	1093	232	971	329	40204445	3.296
47	Farm Operators and Managers	4	48	41	7	41	6	1578096	3.042
66	Plant and System Operators	4	104	82	22	90	12	3665553	2.837
40	Firefighting and Fire Prevention Occupations	4	5	3	2	5	0	179859	2.780
51	Fishers, Hunters, and Trappers	4	6	4	2	5	1	226236	2.652
55	Miscellaneous Mechanics and Repairers	4	351	297	54	314	34	14054925	2.497
77	Water Transportation Occupations	4	27	24	3	26	1	1167632	2.312
67	Machine Operators and Tenders	4	98	86	12	83	15	5197232	1.886
76	Rail Transportation Occupations	4	44	41	3	40	4	2342621	1.878
52	Mechanics and Repairers	4	90	65	25	85	5	4930483	1.825
53	Vehicle and Mobile Equipment Mechanics and Repairers	4	697	570	127	619	73	38638585	1.804
49	Related Agricultural Occupations	4	184	156	28	120	58	10639583	1.729
54	Electrical and Electronic Equipment Repairers	3	286	267	19	259	27	17451418	1.639
69	Woodworking Machine Operators	3	61	53	8	50	8	3895715	1.566
33	Communications Equipment Operators	3	5	5	0	5	0	322489	1.550
73	Fabricators, Assemblers, and Hand Working Occupations	3	375	315	60	310	58	24765682	1.514
39	Supervisors Protective Service Occupations	3	11	8	3	10	0	824576	1.334
61	Precision Woodworking Occupations	3	16	15	1	14	1	1277003	1.253
32	Duplicating, Mail and Other Office Machine Operators	3	5	4	1	5	0	402334	1.243
75	Motor Vehicle Operators	3	852	737	115	777	66	70951254	1.201
72	Machine Operators, Assorted Materials	3	391	342	49	317	68	32720116	1.195
19	Science Technicians	3	25	23	2	24	1	2182664	1.145
71	Textile, Apparel, and Furnishings Machine Operators	3	44	37	7	38	4	4192686	1.049
18	Engineering and Related Technologists and Technicians	3	113	96	17	102	9	11963328	0.945
45	Cleaning and Building Service Occupations	3	174	127	47	137	35	18721645	0.929
60	Precision Metal Working Occupations	3	110	94	16	93	16	13803378	0.797
42	Guards	3	65	59	6	59	6	8639870	0.752
23	Sales Representatives, Commodities Except Retail	3	5	1	4	5	0	696666	0.718
46	Personal Service Occupations	3	41	32	9	39	2	6245599	0.656
34	Mail and Message Distributing Occupations	3	14	13	1	12	2	3324358	0.421
64	Precision Food Production Occupations	3	22	20	2	15	7	5702170	0.386
26	Supervisors, Administrative Support Occupations	3	13	12	1	13	0	3492374	0.372
38	Private Household Occupations	3	7	7	0	6	0	2139619	0.327
20	Technicians: Except Health, Engineering and Science	3	55	44	11	47	6	17039354	0.323
12	Librarians, Archivists, and Curators	3	1	0	1	0	1	346280	0.289
35	Material Recording, Scheduling, and Distributing Clerks	2	66	55	11	54	9	23279476	0.284
63	Precision Workers, Assorted Materials	2	8	8	0	6	2	2982924	0.268
62	Precision Textile, Apparel, and Furnishings Machine Workers	2	3	3	0	3	0	1126787	0.266
74	Production Inspectors, Testers, Samplers, and Weighers	2	21	18	3	14	7	8486888	0.247
6	Natural Scientists	2	10	8	2	10	0	5092852	0.196
16	Writers, Artists, Entertainers, and Athletes	2	26	22	4	22	4	13586366	0.191
2	Management Related Occupations	2	58	43	15	51	7	31558566	0.184
70	Printing Machine Operators	2	9	7	2	8	1	5216022	0.173
4	Engineers	2	53	41	12	51	2	31170008	0.170
9	Therapists	2	4	4	0	4	0	2537372	0.158
3	Engineers, Architects, and Surveyors	2	3	2	1	3	0	1936029	0.155

Continued on next page

Table E.3 – *Continued from previous page*

Occupation		Risk	Fatality Count					Fatality	
				All		Non-Hispanic	Hispanic	Employment	Rate
No.	Name	Quantile	Total	Regular	Irregular	Total	Total	All	All
43	Food Preparation and Service Occupations	2	58	44	14	50	8	38271779	0.152
24	Sales Workers, Retail and Personal Services	2	79	67	12	72	7	62803476	0.126
10	Teachers, Postsecondary	2	5	4	1	5	0	4025664	0.124
37	Miscellaneous Administrative Support Occupations	2	8	7	1	7	1	7160583	0.112
22	Sales Representatives, Finance and Business Services	2	16	11	5	13	3	14658820	0.109
44	Health Service Occupations	2	4	4	0	4	0	4079960	0.098
14	Social, Recreation, and Religious Workers	2	9	6	3	9	0	9749560	0.092
1	Executive, Administrative, and Managerial Occupations	1	103	68	35	98	5	120638490	0.085
7	Health Diagnosing Occupations	1	6	4	2	5	1	7903460	0.076
29	Information Clerks	1	2	2	0	1	1	3081325	0.065
17	Health Technologists and Technicians	1	3	2	1	3	0	4947980	0.061
11	Teachers, Except Postsecondary	1	4	2	2	4	0	7432413	0.054
30	Records Processing Occupations, Except Financial	1	1	1	0	1	0	2032695	0.049
8	Health Assessment and Treating Occupations	1	2	2	0	2	0	4336221	0.046
27	Computer Equipment Operators	1	1	1	0	1	0	2786428	0.036
31	Financial Records Processing Occupations	1	1	0	1	1	0	2799296	0.036
36	Adjusters and Investigators	1	2	2	0	2	0	9242936	0.022
21	Sales Occupations	1	9	7	2	7	2	43137743	0.021
5	Mathematical and Computer Scientists	1	0	0	0	0	0	18912725	0
59	Precision Production Occupations	1	0	0	0	0	0	18891729	0
15	Lawyers and Judges	1	0	0	0	0	0	6725909	0
13	Social Scientists and Urban Planners	1	0	0	0	0	0	1851291	0
28	Secretaries, Stenographers, and Typists	1	0	0	0	0	0	1153835	0

Table E.4: Occupations Mapping

Occupation No.	Name	Three Digit Occupations
1	Executive, Administrative, and Managerial Occupations	(3) Legislators; (4) Chief executives and general administrators, public administration; (5) Administrators and officials, public administration; (6) Administrators, protective services; (7) Financial managers; (8) Personnel and labor relations managers; (9) Purchasing managers; (13) Managers, marketing, advertising, and public relations; (14) Administrators, education and related fields; (15) Managers, medicine and health; (16) Postmasters and mail superintendents; (17) Managers, food serving and lodging establishments; (18) Managers, properties and real estate; (19) Funeral directors; (21) Managers, service organizations, n.e.c.; (22) Managers and administrators n.e.c.
2	Management Related Occupations	(23) Accountants and auditors; (24) Underwriters; (25) Other financial officers; (26) Management analysts; (27) Personnel, training, and labor relations specialists; (28) Purchasing agents and buyers, farm products; (29) Buyers, wholesale and retail trade except farm products; (33) Purchasing agents and buyers, n.e.c.; (34) Business and promotion agents; (35) Construction inspectors; (36) Inspectors and compliance officers, except construction; (37) Management related occupations, n.e.c.
3	Engineers, Architects, and Surveyors	(43) Architects
4	Engineers	(44) Aerospace; (45) Metallurgical and materials; (46) Mining; (47) Petroleum; (48) Chemical; (49) Nuclear; (53) Civil; (54) Agricultural; (55) Electrical and electronic; (56) Industrial; (57) Mechanical; (58) Marine and naval architects; (59) Engineers, n.e.c.; (63) Surveyors and mapping scientists
5	Mathematical and Computer Scientists	(64) Computer systems analysts and scientists; (65) Operations and systems researchers and analysts; (66) Actuaries; (67) Statisticians; (68) Mathematical scientists, n.e.c.
6	Natural Scientists	(69) Physicists and astronomers; (73) Chemists, except biochemists; (74) Atmospheric and space scientists; (75) Geologists and geodesists; (76) Physical scientists, n.e.c.; (77) Agricultural and food scientists; (78) Biological and life scientists; (79) Forestry and conservation scientists; (83) Medical scientists
7	Health Diagnosing Occupations	(84) Physicians; (85) Dentists; (86) Veterinarians; (87) Optometrists; (88) Podiatrists; (89) Health diagnosing practitioners, n.e.c.
8	Health Assessment and Treating Occupations	(95) Registered nurses; (96) Pharmacists; (97) Dietitians
9	Therapists	(98) Respiratory therapists; (99) Occupational therapists; (103) Physical therapists; (104) Speech therapists; (105) Therapists, n.e.c.; (106) Physicians' assistants
10	Teachers, Postsecondary	(113) Earth, environmental, and marine science teachers; (114) Biological science teachers; (115) Chemistry teachers; (116) Physics teachers; (117) Natural science teachers, n.e.c.; (118) Psychology teachers; (119) Economics teachers; (123) History teachers; (124) Political science teachers; (125) Sociology teachers; (126) Social science teachers, n.e.c.; (127) Engineering teachers; (128) Mathematical science teachers; (129) Computer science teachers; (133) Medical science teachers; (134) Health specialties teachers; (135) Business, commerce, and marketing teachers; (136) Agriculture and forestry teachers; (137) Art, drama, and music teachers; (138) Physical education teachers; (139) Education teachers; (143) English teachers; (144) Foreign language teachers; (145) Law teachers; (146) Social work teachers; (147) Theology teachers; (148) Trade and industrial teachers; (149) Home economics teachers; (153) Teachers, postsecondary, n.e.c.; (154) Postsecondary teachers, subject not specified
11	Teachers, Except Postsecondary	(155) Teachers, prekindergarten and kindergarten; (156) Teachers, elementary school; (157) Teachers, secondary school; (158) Teachers, special education; (159) Teachers, n.e.c.; (163) Counselors, educational and vocational
12	Librarians, Archivists, and Curators	(164) Librarians; (165) Archivists and curators
13	Social Scientists and Urban Planners	(166) Economists; (167) Psychologists; (168) Sociologists; (169) Social scientists, n.e.c.; (173) Urban planners
14	Social, Recreation, and Religious Workers	(174) Social workers; (175) Recreation workers; (176) Clergy; (177) Religious workers, n.e.c.
15	Lawyers and Judges	(178) Lawyers; (179) Judges
16	Writers, Artists, Entertainers, and Athletes	(183) Authors; (184) Technical writers; (185) Designers; (186) Musicians and composers; (187) Actors and directors; (188) Painters, sculptors, craft-artists, and artist printmakers; (189) Photographers; (193) Dancers; (194) Artists, performers, and related workers, n.e.c.; (195) Editors and reporters; (197) Public relations specialists; (198) Announcers; (199) Athletes
17	Health Technologists and Technicians	(203) Clinical laboratory technologists and technicians; (204) Dental hygienists; (205) Health record technologists and technicians; (206) Radiologic technicians; (207) Licensed practical nurses; (208) Health technologists and technicians, n.e.c.
18	Engineering and Related Technologists and Technicians	(213) Electrical and electronic technicians; (214) Industrial engineering technicians; (215) Mechanical engineering technicians; (216) Engineering technicians, n.e.c.; (217) Drafting occupations; (218) Surveying and mapping technicians
19	Science Technicians	(223) Biological technicians; (224) Chemical technicians; (225) Science technicians
20	Technicians: Except Health, Engineering and Science	(226) Airplane pilots and navigators; (227) Air traffic controllers; (228) Broadcast equipment operators; (229) Computer programmers; (233) Tool programmers, numerical control; (234) Legal assistants; (235) Technicians, n.e.c.
21	Sales Occupations	(243) Supervisors and proprietors, sales occupations
22	Sales Representatives, Finance and Business Services	(253) Insurance sales occupations; (254) Real estate sales occupations; (255) Securities and financial services sales occupations; (256) Advertising and related sales occupations; (257) Sales occupations, other business services

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Table E.4 – *Continued from previous page*

Occupation No.	Name	Three Digit Occupations
23	Sales Representatives, Commodities Except Retail	(258) Sales engineers; (259) Sales representatives, mining, manufacturing, and wholesale
24	Sales Workers, Retail and Personal Services	(263) Sales workers, motor vehicles and boats; (264) Sales workers, apparel; (265) Sales workers, shoes; (266) Sales workers, furniture and home furnishings; (267) Sales workers; (268) Sales workers, hardware and building supplies; (269) Sales workers, parts; (274) Sales workers, other commodities; (275) Sales counter clerks; (276) Cashiers; (277) Street and door-to-door sales workers; (278) News vendors
25	Sales Related Occupations	(283) Demonstrators, promoters and models, sales; (284) Auctioneers; (285) Sales support occupations, n.e.c.
26	Supervisors, Administrative Support Occupations	(303) Supervisors, general office; (304) Supervisors, computer equipment operators; (305) Supervisors, financial records processing; (306) Chief communications operators; (307) Supervisors
27	Computer Equipment Operators	(308) Computer operators; (309) Peripheral equipment operators
28	Secretaries, Stenographers, and Typists	(313) Secretaries; (314) Stenographers; (315) Typists
29	Information Clerks	(316) Interviewers; (317) Hotel clerks; (318) Transportation ticket and reservation agents; (319) Receptionists; (323) Information clerks, n.e.c.
30	Records Processing Occupations, Except Financial	(325) Classified-ad clerks; (326) Correspondence clerks; (327) Order clerks; (328) Personnel clerks, except payroll and timekeeping; (329) Library clerks; (335) File clerks; (336) Records clerks
31	Financial Records Processing Occupations	(337) Bookkeepers, accounting, and auditing clerks; (338) Payroll and timekeeping clerks; (339) Billing clerks; (343) Cost and rate clerks; (344) Billing, posting, and calculating machine operators
32	Duplicating, Mail and Other Office Machine Operators	(345) Duplicating machine operators; (346) Mail preparing and paper handling machine operators; (347) Office machine operators, n.e.c.
33	Communications Equipment Operators	(348) Telephone operators; (353) Communications equipment operators, n.e.c.
34	Mail and Message Distributing Occupations	(354) Postal clerks, exc. mail carriers; (355) Mail carriers, postal service; (356) Mail clerks, exc. postal service; (357) Messengers
35	Material Recording, Scheduling, and Distributing Clerks	(359) Dispatchers; (363) Production coordinators; (364) Traffic, shipping, and receiving clerks; (365) Stock and inventory clerks; (366) Motor readers; (368) Weighers, measurers, checkers and samplers; (373) Expediters; (374) Material recording, scheduling, and distributing clerks, n.e.c.
36	Adjusters and Investigators	(375) Insurance adjusters, examiners, and investigators; (376) Investigators and adjusters except insurance; (377) Eligibility clerks, social welfare; (378) Bill and account collectors
37	Miscellaneous Administrative Support Occupations	(379) General office clerks; (383) Bank tellers; (384) Proofreaders; (385) Data-entry keyers; (386) Statistical clerks; (387) Teachers' aides; (389) Administrative support occupations, n.e.c.
38	Private Household Occupations	(403) Launderers and ironers; (404) Cooks, private household; (405) Housekeepers and butlers; (406) Child care workers, private household; (407) Private household cleaners and servants
39	Supervisors Protective Service Occupations	(413) Supervisors, firefighting and fire prevention occupations; (414) Supervisors, police and detectives; (415) Supervisors, guards
40	Firefighting and Fire Prevention Occupations	(416) Fire inspection and fire prevention occupations; (417) Firefighting occupations
42	Guards	(425) Crossing guards; (426) Guards and police, except public service; (427) Protective service occupations, n.e.c.
43	Food Preparation and Service Occupations	(433) Supervisors, food preparation and service occupations; (434) Bartenders; (435) Waiters and waitresses; (436) Cooks; (438) Food counter, fountain and related occupations; (439) Kitchen workers, food preparation; (443) Waiters/waitresses' assistants; (444) Miscellaneous food preparation occupations
44	Health Service Occupations	(445) Dental assistants; (446) Health aides, except nursing; (447) Nursing aides, orderlies, and attendants
45	Cleaning and Building Service Occupations, except Household	(448) Supervisors cleaning and building service workers; (449) Maids and houseman; (453) Janitors and cleaners; (454) Elevator operators; (455) Post control occupations
46	Personal Service Occupations	(456) Supervisors, personal service occupations; (457) Barbers; (458) Hairdressers and cosmetologists; (459) Attendants, amusement and recreation facilities; (461) Guides; (462) Ushers; (463) Public transportation attendants; (464) Baggage porters and bellhops; (465) Welfare service aides; (466) Family child care providers; (467) Early childhood teacher's assistants; (468) Child care workers, n.e.c.; (469) Personal service occupations, n.e.c.
47	Farm Operators and Managers	(473) Farmers, except horticultural; (474) Horticultural specialty farmers; (475) Managers, farms, except horticultural; (476) Managers, horticultural specialty farms
48	Farm Occupations Except Managerial	(477) Supervisors, farm workers; (479) Farm workers; (483) Marine life cultivation workers; (484) Nursery workers
49	Related Agricultural Occupations	(485) Supervisors related agricultural occupations; (486) Groundskeepers and gardeners, except farm; (487) Animal caretakers, except farm; (488) Graders and sorters, agricultural products; (489) Inspectors, agricultural products
50	Forestry and Logging Occupations	(494) Supervisors, forestry, and logging workers; (495) Forestry workers, except logging; (496) Timber cutting and logging occupations
51	Fishers, Hunters, and Trappers	(497) Captains and other officers, fishing vessels; (498) Fishers; (499) Hunters and trappers
52	Mechanics and Repairers	(503) Supervisors, mechanics and repairers

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Table E.4 – *Continued from previous page*

Occupation No.	Name	Three Digit Occupations
53	Vehicle and Mobile Equipment Mechanics and Repairers	(505) Automobile mechanics; (506) Automobile mechanic apprentices; (507) Bus, truck, and stationary engine mechanics; (508) Aircraft engine mechanics; (509) Small engine repairers; (514) Automobile body and related repairers; (515) Aircraft mechanics, exc. engine; (516) Heavy equipment mechanics; (517) Farm equipment mechanics; (518) Industrial machinery repairers; (519) Machinery maintenance occupations
54	Electrical and Electronic Equipment Repairers	(523) Electronic repairers, communications and industrial equipment; (525) Data processing equipment repairers; (526) Household appliance and power tool repairers; (527) Telephone line installers and repairers; (529) Telephone installers and repairers; (533) Miscellaneous electrical and electronic equipment repairers; (534) Heating, air conditioning, and refrigeration mechanics
55	Miscellaneous Mechanics and Repairers	(535) Camera, watch, and musical instrument repairers; (536) Locksmiths and safe repairers; (538) Office machine repairers; (539) Mechanical controls and valve repairers; (543) Elevator installers and repairers; (544) Millwrights; (547) Specified mechanics and repairers, n.e.c.; (549) Not specified mechanics and repairers
56	Supervisors, Construction Occupations	(553) Supervisors: brickmasons, stonemasons, and tile; (554) Supervisors: carpenters and related workers; (555) Supervisors: electricians and power transmission; (556) Supervisors: painters, paperhanger, and plasterers; (557) Supervisors: plumbers, pipfitters, and steamfitters; (558) Supervisors: n.e.c.
57	Construction Trades Except Supervisors	(563) Brickmasons and stonemasons; (564) Brickmason and stonemason apprentices; (565) Tile setters, hard and soft; (566) Carpet installers; (567) Carpenters; (569) Carpenter apprentices; (573) Drywall installers; (575) Electricians; (576) Electrician apprentices; (577) Electrical power installers and repairers; (579) Painters, construction and maintenance; (583) Paperhangers; (584) Plasterers; (585) Plumbers, pipefitters, and steamfitters; (587) Plumber, pipefitter, and steamfitter apprentices; (588) Concrete and terrazzo finishers; (589) Glaziers; (593) Insulation workers; (594) Paving, surfacing, and tamping equipment operators; (595) Roofers; (596) Sheetmetal duct installers; (597) Structural metal workers; (598) Drillers, earth; (599) Construction trades, n.e.c.
58	Extractive Occupations	(613) Supervisors, extractive occupations; (614) Drillers, oil well; (615) Explosives workers; (616) Mining machine operators; (617) Mining occupations, n.e.c.
59	Precision Production Occupations	(628) Supervisors, production occupations
60	Precision Metal Working Occupations	(634) Tool and die makers; (635) Tool and die maker apprentices; (636) Precision assemblers, metal; (637) Machinists; (639) Machinist apprentices; (643) Boilermakers; (644) Precision grinders, filers, and tool sharpeners; (645) Patternmakers and model makers, metal; (646) Lay-out workers; (647) Precious stones and metals workers (Jewelers); (649) Engravers, metal; (653) Sheet metal workers; (654) Sheet metal worker apprentices; (655) Miscellaneous precision metal workers
61	Precision Woodworking Occupations	(656) Patternmakers and model makers, wood; (657) Cabinet makers and bench carpenters; (658) Furniture and wood finishers; (659) Miscellaneous precision woodworkers
62	Precision Textile, Apparel, and Furnishings Machine Workers	(666) Dressmakers; (667) Tailors; (668) Upholsterers; (669) Shoe repairers; (674) Miscellaneous precision apparel and fabric workers
63	Precision Workers, Assorted Materials	(675) Hand molders and shapers, except jewelers; (676) Patternmakers, lay-out workers, and cutters; (677) Optical goods workers; (678) Dental laboratory and medical appliance technicians; (679) Bookbinders; (683) Electrical and electronic equipment assemblers; (684) Miscellaneous precision workers, n.e.c.
64	Precision Food Production Occupations	(686) Butchers and meat cutters; (687) Bakers; (688) Food batchmakers
66	Plant and System Operators	(694) Water and sewage treatment plant operators; (695) Power plant operators; (696) Stationary engineers; (699) Miscellaneous plant and system operators
67	Machine Operators and Tenders	(703) Lathe and turning machine set-up operators; (704) Lathe and turning machine operators; (705) Milling and planing machine operators; (706) Punching and stamping press machine operators; (707) Rolling machine operators; (708) Drilling and boring machine operators; (709) Grinding, abrading, buffing, and polishing machine operators; (713) Forging machine operators; (714) Numerical control machine operators; (715) Miscellaneous metal, plastic, stone, and glass working machine operators; (717) Fabricating machine operators, n.e.c.
68	Metal and Plastic Processing Machine Operators	(719) Molding and canting machine operators; (723) Metal plating machine operators; (724) Heat treating equipment operators; (725) Miscellaneous metal and plastic processing machine operators
69	Woodworking Machine Operators	(726) Wood lathe, routing, and planing machine operators; (727) Sawing machine operators; (728) Shaping and joining machine operators; (729) Nailing and tacking machine operators; (733) Miscellaneous woodworking machine operators
70	Printing Machine Operators	(734) Printing press operators; (735) Photoengravers and lithographers; (736) Typesetters and compositors; (737) Miscellaneous printing machine operators
71	Textile, Apparel, and Furnishings Machine Operators	(738) Winding and twisting machine operators; (739) Knitting, looping, taping, and weaving machine operators; (743) Textile cutting machine operators; (744) Textile serving machine operators; (745) Shoe machine operators; (747) Pressing machine operators; (748) Laundering and dry cleaning machine operators; (749) Miscellaneous textile machine operators

Continued on next page

Table E.4 – *Continued from previous page*

Occupation No.	Name	Three Digit Occupations
72	Machine Operators, Assorted Materials	(753) Cementing and gluing machine operators; (754) Packaging and filling machine operators; (755) Extruding and forming machine operators; (756) Mixing and blending machine operators; (757) Separating, filtering, and clarifying machine operators; (758) Compressing and compacting machine operators; (759) Painting and paint spraying machine operators; (763) Roasting and baking machine operators, food; (764) Washing, cleaning, and pickling machine operators; (765) Folding machine operators; (766) Furnace, kiln, and oven operators, exc. food; (768) Crushing and grinding machine operators; (769) Slicing and cutting machine operators; (773) Motion picture projectionists; (774) Photographic process machine operators; (777) Miscellaneous machine operators, n.e.c.; (779) Machine operators, not specified
73	Fabricators, Assemblers, and Hand Working Occupations	(783) Welders and cutters; (784) Solderers and brazers; (785) Assemblers; (786) Hand cutting and trimming occupations; (787) Hand molding, casting, and forming occupations; (789) Hand painting, coating, and decorating occupations; (793) Hand engraving and printing occupations; (795) Miscellaneous hand working occupations
74	Production Inspectors, Testers, Samplers, and Weighers	(796) Production inspectors, checkers, and examiners; (797) Production testers; (798) Production samplers and weighers; (799) Graders and sorters, exc. agricultural
75	Motor Vehicle Operators	(803) Supervisors, motor vehicle operators; (804) Truck drivers; (806) Driver-sales workers; (808) Bus drivers; (809) Taxicab drivers and chauffeurs; (813) Parking lot attendants; (814) Motor transportation occupations, n.e.c.
76	Rail Transportation Occupations	(823) Railroad conductors and yardmasters; (824) Locomotive operating occupations; (825) Railroad brake, signal, and switch operators; (826) Rail vehicle operators, n.e.c.
77	Water Transportation Occupations	(828) Ship captains and mates, except fishing boats; (829) Sailors and deckhands; (833) Marine engineers; (834) Bridge, lock, and lighthouse tenders
78	Material Moving Equipment Operators	(843) Supervisors, material moving equipment operators; (844) Operating engineers; (845) Longshore equipment operators; (848) Hoist and winch operators; (849) Crane and tower operators; (853) Excavating and loading machine operators; (855) Grader, dozer, and scraper operators; (856) Industrial truck and tractor equipment operators; (859) Miscellaneous material moving equipment operators
79	Handlers, Equipment Cleaners, Helpers, and Laborers	(864) Supervisors, handlers, equipment cleaners, and laborers, n.e.c.; (865) Helpers, mechanics and repairers
80	Helpers, Construction and Extractive Occupations	(866) Helpers, construction trades; (867) Helpers, surveyor; (868) Helpers, extractive occupations; (869) Construction laborers; (874) Production helpers
81	Freight, Stock, and Material Handlers	(875) Garbage collectors; (876) Stevedores; (877) Stock handlers and baggers; (878) Machine feeders and offbearers; (883) Freight, stock, and material handlers, n.e.c.; (885) Garage and service station related occupations; (887) Vehicle washers and equipment cleaners; (888) Hand packers and packagers; (889) Laborers, except construction

Note: Optional/reference for the time being