What is the Rationale for an Insurance Coverage Mandate? Evidence from Workers' Compensation Insurance*

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Abstract

There is ongoing policy debate about whether government insurance coverage mandates are necessary to effectively address market failures in private insurance markets. This paper analyzes the demand for insurance in the absence of a coverage mandate and the potential market failure rationale for coverage mandates in the context of workers' compensation insurance. Workers' compensation is a state-regulated insurance program that provides employees with income and medical benefits in the event of work-related injuries or illnesses. Nearly all states have mandated workers' compensation insurance coverage; the sole exception is Texas. Using administrative data from the unique voluntary Texas workers' compensation insurance system, we estimate the demand for workers' compensation insurance leveraging idiosyncratic regulatory updates to relative premiums across industry-occupation classifications. The difference-in-differences estimates indicate that the demand for workers' compensation coverage is price-sensitive, with a 10% increase in premiums leading to approximately a 3% decline in coverage. Drawing upon these estimates and additional data on claim costs, we analyze potential rationale for government intervention to increase coverage, through subsidies or a mandate. This analysis suggests that classic market failure justifications for government intervention in insurance markets—such as adverse selection, market power, and externalities—may not be compelling justifications for a mandate in this setting.

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1 Introduction

For many risks individuals face, the government is involved in the provision of insurance. Government involvement spans the spectrum from regulating pricing or coverage options in private insurance markets, to mandating the purchase of private insurance, to even the direct provision of insurance. The recent policy controversy surrounding the coverage mandates included in the Affordable Care Act has fueled an ongoing policy debate over the appropriate role of the government in the regulation of private insurance markets: should the government allow consumers to choose whether or not to purchase insurance, or should the government mandate the purchase of private insurance? Proponents of coverage mandates argue that they are necessary to address market failures such as adverse selection or externalities. Opponents of coverage mandates argue that allowing consumers to decide whether or not to purchase insurance while guaranteeing access to insurance (through, for example, regulating the form of coverage and pricing) is a better solution that respects consumer choices while overcoming the main inefficiencies that can arise in insurance markets.

This paper analyzes the demand for insurance in the absence of a coverage mandate and the potential rationale for coverage mandates in the setting of workers' compensation insurance. Workers' compensation is one of the first examples of large-scale social insurance in the United States, with the enactment of workers' compensation systems dating back to the 1910s.[1] Workers' compensation is a large state-regulated insurance program that provides covered employees with income and medical benefits in the event of work-related injuries or illnesses in exchange for forgoing the right to sue their employer for compensation for these workplace injuries.[2] Workers' compensation insurance is the primary mechanism for recourse for workplace injuries in the US; the aggregate cost of work-related injuries within state workers' compensation systems was $96.5 billion in 2016, representing 1.3% of covered payroll.[3] Workers' compensation insurance coverage mandates are almost universal, with all but one state mandating that employers provide workers' compensation insurance coverage to employees.[4] Texas is unique among US states in having no coverage mandate for workers' compensation insurance, leaving employers in Texas free to choose whether or not to participate in the state-regulated workers' compensation system. A worker who suffers an on-the-job injury

[1]The first comprehensive workers' compensation law in the United States was passed in Wisconsin in 1911. Nine other states passed regulations that year, followed by thirty-six more states by 1920. The final state to pass comprehensive workers' compensation legislation was Mississippi in 1948. For further discussion of the history of workers' compensation programs, see: Guyton (1999); Howard (2002); Larson (1951-1952).

[2]For convenience, we use *workplace injury* to refer to both workplace injuries and illnesses.

[3]Source: National Academy of Social Insurance Report (McLaren, Baldwin and Boden (2018)).

[4]Interestingly, many state workers' compensation programs were voluntary until the early 1970s. In 1972, the National Commission on State Workmen's Compensation Laws recommended that workers' compensation coverage be made compulsory, and by the mid-1970s almost all states passed amendments mandating that employers provide workers' compensation insurance. South Carolina enacted a coverage mandate in 1997, leaving Texas as the only remaining state with a voluntary workers' compensation insurance program. See Section 2.1 for more detail on the history of workers' compensation mandates.

at a *participating employer* (i.e., an employer that participates in the state workers' compensation system) receives workers' compensation benefits as defined by statute. In contrast, there are no statutorily defined benefits for a worker who suffers an on-the-job injury at a *non-participating employer* (i.e., an employer that has chosen not to participate in the state workers' compensation system), and such employers may be exposed to tort liability for workplace injuries. In Texas, the total payroll covered by workers' compensation insurance policies was $254 billion annually in the period 2006-2011, which represents roughly 73% of the total Texas private industry payroll.[5]

Recently, lawmakers in several states have begun to re-evaluate their workers' compensation coverage mandates and consider a voluntary workers' compensation insurance system based on the Texas model. In 2013, Oklahoma enacted a law intended to allow employers to opt out of the state workers' compensation system, though the law was overturned by the Oklahoma supreme court in 2015.[6] Similar laws have recently been proposed in state legislatures in Tennessee, Florida, South Carolina, and Arkansas. These recent legislative actions have revived the ongoing debate about the rationale for mandating workers' compensation insurance and whether this coverage should be mandated.

The debate over coverage mandates in workers' compensation raises several unanswered questions. What would be the prevalence of workers' compensation insurance take-up in the absence of a legal requirement to provide coverage? How responsive is take-up of workers' compensation to the price of coverage? What are the potential rationale for workers' compensation coverage mandates or hypothetical other alternative interventions such as subsidies? Despite the importance of these questions to the emerging policy debate over workers' compensation coverage mandates, evidence on the determinants of the demand for workers' compensation coverage and the rationale for coverage mandates is extremely scarce. In this paper, we empirically examine the demand for workers' compensation coverage within the context of the Texas workers' compensation system, with the aim of providing evidence on these questions. The Texas workers' compensation system provides a unique opportunity to investigate these questions for several reasons. First, coverage is voluntary and thus it is possible to analyze the demand for coverage. Second, while coverage is voluntary, other aspects of the state-regulated workers' compensation system are very similar to the workers' compensation systems in other states (e.g., the state regulates the form of coverage, the pricing of policies available from private insurers, etc.). Thus, Texas provides a useful case study of an otherwise typical workers' compensation system that exists in the absence of a coverage mandate. Third, there exists extensive, plausibly exogenous variation in premiums and rich administrative data on coverage, costs, and premiums.

[5]Authors' calculations based on the total covered payroll reported by the Texas Department of Insurance and the total payroll in Texas as estimated from the Quarterly Census of Employment and Wages published by the Bureau of Labor Statistics.

[6]See Sengupta, Baldwin and Reno (2014).

Using rich administrative data on workers' compensation coverage, we exploit variation in insurance premiums resulting from regulatory updates to analyze the demand for workers' compensation insurance. Like other state workers' compensation systems, the workers' compensation system in Texas is heavily regulated by the state, both in terms of the form of polices and the premiums insurers can charge. In particular, the structure of relative premiums across industry-occupation classifications is set by the government. We utilize idiosyncratic regulatory updates to these industry-occupation relative premiums in a differences-in-differences framework to estimate demand. These periodic regulatory updates induce large changes in premiums within classification, over time: the mean absolute premium update is 8.9% and the interquartile range of premium updates is 14.5%. Exploiting this variation, our baseline demand estimates suggest that a 10% increase in the premium results in approximately a 3% decline in the number of firms enrolled in workers' compensation insurance and the payroll covered by workers' compensation insurance. The demand estimates are statistically precise and robust to alternative specifications including more flexible controls, alternative specifications exploiting the precise timing of the updates, and alternative specifications exploiting nonlinearities in the rate update algorithm.

Motivated by the ubiquity of coverage mandates in the setting of workers' compensation insurance, we then use the demand estimates along with administrative cost data to investigate various potential rationale for government intervention to increase coverage through a mandate and/or subsidies in this market. Specifically, we consider three classic market failure rationale for government intervention to increase coverage: adverse selection, market power, and externalities. Following the approach outlined by Einav and Finkelstein (2011) and Einav, Finkelstein and Cullen (2010), we employ administrative cost data to investigate the degree of selection in this market leveraging the premium variation used to estimate demand. We find no evidence of adverse selection in this setting, indicating that there is no evidence that adverse selection justifies a coverage mandate in this market. We then explore market power as a potential alternative justification for government intervention through a series of welfare counterfactuals. In this analysis, we interpret the estimated demand for workers' compensation as representing the combined surplus of employers and employees, as they jointly make up the consumers in this market. This analysis suggests that there is little welfare at stake comparing the status quo to a perfectly competitive market and that market power is not a compelling justification for a coverage mandate in this setting. Lastly, we present additional analysis suggesting that potential externalities on external parties—such as health insurers or charity care providers—do not appear to be a compelling justification for mandating coverage in this market.

Overall, our analysis suggests coverage mandates in this setting may not be motivated by classic market failure rationale such as adverse selection, market power, and externalities. We conclude by discussing two possible interpretations of our findings. One interpretation of this evidence is that a workers' compensation insurance coverage mandate may not improve welfare relative to a regulated voluntary market for this coverage. Another interpretation of the evidence is that there may be alternative justifications for a coverage mandate, such as behavioral biases or labor market frictions, that go beyond the classic market failure rationale we investigate in the revealed preference welfare analysis. Our empirical strategy does not allow us to rule out (or rule in) either of these interpretations, though we briefly discuss the plausibility of these interpretations in light of prior studies on workers' compensation insurance.

Beyond addressing an important policy question, our research contributes to several distinct areas of the economics literature. This paper contributes to the recent growing literature investigating asymmetric information in private insurance markets and the welfare implications of government intervention. Some recent empirical papers have analyzed welfare in settings such as health insurance (e.g., Hackmann, Kolstad and Kowalski (2015), Einav, Finkelstein and Cullen (2010), Bundorf, Levin and Mahoney (2012), Finkelstein, Hendren and Shepard (2017)), annuities (e.g., Einav, Finkelstein and Schrimpf (2010), Finkelstein and Poterba (2004)), disability insurance (e.g., Cabral and Cullen (2018)) and unemployment insurance (e.g., Hendren (2017), Landais et al. (2017)).[7] Our paper contributes to this literature in two key ways. First, our study is the first to investigate adverse selection and the efficiency consequences of government intervention to increase coverage in the setting of workers' compensation insurance. Workers' compensation insurance is a large and important insurance market, and there is active policy debate concerning government intervention to increase coverage. A major barrier to studying this question is that workers' compensation coverage is typically mandatory, making it impossible to estimate the demand for insurance in a counterfactual voluntary market for this coverage. This study overcomes this challenge by leveraging the unique voluntary market for workers' compensation insurance in Texas. Second, while several studies in this literature focus on welfare in isolated settings utilizing data from one employer or one insurer, this study is among only a handful of studies that investigate the welfare effects of government intervention in a large market that is particularly relevant for current policy debates.

Our paper also contributes to the broader literature on workers' compensation insurance. Much of the prior literature on workers' compensation insurance focuses on the incentive effects of program features (e.g., Krueger (1990*a*,*b*); Meyer, Viscusi and Durbin (1995); Neuhauser and Raphael (2004)), the impact of the generosity of medical benefits (e.g., Powell and Seabury (2018)), and the incidence of the program or changes within the program (e.g., Fishback and Kantor (1995); Gruber and Krueger (1991)).[8] This paper contributes to this literature by being the first study to investigate a voluntary workers' compensation market to estimate the demand for workers' compensation insurance and to analyze the potential efficiency

[7] For a more comprehensive review of this literature, see Einav, Finkelstein and Levin (2010) and Chetty and Finkelstein (2013).

[8] See Krueger and Meyer (2002) for a review of the prior literature investigating the labor supply effects of workers' compensation insurance wage replacement benefits.

implications of government intervention to increase coverage, providing evidence pertinent to the ongoing policy debate surrounding workers' compensation mandates.[9] Lastly, this paper contributes to the literature on the demand for employment-linked insurance. While much of the prior work on the demand for employment-linked insurance focuses on contexts such as health insurance (e.g., Finkelstein (2002); Gruber and Lettau (2004); Kolstad and Kowalski (2016)) and long-term care insurance (e.g., Courtemanche and He (2009)), our paper is the first to provide evidence on the demand for workers' compensation insurance.

This paper proceeds as follows. Section 2 provides details on the institutional setting and the data. Section 3 outlines the empirical strategy and Section 4 presents the demand estimates. Section 5 considers potential rationale for government intervention to increase coverage, presenting supplemental evidence and welfare analysis. Lastly, Section 6 concludes.

2 Background and Data

In this section, we begin by providing background information on the structure of the Texas workers' compensation system and workers' compensation systems more broadly. We then describe the data sources we utilize and present descriptive statistics.

2.1 Background

2.1.1 Workers' Compensation Insurance

Workers' compensation is a state-regulated insurance system that provides covered employees with income and medical benefits for work-related injuries or illnesses. Workers' compensation is frequently characterized as a "grand bargain" between workers and employers: relative to the status quo that preceded the enactment of workers' compensation statutes in the early 20th century, workers gained a reliable source of no-fault compensation for on-the-job accidents while employers gained protection from tort liability resulting from on-the-job accidents. Each of the 50 states and the District of Columbia has its own workers' compensation program. In contrast to unemployment insurance, workers' compensation is entirely the prerogative of the states, with no significant federal involvement.[10]

Institutionally, the way this market functions is that employers purchase workers' compensation coverage. This coverage provides employers with liability protection against workplace injuries and provides employees with medical and income benefits in the event of workplace injuries. Workers' compensation

[9] Our work also is also related to a few prior descriptive studies on employers opting out of the Texas workers' compensation system. Butler (1996) finds that safety conditions—-as proxied by workplace fatalities—are not systematically different across participating and non-participating employers, though reported sprains and strains are lower among firms opting out of workers' compensation insurance. Morantz (2010) conducts and summarizes an employer survey assessing the compensation for work-related injuries at large non-participating employers, and Morantz (2016) summarizes detailed data on compensation offered to injured employees at select employers opting out of the workers' compensation insurance system.

[10] Separate U.S. government programs also cover federal civilian employees and specific high-risk workers such as energy employees exposed to radiation.

insurance coverage is effectively mandatory for employers in all states other than Texas. In contrast, employers in Texas can choose whether or not to provide workers' compensation insurance coverage to their employees.[11] Although coverage mandates in 15 other states have exemptions for very small businesses and many states have additional exemptions for specific classes of workers such as agricultural or domestic workers, Texas is the only state where a substantial portion of the workforce is outside the workers' compensation system. In 2014, an estimated 20% of non-federal workers in Texas were not covered by workers' compensation, while an estimated 1.4% of non-federal workers in other states were not covered by workers' compensation insurance (Baldwin and McLaren, 2016).

Interestingly, workers' compensation coverage mandates have not always been the norm. Until the early 1970s, more than a third of state workers' compensation systems were voluntary.[12] In 1972, the National Commission on State Workmen's Compensation Laws recommended that workers' compensation coverage be made compulsory, and by the mid-1970s almost all states had passed amendments mandating that employers provide workers' compensation insurance.[13] South Carolina enacted a coverage mandate in 1997, leaving Texas as the only remaining state with a voluntary workers' compensation insurance program. Recently, several states have begun to consider rolling back their coverage mandates to revert to a voluntary workers' compensation insurance system.

Most workers' compensation coverage is provided through insurance policies purchased by employers from workers' compensation insurers, either private insurers or public/quasi-public insurers (also known as state funds) which have considerable market share in many states.[14] The majority of the Texas workforce that is covered by workers' compensation obtains this coverage through an employer-purchased policy from a workers' compensation insurer. The Texas workers' compensation insurance market is fairly concentrated: the top 10 insurance companies in 2015 served 79% of the market, and the largest insurer, Texas Mutual Insurance Company, served 40% of the market (TDI, 2016). Texas Mutual Insurance Company, formerly the Texas Workers' Compensation Fund, is a quasi-public insurer and wrote $947 million in direct written premiums in 2015. The Legislature created Texas Mutual in 1991 to serve as a competitive force in the marketplace and to guarantee the availability of affordable workers' compensation insurance.

While most employers obtain workers' compensation coverage through purchasing a workers' com-

[11] Government agencies and public institutions are required to provide workers' compensation insurance.

[12] An opinion by the New York Court of Appeals—*Ives v. South Buffalo Railway Company* 94 N.E. 431 (NY 1911)—struck down a compulsory workers' compensation statute under the New York state constitution. Potentially as a consequence of the *Ives* decision, many states adopted elective workers' compensation insurance systems to avoid legal scrutiny. The U.S. Supreme Court— in *Mountain Timber Co. v. Washington* (1917)—upheld a compulsory workers' compensation insurance law, which settled the constitutional concern about the legality of a coverage mandate. In light of this, it is interesting to note that more than a half century later several states mandated participation in their workers' compensation insurance systems. For more detail on the history of workers' compensation insurance mandates, see Howard (2002); Morantz (2010); Larson (1951-1952); National Commission on State Workmen's Compensation Laws (1972).

[13] See National Commission on State Workmen's Compensation Laws (1972).

[14] In four states, a state fund is the only provider of workers' compensation insurance.

pensation policy from an insurer, some large employers have the option to become a certified self-insured employer. Certified self-insured employers are required to provide the same regulated benefits to employees in the event of workplace injury or illness in exchange for protection from tort liability. Texas imposes strict requirements on certified self-insured employers, effectively limiting this option to very large firms that can demonstrate substantial reserves for paying out future claims.[15] Perhaps because of these strict requirements, only 95 employers were certified self-insured in Texas at any point during our period of analysis, 2006-2011, and these firms collectively represent approximately 5% of Texas private sector workers.[16]

2.1.2 Prevalence and Consequences of Non-Participation

Table 1 describes aggregates from a biennial employer survey commissioned by the Texas Department of Insurance (TDI) investigating the prevalence of employer participation in the Texas workers' compensation system.[17] Averaging across the 2006/2008/2010 surveys, workers' compensation insurance coverage is held by approximately 66% of Texas employers, representing 78% of employees statewide. There are a few notable dimensions of heterogeneity in workers' compensation coverage. First, the fraction of participating employers increases with employer size: employers with fewer than five employees are nearly twice as likely to opt-out of workers' compensation insurance relative to firms with more than 500 employees. We note that this pattern of increasing participation with employer size is not monotonic, with very large firms with more than 500 employees being more likely to opt out of the workers' compensation system than sightly smaller firms with 100-499 employees. Second, employer participation rates are higher in the high-risk goods-producing industries and lower in service sectors. However, the participation rate varies within a fairly narrow range across the aggregated industry groups, with the highest participation rate (77%) in mining/utilities/construction and the lowest participation rate (54%) in arts/entertainment/accommodation/food services.

When an employer participates in the workers' compensation system, legal recourse for workplace injury is replaced by a no-fault system of defined benefits in the event of workplace injury. Workers' compensation serves as the exclusive remedy available to covered workers for workplace injury and illness,

[15] As of January 1, 1993, employers who meet certain safety and financial requirements may apply to be a certified self-insured employer in Texas. Self-insurance allows an employer to assume the risk for the vast majority of its workers' compensation liability, and purchase some form of excess or stop-loss coverage to protect the employer from catastrophic losses. Self-insurance provides employers with greater control over claims and disability management, and also provides loss-control incentives for employers to promote workplace safety. To be eligible for the certified self-insured program, private employers need to have an estimated unmodified manual insurance premium of at least $500,000 in Texas , or at least $10,000,000 nationwide, and meet other qualifications. As of January 1, 2016, there are about 130 employers who are self-insured. A detailed list of self-certified employers could be found here: `http://www.tdi.texas.gov/wc/si/documents/selfinsurlist.pdf`.

[16] For this study, we obtained data on the 95 firms ever self-insured during the analysis period, 2006-2011. Based on the administrative data provided by TDI, these firms collectively represent approximately 450,000 workers, or roughly 5% of Texas private sector workers.

[17] See TDI (2014). Choi (2011) presents an in depth discussion of the strengths and limitations of this survey data.

meaning that workers covered by workers' compensation cannot sue their employers for negligence. In comparison to a successful lawsuit or legal settlement, workers' compensation also limits the amount of compensation available to workers: earnings losses are not fully insured by workers' compensation, and workers' compensation does not allow workers to recover non-economic damages (i.e,. pain and suffering or punitive damages) that may be compensated in a lawsuit.[18] When employers opt out of the workers' compensation system, they forgo the protections afforded by the exclusive remedy feature of workers' compensation and assume the risk of liability for negligence.

Employers outside the workers' compensation system manage legal settlements for work-related injuries and illnesses in a variety of ways. For instance, roughly a third of non-participating employers design a formal or informal occupational benefit plan to offer workers after they suffer a work-related injury.[19] In contrast to workers' compensation insurance, the existence of an alternative occupational benefit plan does not shield an employer from tort liability.[20] Instead, one way to think about these plans is as a standardized form of settlement offered to employees after suffering a common work-related injury, where these benefit packages reduce the transaction costs associated with addressing injuries through the tort system. Based on a survey of large non-participating employers, Morantz (2010) reports that these plans typically offer medical and wage replacement benefits for temporary impairments and it is common for non-participating employers with these plans to still reach legal settlements outside the scope of these plans, particularly for cases involving permanently impaired workers. Further, Morantz (2010) reports that non-participating employers commonly state that an advantage of opting out is the ability to control the design of benefits available to injured workers.[21,22]

Importantly, workers' compensation coverage may be valued by both employers and employees, for

[18]While no systematic data exists on lawsuits and legal settlements, our discussions with individuals in the workers' compensation legal industry in Texas suggest that lawsuits involving injured employees at non-participating employers typically conclude with an out-of-court settlement (instead proceeding to trial).

[19]Source: TDI (2014).

[20]It is unlawful for non-participating employers to contract with employees pre-injury to restrict avenues for legal recourse in the event of an injury. This point was clarified in 2001 when the Texas Workers' Compensation Act was amended to include a prohibition against waivers of the right to bring a lawsuit against non-participating employers. See Acts 2001, 77th Legislature, Ch. 1456(e) and Texas Labor Code Sec. 406.033(e) (2010). This amendment was a reaction to legal challenges to such waivers at some non-participating employers. Since the enactment of this 2001 amendment, an injured worker at a non-participating employer has the right to sue their employer for negligence, regardless of any existence of an occupational benefit plan. After an injury takes place, a worker may decide to accept a settlement from a non-participating employer.

[21]According to Morantz (2010), in some ways non-participating employer occupational benefit plans on average appear more generous than statutory benefits in the workers' compensation system: these plans typically do not have a waiting period, do not cap the weekly wage replacement benefits for temporary impairments, and have a longer eligible duration for wage replacement benefits for temporary impairments. In other ways, these alternative plans appear less generous: most alternative plans have an end-of-shift or twenty-four hour reporting deadline (as compared to 30 day deadline in the workers' compensation program), do not cover permanent partial or total disability, limit medical benefits to about two years, and impose per-person or per-event caps on total benefits. See Morantz (2010), Morantz (2016), and Butler (1996) for a more in depth comparison compensation for work-related injuries at large non-participating employers relative to benefits within the workers' compensation system.

[22]Given prior evidence suggesting there is substantial scope for moral hazard in workers' compensation insurance (e.g., Krueger (1990*b*), Krueger (1990*a*), Meyer, Viscusi and Durbin (1995)), it is perhaps not surprising that some employers would try to innovate over the standard workers' compensation benefit package given the opportunity. The impact of the particular alternative risk management techniques adopted by non-participating employers is an important topic for future research.

several reasons. First, the existence of workers' compensation insurance may reduce the payments from employers and employees to lawyers relative to the outside option of legal recourse, providing surplus that may be split between employers and employees. Second, risk averse employers and/or risk averse employees may value the statutory defined benefits of workers' compensation insurance over the uncertainty involved with recourse through the tort system. The delays and uncertainty involved in pursuing compensation through the tort system were an important motivation for the establishment of workers' compensation systems (Fishback and Kantor, 1998).

Of course, there may be heterogeneity across both employers and employees in the valuation of workers' compensation insurance relative to the outside option of legal recourse. From the perspective of an employee or employer, there are two horizontally differentiated options which offer recourse for work-related injuries and illnesses: workers' compensation insurance and legal recourse. While some employers and employees may place a large value on workers' compensation insurance over the outside option of legal recourse, others may place little value on workers' compensation insurance relative to the outside option. Heterogeneous values for workers' compensation may reflect heterogeneity across employers/employees in the attractiveness of the outside option. For instance, there may be significant heterogeneity in the transaction costs associated with reaching settlements for workplace injuries in the absence of workers' compensation insurance or heterogeneity in the ability to manage moral hazard within the outside option relative to the workers' compensation insurance system. The crux of the argument made by proponents of the Texas model is that a one-size-fits-all coverage mandate may hurt employers and employees alike as it does not accommodate heterogeneous preferences in the relative valuation of workers' compensation coverage compared to the outside option.

While employers decide whether or not to purchase workers' compensation insurance, the consumer in the workers' compensation market may more accurately be thought of as some combination of employers and employees because both employers and employees may benefit from this coverage. As will become clear below, the empirical strategy and data utilized in this paper does not allow us to investigate the division of surplus among consumers in this market (e.g., between employers and employees). Instead, we have two primary aims in this paper. First, we estimate the demand for workers' compensation insurance using regulatory variation in premiums. Second, we analyze potential rationale for coverage mandates. For some of this latter analysis, we interpret the estimated demand curve as representing the joint valuation of workers' compensation insurance to both employers and employees. This interpretation is valid if employers account for employee preferences, as well as their own preferences, when purchasing workers' compensation insurance. For instance, the theory of compensating differentials suggests that employers would account for employee preferences when selecting whether or not to purchase workers' compensation insurance. In Section 5.3, we discuss the robustness of our analysis to relaxing this interpretation and potential alternative justifications for coverage mandates if this interpretation is not appropriate.

2.1.3 Regulation of Premiums and Benefits

Like other state workers' compensation programs, Texas regulates both the form of workers' compensation insurance policies that may be sold and the pricing of these policies. The policies sold by workers' compensation insurers guarantee the same stated benefits in terms of wage replacement and medical coverage in the event of injury. The basic structure of premiums per \$100 of covered payroll charged to employer j by insurer i in time period t for plan type p can be described by the following expression:

$$\text{premium}_{jitp} = b_t(c_j) \times r_t(e_{jt}) \times d_{ip} \times f_{it}. \tag{1}$$

There are several components to this premium. The base rate, $b_t(c_j)$, depends on an employer's workers' compensation industry-occupation classification, c_j. The Texas Department of Insurance (TDI) sets these classification base rates for the 360 distinct industry-occupation workers' compensation classifications. As discussed further below, our empirical strategy exploits regulatory updates to these classification base rates which induce classification-specific idiosyncratic shocks to the relative premium for obtaining workers' compensation coverage. Another component to premiums above is an experience rating multiplier, $r_t(e_{jt})$, which is a function of employer j's prior experienced claim history, e_{jt}. Like the classification base rates, the experience rating multiplier function is set by the regulator. Additionally, there is a regulated plan type multiplicative discount (d_{ip}) for plans that deviate from the standard coverage by including features such as employer deductibles or more restricted health care provider networks.[23] Lastly, each insurer can chose its multiplier, f_{it}, which gives the insurer an ability to set the overall price level charged for its policies even though insurers cannot set relative prices across classifications or loss experience groups.

In practice, employers may have multiple associated industry-occupation classifications if they have a diverse workforce. Typically, an employer has a primary classification, often referred to as the *governing classification*, which covers the vast majority of the employer's payroll.[24] Actual premiums paid are adjusted to account for the fraction of the employer's workforce dedicated to other categories (most commonly clerical and transportation services), and the percent of payroll allocated to each classification is subject to verification with ex post payroll auditing. Throughout we treat an employer's payroll classification(s) as

[23]In practice, the most common plan type discount is an employer deductible discount, and the allowable deductible discounts are set by the regulator. For smaller discounts (e.g., network discounts), the insurer has some discretion in setting the multiplicative discount rate applicable for all policies sold of that plan type.

[24]Based on the authors' discussions with the Texas Department of Insurance Actuarial Office, it is common for medium to large size employers to have a governing classification that represents roughly 80-90% of payroll with adjustments for the remaining 10-20% of payroll dedicated to other areas, most commonly clerical or transportation services.

exogenous. In Appendix Section D.1, we illustrate that it is uncommon for employers to change governing classifications, and changes in governing classifications are not systematically related to the rate updates we leverage for identification.

As described further below, we investigate two coverage measures in the demand estimation: the number of covered employers and total covered payroll. In our analysis below, the number of covered employers is constructed based on an employer's governing classification, as this is the classification information reported in the policy-level data. In contrast, the measure we use for total covered payroll is constructed by TDI which precisely allocates payroll across the corresponding classifications. The demand estimates are similar across specifications using these two measures.

2.2 Data

We have compiled a unique dataset for this study drawing on several administrative data sources. We obtained publicly available administrative actuarial data from the Texas Department of Insurance (TDI) at the classification-year level for several measures of interest describing the workers' compensation insurance market including: covered payroll, mean claim cost data, and industry-occupation classification base rates. Through an open records request, we obtained additional TDI actuarial data on mean premiums at the classification-year level. We also obtained unique, administrative micro-data on all employer workers' compensation insurance policies through a separate open records request. This data contains information on each workers' compensation insurance policy, including employer identifiers (e.g., Federal Employer Identification Number, firm name), workers' compensation industry-occupation classification code, North American Industry Classification System (NAICS) industry code, insurer name, policy effective date, premiums paid, and policy expiration date. Additionally, we obtained supplemental administrative data on each certified self-insured employer in the state of Texas for our analysis period through a third open records request; this data includes firm name, number of covered employees, and coverage effective dates. We augment the administrative data on the Texas workers' compensation system with public data on employment from the Quarterly Census of Employment and Wages (QCEW). Finally, we supplement these data with data reported by TDI on insurer combined loss ratios (Choi, 2011). The main analysis will utilize data from 2006 to 2011, as all of the key variables are available for this period.

Throughout, our analysis focuses on private sector employees, as government employees are insured through a separate system. Our baseline analysis excludes certified self-insured employers and associated employee payroll. We make this exclusion for two key reasons: (i) our identification strategy leverages variation in the premiums for coverage purchased from workers' compensation insurance providers, and (ii) the administrative data on covered payroll and claims are only available for the payroll covered through policies purchased from a workers' compensation insurance provider. While in principle, the regulatory updates to premiums could have induced substitution between the market for purchased policies and certified self-insurance, in practice we find no such substitution. Further, using administrative data on both the number of employers with purchased policies and the number of certified-self insured employers, we illustrate that the demand analysis in terms of the number of covered employers is qualitatively and quantitatively very similar regardless of whether we include the certified self-insured. See Appendix D.2 for this supplemental analysis.

Table 2 Panel A displays summary statistics for several key variables aggregated to the state-year level. Across the analysis period, approximately $254 billion of payroll is annually insured through the Texas workers' compensation system, comprising approximately 73% of private sector Texas payroll.[25,26] The number of claims per $100 of covered payroll is 5.86×10^{-5}, representing an annual mean claim probability of roughly 2.9% for workers earning $50,000 annually (roughly the mean annual earnings in this population). The mean premiums for policies sold is $1.79 per $100 of payroll. The mean total claim cost (inclusive of both the insurer costs and employer out-of-pocket costs) associated with workplace illness and injury for covered employees is $2.11 per $100 of covered payroll, with roughly 60% of costs attributable to medical spending and 40% to income benefits.[27] Because the classification-year claim cost data are inclusive of the costs paid out-of-pocket by employers, we cannot compare the classification-year premium and total claim cost data to understand the insurer profit margins. Given this data limitation, the welfare analysis in Section 5 utilizes this claim cost data to trace out the slope of the insurer average cost curve, under the assumption that insurer claim costs are proportional to total claim costs. We then augment this data with aggregate reported combined insurer loss ratios to identify the level of profit margins (the distance between the average cost and demand curves at the observed quantity insured).

Table 2 Panel B displays unweighted summary statistics describing the baseline estimation sample: classification-year level data covering 2006-2011. The sample consists of the 1,950 classification-year observations for which there is positive covered payroll, which collectively represent 326 distinct industry-occupation classifications. The mean covered payroll is $782 million across observations, with the interquartile range spanning from $25 million to $308 million. In addition to the variation in the size of classifications, there is considerable variation in classification base rates, mean premiums, and subsequent claim costs. The unweighted mean premium is $5.75 per $100 payroll, with the interquartile range spanning from $3.04 per $100 payroll to $7.09 per $100 payroll. To contextualize this variation, Appendix Table

[25] As noted in Table 2, dollar quantities are CPI-U adjusted to be 2006 dollars.

[26] We calculate that the covered payroll in the Texas workers' compensation market comprises approximately 73% of private sector Texas payroll by comparing TDI administrative covered payroll data to total private sector payroll data from the QCEW 2006-2011.

[27] Employers bear some of the claim costs through employer cost-sharing (e.g., deductibles).

A1 displays the largest classifications by covered payroll among classifications in the lowest 5% of the 2006 base rate distribution and among classifications in the highest 5% of the 2006 base rate distribution. Low risk classifications such as clerical employees, salespersons, physicians, college professional employees, and architects comprise some of the largest classifications at the low end of the base rate distribution. The largest classifications at the high end of the base rate distribution represent high risk classifications such as: oil and gas well employees and drivers, bus drivers, electric light or power line construction workers, and roofing employees. Comparing rates across the tails of the base rate distribution, we see that workers' compensation premiums are approximately 40 times higher for oil/gas well employees than for clerical office employees. While there is substantial cross-sectional variation in base rates across industry-occupation classifications, our identification strategy leverages within-classification idiosyncratic shocks to base rates induced by regulatory updates, as described further in the following section.

3 Empirical Strategy

3.1 Variation

Our strategy to estimate the demand for workers' compensation coverage is to isolate plausibly exogenous variation in premiums arising from regulatory updates to base rates across industry-occupation classifications. As described in the prior section, premiums are heavily regulated in this market, and the Texas Department of Insurance (TDI) is charged with setting the relative premiums across roughly 360 industry-occupation groups through setting the corresponding classification base rates employed in this market. Since all further adjustments to premiums are multiplicative and orthogonal to classification, a 1% increase in the classification base rate leads to a 1% increase in premiums. We utilize idiosyncratic updates to these base rates in a differences-in-differences framework for our main estimation.

Prior to 2009, TDI updated base rates on an annual basis, while in more recent years base rates are updated every other year. There were four total base rates updates during our analysis period, in each of the following years: 2007, 2008, 2009, and 2011. Below, we provide a brief outline of the regulators' algorithm for updating base rates and then we summarize a few key features of the algorithm. A basic outline of the steps of the update algorithm is as follows:

1. Input raw claim loss experience in classification from 5 year window, lagged by 3 years (e.g., for 2007 base rate, input is raw losses from 2000-2004).
2. Raw losses were adjusted to exclude all amounts in excess of $350,000 per claim, $700,000 per accident.
3. These limited losses are adjusted to a common level (the average level of current base rates).
4. Take weighted average of indicated rate (the average adjusted losses from the from previous step)

and current rate, where weights depends on number of claims ("credibility weighting").

5. Normalize the rates from the prior step to have same mean as the current year, and cap the change to be at most +/-25% of current classification base rate.
6. (Some Years) Across-the-board update to base rates.

The inputs into the update algorithm are: (i) historical classification claims experience (specifically, a five year moving average of claims experience with a three-year lag) and (ii) current classification base rates. The algorithm determines the weight to place on this claims experience verses the current classification base rate, through an assessment of the noise in this experience measure. The algorithm then caps any changes at +/- 25% of the current classification base rate. Appendix Section A presents for a full description of the rate update algorithm. As described further below, we exploit several mechanical features of this algorithm that generate arbitrary variation in base rates to investigate the robustness of our findings.

The final output of the algorithm is an updated set of base rates, where these rates are normalized so that the weighted mean of the base rates is unaltered by this update process. There are three updates during our period that are exceptions: 2008, 2009, and 2011. During these updates, TDI made an across-the-board downward level adjustment in base rates as a final step in the update process (step 6 above).[28] Because insurers are free to set level of premiums overall (as described in the prior section), insurers can effectively undo the effect of any across-the-board adjustment in the level of base rates on premiums. Additionally, all of our analysis will include time effects, allowing us to focus on updates in the relative base rates across classifications (as opposed to the level of base rates). Thus, our discussion of the identifying variation below focuses on the updates to the proposed base rates (the output from step 5) before any across-the-board adjustments, not the final adopted base rates.[29]

Figure 1 displays a histogram depicting the updates to the classification base rates as a percentage of the current base rates.[30] This figure displays these updates pooling across all updates during the sample period, while Appendix Figure A1 displays histograms of the updates year by year. There are a few things worth noting about this figure. First, the figure illustrates that the typical updates in classification base rates are large in relative terms. The mean absolute percent change in the base rate is 8.9% , and the interquartile range of percent changes in base rates is 14.5% . Second, as discussed above, the figure clearly depicts that the base rate updates are capped at +/- 25% change relative to the current classification base rate level.

[28]In 2008, 2009, and 2011, classification base rates were decreased across the board by 7.7%, 10% and 7.4%, respectively.

[29]Each table and figure clearly indicates which base rate is being described. Appendix Section A describes the update algorithm step-by-step and describes the role of each of the interim and final base rates we discuss in the text.

[30]This histogram describes the distribution of classification proposed base rate updates prior to any across-the-board adjustments to the level of base rates in years in which this occurs (2008, 2009, 2011). As discussed further in the text, because year fixed effects are included in all the specifications, all the identification will come from changes in the base rates before any across-the-board adjustments. Thus, Figure 1 focuses on this variation. Nevertheless, for comparison, Appendix Figure A2 separately plots the histograms of final base rate updates year-by-year inclusive of any applicable across-the-board adjustments.

Pooling across the updates during the sample period, the cap is binding for 6.6% of classification updates.

Figure 2 presents another illustration of this cap feature of the base rate update algorithm. Pooling data across the base rate updates, this figure plots the ratio of hypothetical uncapped base rates to current base rates on the horizontal axis and the ratio of proposed capped base rates to current base rates on the vertical axis for each classification update. Inspecting this figure, we see that the cap feature constrains the actual proposed updates to lie between 0.75 and 1.25 times the current rate, yet some classifications would have received much larger updates (in absolute value) if not for the cap feature.

The baseline empirical strategy leverages all of the idiosyncratic updates to base rates in a difference-in-differences framework to estimate the demand for workers' compensation coverage. A potential concern with this strategy is that the base rate updates rely on historical cost data from the classification, and thus these updates could reflect broader trends in the classification which could have an independent effect on the demand for coverage. We have three broad strategies to address this concern. First, we estimate differences-in-differences specifications which include classification-specific time trends, allowing us to isolate the effect of plausibly exogenous changes to premiums that reflect deviations from classification trends. Second, we estimate additional alternative specifications that leverage the precise timing of updates. Lastly, we estimate alternative specifications that exploit variation in base rates arising from non-linearities in the regulatory formula. We discuss each of these strategies in more detail below in the context of our estimating equations.

3.2 Econometric Model

Let j represent workers' compensation industry-occupation classification and t represent time period. The main regression we estimate can be written as:

$$ln(y_{jt}) = \alpha + \beta ln(b_{jt}) + \delta_j + \theta_t + \epsilon_{jt}, \tag{2}$$

where $ln(y_{jt})$ is the dependent variable and $ln(b_{jt})$ is the natural logarithm of the classification base rate. The specification includes time period fixed effects (θ_t) and classification fixed effects (δ_j). The dependent variables we investigate measure workers' compensation insurance coverage. Specifically, we focus on two coverage measures as dependent variables: (i) the natural logarithm of the total number of covered firms associated with classification j and for policies originating in time period t, and (ii) the natural logarithm of the total covered payroll associated with classification j and for policies originating in time period t.

As described in Section 2.2, many of the variables of interest are available at the classification-year level. Thus, our baseline demand estimation utilizes classification-year level data, where the key independent variable, $ln(b_{jt})$, is the natural logarithm of the average classification base rate applicable for policies associated with classification j and originated in year t.[31] Because some of the base rate updates occur mid-year, we repeat the analysis at the classification-month level for dependent variables available at a higher frequency (e.g., the number of covered employers). This additional analysis yields estimates very similar to the annual estimates, as discussed further in the Section 4.

The key identification assumption behind the specification above is that changes in base rates are uncorrelated with other determinants of the take-up of workers' compensation insurance, conditional on the included controls. As discussed above, a potential concern with the baseline identification strategy is that the base rate updates rely on inputs like historical cost data from the classification, and thus these updates could reflect broader trends in the classification which could have an independent effect on the demand for coverage. We have three broad strategies to address this concern and assess the validity of the baseline identifying assumption.

Our first strategy is to include classification-specific time trends in several of our specifications:

$$ln(y_{jt}) = \alpha + \beta ln(b_{jt}) + \delta_j + \theta_t + \lambda_j t + \epsilon_{jt}, \tag{3}$$

where $\lambda_j t$ represents a classification-specific time trend. Due to power considerations, we include these classification specific trends at 2-digit classification level given our limited sample period. In the Texas workers' compensation insurance system, there are approximately 360 distinct 4-digit classification codes, which are grouped into roughly 70 distinct 2-digit classification codes. These specifications relax the identification assumption by focusing on base rate updates which cause deviations in workers' compensation take-up after accounting for long-run trends among classifications with similar risk experience.

Our second strategy is to estimate specifications that leverage the precise timing of the regulatory rate updates. As discussed above, the historical cost data used as an input in the regulatory update algorithm is a five-year moving average of classification claims experience with a three-year lag. If contrary to the identification assumption, changes in these inputs have an independent effect on workers' compensation take-up, then we would expect to see that changes in workers' compensation take-up pre-date the regulatory rate updates. To assess if this is the case, we estimate regressions of the following form:

$$ln(y_{jt}) = \alpha + \beta ln(b_{jt}) + \phi ln(b_{j,t+2}) + \delta_j + \theta_t + \lambda_j t + \epsilon_{jt}, \tag{4}$$

where $ln(b_{j,t+2})$ represent the natural logarithm of classification base rates to be implemented two years

[31] Because some years span a base rate update, the average base rate is calculated as a weighted average across all policies sold for a particular classification in a particular calendar year, utilizing administrative data on each employers' policy effective date.

into the future. Recall, the update algorithm constructing $b_{j,t+2}$ draws on historical costs in classification j from year $(t-6)$ to $(t-1)$. Thus, $b_{j,t+2}$ is arguably more relevant than $b_{j,t}$ for capturing the expected costs in classification j in time t, though $b_{j,t+2}$ does not affect pricing at time t after controlling for the current base rate, $b_{j,t}$. If our baseline identification assumption holds, we would expect to see no relationship between workers' compensation take-up and this additional term (i.e., $\phi = 0$) and the estimated coefficient on the actual base rate (β) is not sensitive to the inclusion of this additional term. [32]

Lastly, our third strategy to assess the identification assumption is to estimate specifications that take advantage of non-linearities in the regulatory update algorithm. As discussed above, proposed updates to classification base rates are capped to be no greater than +/- 25% of the current classification base rate level. If contrary to the baseline identification assumption, the inputs to the regulatory formula have an independent relationship to workers' compensation take-up above and beyond their role in rate determination, then we would expect to see that hypothetical uncapped base rates would be correlated with take-up after conditioning on the ultimately adopted capped base rates. To test whether this is the case, we estimate specifications of the following form:

$$ln(y_{jt}) = \alpha + \beta ln(b_{jt}) + \pi[ln(\tilde{b}_{j,t}) * \mathbb{1}(capBinding_{jt})] + \delta_j + \theta_t + \lambda_j t + \epsilon_{jt}, \tag{5}$$

where $ln(\tilde{b}_{j,t})$ represents the natural logarithm of the hypothetical uncapped base rate for classification j in year t, and $\mathbb{1}(capBinding_{jt})$ indicates that the +/- 25% cap was binding for the base rate for classification j in year t. If our baseline identification assumption holds, we would expect to see no relationship between workers' compensation take-up and the hypothetical uncapped base rate for classification-years for which the cap was binding (i.e., $\pi = 0$) and the estimated coefficient on the actual base rate (β) is not sensitive to the inclusion of this additional term.

Note that our primary dependent variables (the natural logarithm of covered payroll and the natural logarithm of covered firms) rely solely on the administrative data. As discussed in Section 2.1, there is no administrative data on the universe of eligible firms and eligible payroll within each classification, so it is not possible to estimate demand in terms of the fraction of firms insured or the fraction of payroll insured.[33] Thus, to interpret the estimates as reflecting the demand for insurance, a key assumption is that the eligible population of firms and payroll in each classification is not changing in response to the iden-

[32] We focus on base rates two years into the future for this robustness analysis because these base rates should be unrelated to take-up decisions this year, after controlling for this year's base rates. As discussed in the text, these regressions utilize classification-year level data where base rates in classification j in year t are the average base rate for policies purchased in that calendar year. Because some base rate updates occur mid-year, the average base rate one year into the future may contain information about base rates relevant for purchase decisions at the end of the current year, and thus base rates two years in advance provide a clearer placebo test.

[33] While the Quarterly Census of Employment and Wages (QCEW) reports the total number of firms and payroll in the state of Texas, the workers' compensation classification information is not available for non-participating employers in either public or administrative data.

tifying premium variation.[34] While the lack of classification-level data on the eligible population prevents us from testing this directly, we present some supporting evidence for this assumption by utilizing NAICS industry-year level data on the Texas workforce from the Quarterly Census of Employment and Wages (QCEW). We relate the QCEW industry-year data on industry size to the classification-year level variation in workers' compensation premiums by constructing a unique weighted crosswalk between workers' compensation classifications and NAICS industry codes from the administrative data on all employer workers' compensation insurance polices. Appendix Section D.3 describes this supplemental analysis in detail. The results suggest that neither the aggregate number of firms nor the aggregate number of workers in an industry are responsive to the premium variation within the associated classifications, building confidence in our interpretation of the primary regressions as reflecting the demand for insurance.

4 Demand Estimates

We begin by presenting our baseline demand estimates and the primary robustness analysis, assessing the identification assumption using the three broad strategies described above. We then present additional robustness analysis.

4.1 Baseline Estimates and Primary Robustness Analysis

Table 3 displays the primary demand results. Panel A presents results in terms of the number of covered firms, while Panel B presents results in terms of covered payroll. All specifications include both year fixed effects and industry-occupation classification fixed effects. In each panel, columns (1) and (2) present the results of the main difference-in-differences specifications, without classification-specific time trends (equation 2, column 1) and with classification-specific time trends (equation 3, column 2). Across these specifications, the estimates indicate that an increase in workers' compensation premiums leads to a decline in workers' compensation coverage. Drawing on the estimates in column (1), a 10% increase in premiums leads to a 3.1% decline in the number of covered firms and a 2.8% decline in covered payroll. Based on the 95% confidence interval of these estimates, we can rule out an elasticity less than -0.14 or more than -0.51 in terms of covered firms (and less than -0.05 or more than -0.55 in terms of covered payroll). The results are very similar when including a classification-specific time trend (column 2).

Figure 4 graphically depicts the baseline regressions through binned mean residual plots. The vertical axis displays the mean residuals from a regression of the dependent variable on the controls included in the baseline specification, while the horizontal axis displays mean residuals from a regression of the base rate on the controls included in the baseline specification. Each dot in these figures represents 5% of the

[34] See Appendix Section D.3 for a more detailed description of the assumption needed to address this econometric challenge and supporting evidence for this assumption.

classification-year observations in the baseline sample, where observations are binned by the values on the horizontal axis. Panel A displays the results for the number of covered firms (analogous to the estimates in Table 3 Panel A column 1) and Panel B displays the results for covered payroll (analogous to the estimates in Table 3 Panel B column 1). These plots confirm the strong relationship between base rates and workers' compensation coverage.

As described above, we investigate the robustness of these demand estimates through estimating a series of alternative specifications. Columns (3) and (4) present results from estimating equation 4. These alternative specifications include future base rates two years in advance of their implementation. We report the results with classification-specific time trends (column 4) and without classification-specific time trends (column 3). If, contrary to the identification assumption, changes in the algorithm historical cost inputs have an independent effect on workers' compensation take-up, then we would expect to see that changes in workers' compensation take-up pre-date the regulatory rate updates. However, in both of these specifications, the coefficient estimates on the future base rate are not significant, and the estimated coefficients on the contemporary base rate are largely unchanged. Thus, the pattern of these estimates builds confidence in the identification assumption and the robustness of the baseline demand estimates.

Columns (5) and (6) estimate the alternative specification described in equation 5. This alternative specification assesses the plausibility of the identification assumption by exploiting non-linearities in the regulatory update algorithm resulting from the +/- 25% cap on rate adjustments. We report the results with classification-specific time trends (column 6) and without classification-specific time trends (column 5). If, contrary to the baseline identification assumption, the inputs to the regulatory formula have an independent relationship to workers' compensation take-up above and beyond their role in rate determination, then we would expect to see that hypothetical uncapped base rates would be correlated with take-up after conditioning on the ultimately adopted base rates. However, the coefficient estimates on the hypothetical uncapped base rate are small and statistically insignificant, while the coefficient estimates on the actual base rate are largely unaffected. These results support the baseline identification assumption and the robustness of the baseline estimates.

4.2 Additional Robustness Analysis

In addition to the alternative specifications discussed above, we further probe the robustness of the demand estimates with respect to a few additional potential concerns.

Incidence of Premium Changes It is unclear how the burden of increased premiums (or the benefit from reduced premiums) is shared among employers and employees. While we do not estimate the division of surplus between employer and employees, we investigate the robustness of our demand estimates to various assumptions on this division. To the extent that employers shift the cost of workers' compensation premiums onto workers, wages may be partially shifted upward or downward to reflect changes in workers' compensation premiums. While this has no impact on the interpretation of the number of covered firms analysis (Table 3 Panel A), this may affect the interpretation of covered payroll analysis (Table 3 Panel B). Ideally, the demand estimation would utilize a pure quantity measure which is not sensitive to possibly endogenous wage adjustments. While we analyze the number of covered employers which is a pure quantity measure, we also analyze covered payroll (wages multiplied times hours) which only represents a pure quantity measure if wages are not responsive to the identifying variation in workers' compensation premiums.[35] To evaluate the sensitivity of our estimates to potential endogenous wage adjustment, we repeat the covered payroll regression analysis under various assumptions on the fraction of premiums passed through to employees in the form of reduced wages. Specifically, these additional specifications repeat the baseline payroll regression replacing the dependent variable with the natural logarithm of normalized covered payroll: $ln(\frac{\text{payroll}_{jt}}{1-\theta\times\text{premium}_{jt}})$, where premium_{jt} represents the mean premium per dollar of payroll for classification j in year t and θ represents the fraction of premiums shifted to employees in the form of reduced wages.

Table 4 Panel A displays the results of these additional specifications; column (1) displays the baseline estimates utilizing unadjusted covered payroll for reference, while the remaining columns display the analogous covered payroll regressions under alternative assumptions. The key take-away from these estimates is that regardless of the division of premiums between employers and employees on the margin, increases in classification base rates lead to a decline in covered payroll. Specifically, across the range of possible assumptions on the division of premiums between employees and employers, a 10% increase in classification base rates leads to an estimated decline in normalized covered payroll of 2.3% to 2.8%.[36] For the purpose of our discussion of mandates in Section 5, we utilize demand estimates where quantity is measured as unadjusted covered payroll. Further analysis reported in Appendix Section D.6 demonstrates that the main conclusions of Section 5 are unchanged, regardless of the division of premiums between employers and

[35] Analyzing data from compulsory workers' compensation insurance systems, Gruber and Krueger (1991) find that workers' compensation premium changes in the 1980s in some high-risk industries were largely shifted into wages. As these authors discuss, their findings are consistent with multiple explanations, including that labor supply is more inelastic than labor demand (a typical finding in tax incidence analyses of labor markets) or that employees value workers' compensation coverage changes that were coincident with the premium changes they analyze. Because the present empirical setting is quite different from the setting these authors investigate (for example, in the present empirical setting coverage is optional, all occupational groups are included, etc), it is not clear whether employers or employees bear the incidence of workers' compensation insurance premium updates. While our baseline approach is to analyze unadjusted covered payroll, the key results are not sensitive to which segment of consumers bears the incidence of workers' compensation insurance premiums, as we discuss further in the text.

[36] It is not surprising that the results are robust across the different possible divisions of premium updates across employers and employees. To see this, note that the average premium is $1.79 per $100 in payroll; thus, a 10% across-the-board increase in premiums would lead to approximately a 0.179% decrease in covered payroll if coverage rates were held fixed and premium changes were fully shifted onto employees in the form of reduced wages. In other words, any mechanical effect of premiums on wages is expected to be an order of magnitude smaller than the estimated demand elasticity, regardless of the incidence of workers' compensation insurance premiums.

employees.

Treatment of zeros In the baseline estimation displayed in Table 3, the dependent variables we investigate are: the natural logarithm of the number of covered employers and the natural logarithm of covered payroll. Because the natural logarithm of zero is not defined, this analysis excludes the few observations for classifications with no covered payroll in the relevant year. To investigate the robustness of our results with respect to the treatment of these zero observations, we re-estimate the primary specifications replacing the dependent variable with an inverse hyperbolic sine transformation or a $ln(x+1)$ transformation of the objects of interest, where x represents either the number of covered employers or total covered payroll. The results of these alternative specifications are displayed in Table 4 Panel B. The estimates from these alternative specifications are very similar in magnitude and statistically indistinguishable from those obtained from analogous specifications using the baseline dependent variable definitions (displayed in Table 4 Panel B columns 1 and 4).

Level of observation Table 3 presents the baseline estimation which utilizes classification-year level observations, where the independent variable of interest is the mean classification base rate for policies sold during the relevant year. As discussed in Section 3, some regulatory base rate updates during our analysis period take place mid-year. While data on covered payroll is only available at the classification-year level, the administrative data on covered employers includes the precise effective date and end date for each employer workers' compensation policy. Thus, we can repeat the demand estimation in terms of number of covered employers at the classification-month level. Analogous to our baseline classification-year level analysis, the classification-month analysis utilizes observations which represent all policies originating in a particular month for firms within the relevant classification. Table 4 Panel C reports the results of these alternative specifications along with the baseline estimates for reference. This table displays three versions of these alternative specifications: one version where the dependent variable is defined as $ln($number of policies originated$)$ (excluding classification-month observations for which there are no covered employers), and two alternative versions where the dependent variable is transformed using either a shifted logarithm transformation or inverse hyperbolic sine transformation to include all classification-month observations. The estimates from these alternative specifications are similar in magnitude to and statistically indistinguishable from the baseline estimates utilizing classification-year data. In addition, Appendix Section B presents event study figures utilizing this monthly data on the number of policies originated where we zoom in on the months just surrounding a rate update; this additional analysis illustrates that rate updates are unrelated to coverage before implementation and are associated with a change in coverage shortly after an update is implemented.

5 Welfare Framework and Empirical Evidence

Drawing upon the demand estimates and additional administrative cost data, we investigate the potential rationale for government intervention to increase coverage. Motivated by the near ubiquity of coverage mandates in the the setting of workers' compensation insurance, we begin by discussing the potential rationale for mandating workers' compensation coverage through the lens of a standard welfare framework in insurance settings. We then present empirical evidence on these potential justifications and present counterfactual analysis of the impact of interventions such as a mandate or subsidy. Lastly, we discuss the interpretation of this evidence and potential alternative justifications for mandating coverage.

5.1 Welfare Framework

Classic economic theory provides some potential explanations for why a private market would under-provide insurance relative to the first best, including: adverse selection, market power, and (positive) externalities. Figure 4 illustrates the intuition behind each potential explanation through a graphical example in the spirit of Einav and Finkelstein (2011). Each panel of this figure plots the demand, marginal cost curve, and average cost curve associated with an insurance market, where the horizontal axis represents the fraction with insurance and the vertical axis is measured in dollars. In this graphical illustration (and in the empirical welfare calculations below), we abstract from insurer-level economies of scale and focus on market-level demand and cost curves.[37] Following the prior empirical literature on insurance markets, we consider welfare within the insurance market abstracting from general equilibrium adjustments in related markets.[38] We interpret the demand curve as representing the value of this insurance to consumers, noting that consumers are jointly comprised of employers and employees in the setting of workers' compensation insurance.[39] While the quantitative welfare analysis based on the estimated demand curve relies on this interpretation, we discuss the robustness of our qualitative findings to relaxing this interpretation below.

Motivated by the widespread use of coverage mandates in the setting of workers' compensation insurance, our discussion of the graphical example focuses on the impact of a coverage mandate implemented with full compliance. More broadly, the government may consider a range of policy tools to address un-

[37]As described further below, our data on costs are at the classification-year level, aggregating across all insurers. Our decision to abstract from insurer-level economies of scale is motivated by our desire to connect the welfare framework to objects we can estimate with our data.

[38]Any counterfactual government intervention to increase coverage (e.g. a subsidy or mandate) may induce general equilibrium adjustments in related markets (e.g., labor markets, the associated markets for goods/services, etc) that are not captured by this simple partial equilibrium welfare analysis. For this partial equilibrium analysis, we treat the maximum quantity insured as fixed with respect to the back-of-the-envelope welfare counterfactuals we analyze. Though coverage mandates could theoretically cause the quantity of labor employed to fall, prior empirical work finds no employment effects associated with changes in the actuarial value and cost of mandated workers' compensation benefits (Gruber and Krueger (1991)).

[39]As discussed in Section 2.1, both employers and employees may value workers' compensation insurance relative to the outside option of legal recourse in the event of workplace injury. We interpret the demand curve for insurance as representing the joint valuation of insurance across the relevant marginal consumers (employers and employees).

derinsurance, including mandates, subsidies, and taxes (e.g., a “pay-or-play” mandate). In the empirical analysis, we consider a broader scope of potential government interventions.

Figure 4 Panel A describes a competitive market that is adversely selected (as depicted in the figure by the downward sloping cost curves). In a perfectly competitive market, firms earn zero profits and the equilibrium is defined by the intersection of the demand and the average cost curves (point B). The efficient provision of insurance occurs at the quantity described by the intersection of the demand and the marginal cost curve (point A). Thus, in an adversely selected setting, a competitive market under-provides insurance where the deadweight loss in this figure is described by the area ABC. Though adverse selection may justify a mandate, whether a mandate will improve welfare is an empirical question that will depend on the relative magnitude of the welfare gain among those inefficiently uninsured without a mandate (area ABC) and the welfare loss among those efficiently uninsured without a mandate (area ADE).

Figure 4 Panel B describes an imperfectly competitive market with no selection (as depicted in the figure by the flat marginal/average cost curve). Suppose imperfectly competitive firms charge a single price, where μ denotes the profit per unit. The market equilibrium in this figure is depicted by point B. The efficient provision of insurance occurs at the intersection of the demand and the marginal cost curve (point A). Thus, insurance is under-provided when the market is imperfectly competitive, and the welfare loss of this under-provision is depicted in this figure by area ABC. Whether it is welfare-improving to mandate the purchase of insurance will depend on the relative magnitude of the welfare gained for those inefficiently uninsured without a mandate (area ABC) and the welfare lost for those efficiently uninsured without a mandate (area ADE).

Figure 4 Panel C describes a market with no selection and a positive externality associated with insurance. For example, a positive externality associated with insurance arises if some of the costs covered by the insurer would have been paid by external parties outside of the consumers/producers in the absence of insurance. Panel C illustrates the case of a constant positive externality, where the social marginal cost (SMC) curve is represented as a vertical shift downward relative to the private marginal cost (PMC) curve. In this case, the efficient provision of insurance occurs at the point at which the SMC curve intersects the demand curve (point A). However, a competitive private market would provide insurance at the point at which the PMC curve intersects the demand curve (point B). Thus, a competitive private market would under-provide insurance, where the welfare loss of this under-provision is depicted by area ABC. In the case of a positive externality, whether a mandate will improve welfare is an empirical question that will depend on the relative magnitude of the welfare gain among those inefficiently uninsured without a mandate (area ABC) and the welfare loss among those efficiently uninsured without a mandate (area ADE).

There are a few key take-aways from this simple graphical example. First, adverse selection, market power, and positive externalities may each contribute to the under-provision of insurance relative to the first best. Thus, either adverse selection, market power, or positive externalities are potential justifications for mandating coverage. Second, the existence of adverse selection, market power, and/or positive externalities is not sufficient for justifying a coverage mandate. Whether a mandate will improve welfare will depend on the empirical demand and cost curves.

5.2 Empirical Evidence

5.2.1 Selection

Next, we look to the data for evidence relating to these potential justifications. Leveraging the same price variation used to estimate demand, we test for the presence of adverse selection following the approach outlined by Einav and Finkelstein (2011) and Einav, Finkelstein and Cullen (2010). Specifically, we estimate the baseline empirical specification outlined in equation 2, replacing the dependent variable with applicable measures of costs. In this analysis, let us assume that marginal costs are monotonic in the quantity insured, so that the sign of the relationship between average costs and quantity is informative as to the degree of selection (as measured by the sign of the slope of the marginal cost curve). To operationalize this test for selection, we pair our primary data with additional administrative data on claim costs by classification and policy origination year (described in detail in Section 2.1).

Table 5 Panel A reports the results of this analysis. Each column corresponds to a separate regression, where the corresponding dependent variable is indicated at the top of the column. The even columns display the results from estimating specifications with classification-specific time trends, while the odd columns display the results from specifications that exclude these additional controls. One challenge with estimating selection is that some classifications have no claims in some years, so the natural logarithm of the average cost for such observations is undefined. We confront this issue by estimating specifications on various samples. Table 5 Panel A presents the results for the baseline specifications which use the baseline demand estimation sample and an inverse hyperbolic sine transformation to include classification-year observations with zero costs. Table 6 presents robustness analysis investigating alternative specifications utilizing a $ln(x)$ transformation or a $ln(x+1)$ transformation. The analysis and discussion below focuses on the baseline estimates in Table 5 Panel A, where we interpret the inverse hyperbolic sine transformed variables as an approximation of the natural logarithm. We obtain qualitatively similar findings utilizing the alternative specifications in Table 6.

Because insurers in this setting are allowed to risk adjust premiums (through a multiplicative experience rating modifier as described in Section 2.1), the welfare-relevant measure of selection depends on whether risk-adjusted insurer expected costs are related to the premium variation. Table 5 Panel A columns

(1) and (2) report the results relating a feasible proxy for risk-adjusted insurer expected costs— ex post realized claim costs per risk-adjusted payroll—to the base rate variation. The coefficient estimates on the base rate are both quantitatively small and statistically indistinguishable from zero. Scaling these cost estimates by the appropriate demand estimates in terms of risk-adjusted payroll (from Table 5 Panel A columns 3 and 4), the estimates suggest that a 1% increase in risk-adjusted covered payroll induces a 0.04% increase in mean claim costs [95% CI -0.64 to 0.72] (based on Table 5 Panel A columns 1 and 3) or a 0.13% decrease in mean claim costs [95% CI -0.70 to 0.96] (based on Table 5 Panel A columns 2 and 4).[40]

To see the magnitude of the point estimates graphically, Appendix Figure A4 Panels A and B plot the implied demand and cost curves based on the risk-adjusted cost elasticity estimate, market-level aggregate data (on premiums, costs, and quantity), and a linear or constant elasticity extrapolation, respectively.[41] This figure illustrates that the implied risk-adjusted marginal/average costs based on the point estimates in Table 5 Panel A are very close to constant in the quantity insured. Further, Table 5 Panel B displays the implied welfare cost of selection using the implied cost curves based on extrapolating from these statistically insignificant point estimates. The point estimates from Panel A specification (1) based on a linear extrapolation indicate an implied welfare cost from over-insurance due to advantageous selection of 0.04 cents per $100 of risk-adjusted payroll or approximately $0.20 annually for a worker with annual earnings of $50K (roughly the mean annual earnings); the point estimates from Panel A specification (2) based on a linear extrapolation indicate an implied welfare cost from under-insurance due to adverse selection of 0.34 cents per $100 of risk-adjusted payroll or approximately $1.70 annually for a worker with annual earnings of $50K. Overall, the calculations in Table 5 Panel B illustrate the implied welfare cost of selection is economically small and statistically indistinguishable from zero.

Based on the estimates above, there is no evidence of adverse selection in this setting. We probe the robustness of this qualitative finding in a variety of ways. First, we estimate additional specifications with alternative transformations of the cost measure as described above. The results reported in Table 6 illustrate that these additional specifications yield similar findings. Second, Appendix Table A5 presents additional specifications utilizing several alternative measures of claims: overall costs (the baseline measure), medical costs, income benefit costs, total claims, serious claims, non-serious claims, and "medical only" claims (i.e., claims with no income benefits). Across all the specifications, the coefficient estimates on the base rate are small and statistically indistinguishable from zero. Lastly, Appendix Table A6 displays additional analysis where we leverage nonlinearities in the regulatory update formula to provide further evidence on the robustness of the baseline selection analysis and the plausibility of the associated identification assumption.

[40]See Appendix Section C and Appendix Table A7 for more detail on these estimates. The reported confidence intervals are based on bootstrapped standard errors (clustered at the classification level) employing 1,000 randomly drawn bootstrap samples.

[41]For a more detailed explanation of the welfare calculations, see Section 5.2.2 below and Appendix Section C.

The key take-away from this analysis is that we find no evidence of adverse selection in this setting. This finding is robust to the inclusion/exclusion of classification-specific time trends (evidenced by the similarity of results across the odd and even columns of Table 5), different methods to deal with zero cost observations (e.g., alternative specifications reported in Table 6), alternative specifications that assess the identification assumption (e.g., alternative specifications in Appendix Table A6) and alternative measures of claims (e.g., the alternative specifications reported in Appendix Table A5).[42] It is important to note that workers' compensation insurance is a much more heavily risk-adjusted market than many other insurance markets (e.g., individual health insurance, individual annuities, etc). Thus, one possible explanation for the lack of evidence of adverse selection in this setting is that the extensive risk adjustment in this context—through industry-occupational rating and extensive experience rating—may be effective at addressing selection.

5.2.2 Market Power

Next, we turn to another potential justification for government intervention to increase insurance coverage: market power. As described in Section 2.1, like many other states, the Texas state legislature created a quasi-public insurer to compete with private insurers in the state workers' compensation market. In 1991, the state legislature created Texas Mutual Insurance Company, which currently serves 40% of the workers' compensation insurance market. Perhaps partially due to the large presence of the quasi-public Texas Mutual Insurance Company, the profit margins in the market are fairly low based on the reported mean combined insurer loss ratio of 88%, representing the fraction of premiums collected that are paid out in costs.

To investigate the potential quantitative importance of market power, we conduct back-of-the-envelope welfare calculations utilizing demand curves based on our demand elasticity estimates along with aggregate administrative data reported to the regulator on premiums and market-level insurer combined loss ratios.[43] Abstracting from fixed costs, we use the mean reported loss ratio and mean premiums over our time period to back out the implied profit margin (and thus mean costs). Note that this broader market-level measure of costs based on insurer-reported combined loss ratios goes beyond claim costs, as it accounts for the timing of incurred losses/premiums and administrative costs. We then employ a few parametric assumptions to extrapolate from our estimated demand elasticity and conduct several back-of-the-envelope calculations projecting welfare under various hypothetical government interventions. As described in Section 2.1, insurers in this market only choose the overall price level; relative prices across industry-occupation groups and across experience rating groups are fixed by regulation. Thus, for the pur-

[42] Appendix Tables A8 and A9 display further robustness analysis illustrating the key findings are unchanged when incorporating alternative incidence assumptions.

[43] See Choi (2011).

pose of this calculation, we model this as a single market where we measure the quantity insured as the fraction of risk-adjusted payroll that is insured. To obtain the aggregate risk-adjusted payroll in the population, we extrapolate based on the estimated relationship between the mean experience rating modifier and the quantity of payroll insured.[44] To measure the universe of possible payroll insured, we obtain aggregate Texas payroll data from the Quarterly Census of Employment and Wages (QCEW). Specifically, we define the relevant population for this market to be all private sector payroll in the state of Texas, excluding the fraction of payroll attributable to certified self-insured firms as described further in Section 2.1 and Appendix D.2. Based on the empirical analysis described above which finds no evidence of selection, we do these calculations under the assumption of no selection, meaning that there is a flat market-level average/marginal (risk-adjusted) cost curve.[45] Appendix Table A7 illustrates that the welfare analysis is very similar if instead we employ the small (and statistically indistinguishable from zero) risk-adjusted cost elasticity estimates reported in Table 5.[46] In the following calculations, we ignore potential externalities and revisit the role of externalities further in Section 5.2.3 below.

Table 7 Panel A displays the welfare calculations, while Panel B reports the underlying point estimates and corresponding demand curve. The counterfactuals are conducted using two alternative parametric extrapolations from the estimated demand elasticity: linear demand (displayed in columns 1 and 2) and constant elasticity demand (displayed in columns 3 and 4). In addition to the reported estimates in Table 7, Figure 5 Panel A displays the linear and constant elasticity demand curves graphically, along with the mean premiums and costs. The figure indicates the observed quantity insured and the optimal quantity insured. Dashed vertical reference lines indicate the range of the identifying variation: the implied range in quantity based on a constant elasticity specification and the observed range of premium variation spanning a +/- 25% price change. Note that the identifying variation spans the relevant range of quantities for the analysis comparing the observed quantity insured to the optimal quantity insured, thus the fitted linear and constant elasticity demand curves closely correspond to one another in this range. The counterfactuals related to an insurance mandate are outside of the range of the identifying variation, and thus will naturally be more sensitive to the chosen functional form for demand.

Table 7 reports welfare measured in dollars per $100 of risk-adjusted payroll. In addition, we also report

[44]See Appendix Section C for more details.

[45]While the selection analysis in Table 5 utilizes claim cost data (available at the classification-year level), the welfare calculations here utilize more comprehensive aggregate cost data inclusive of both claim costs and administrative costs and accounting for the timing of incurred premiums and losses. To the extent that administrative costs can be thought of as a constant loading factor per unit of payroll, the cost elasticities estimated in Table 5 are informative about the degree of selection using a more comprehensive definition of costs.

[46]This robustness is not surprising given the small magnitude of the risk-adjusted cost elasticity estimates. As can be seen in Appendix Figure A4, the risk-adjusted cost elasticity estimates imply nearly flat marginal and average cost curves. Because the implied empirical cost curves are so close to horizontal (and we cannot statistically reject that they are indeed horizontal), we assume marginal/average costs are constant in the baseline welfare analysis. Appendix Table A7 illustrates that the welfare analysis is very similar if instead we employ the risk-adjusted cost elasticity estimates reported in Table 5.

two scaled measures of welfare to ease interpretation. The table reports welfare as a percent of the mean cost of the insured (one measure of the size of the market). To contextualize the relative estimates in terms of annual dollars, the table also reports welfare measures scaled by $50K, approximately the mean annual earnings for Texas workers in 2011.[47] Note that this is simply a convenient way to contextualize the magnitude of the estimates rather than a statement regarding the incidence of workers' compensation surplus among employees/employers. As discussed earlier, the workers' compensation insurance consumer can be thought of as some combination of the employee and the employer. Because nothing about our data and variation allows us to decompose the division of surplus between employees and employers, we abstract from this distinction throughout and conduct revealed preference welfare analysis by interpreting the demand curve as representing the value of insurance to workers' compensation consumers, where consumers are some combination of employers and employees.

First, let us consider the optimal allocation in this market. Note that in the absence of selection, a perfectly competitive market yields the optimal allocation. According to our estimates,the optimal allocation in this setting is attained when 73.4% of risk-adjusted payroll is insured in the linear specification (73.7% in the constant elasticity extrapolation), an almost 4 percentage point increase over the status quo quantity insured of 70%.[48] Focusing on the linear demand specification, relative to the imperfectly competitive status quo, moving to the perfectly competitive optimal allocation would increase welfare by $0.0041 per $100 of risk-adjusted payroll, with a 95% confidence interval allowing us to rule out an increase less than $0.0019 or more than $0.0063 per $100 of risk-adjusted payroll. Scaling this by $50K (roughly the mean annual earnings), these estimates imply a welfare increase of $2.03 annually per worker in a perfectly competitive optimum relative to the status quo. The welfare associated with moving from the status quo to the optimum is approximately 0.26% of the mean insured cost in this market. We obtain very similar welfare estimates in the alternative specification with constant elasticity demand (reported in columns 3 and 4).

Overall, the small magnitude of these estimates indicates that there is very little welfare at stake for a move from the imperfectly competitive status quo to the perfectly competitive optimum. Put differently, further government intervention to increase enrollment in this market through subsidies would at best generate a small amount of surplus (an increase of approximately $2.03 per worker annually) and at worst be welfare-detrimental. For instance, let us consider a government subsidy to move the market from the status quo to the optimal allocation. If there is no deadweight loss of taxation to fund this subsidy, the government could obtain the optimal allocation for a net welfare increase of $0.004 per $100 of risk-adjusted payroll, or

[47] Based on the authors' calculations, the mean earnings of Texas workers in the QCEW data for 2011 is roughly $50K.

[48] Pooling the data over our sample period, 73% of private industry payroll is insured (as reported in Table 2) and 70% of risk-adjusted private industry payroll is insured. As discussed above, we obtain risk-adjusted payroll using data on experience rating and extrapolating from the estimated reduced form relationship between the mean experience rating factor and base rates. See Appendix Section C for more details.

approximately $2.03 per worker annually. However, more realistically, there is likely some deadweight loss associated with raising tax revenue to cover the cost of the subsidy. If we assume the marginal deadweight loss associated with taxation is 25% and the subsidy is fully passed-through to consumers, then the subsidy needed to implement the optimal allocation would reduce welfare relative to the status quo. Based on estimates from either demand specification, welfare would decline by $0.036 per $100 of risk-adjusted payroll, or approximately $18 per worker annually, if such a subsidy to support the optimal allocation were adopted relative to the status quo. Thus, such a subsidy would not improve efficiency after accounting for the deadweight loss of taxation to fund the subsidy. In fact, a subsidy to implement the optimal allocation will be welfare-detrimental provided that the marginal deadweight loss associated with taxation per dollar of subsidy is greater than 3%. Overall, this evidence suggests that market power does not present a compelling justification for government intervention to further increase insurance enrollment in this setting.

The most common form of government intervention in the setting of workers' compensation insurance is a coarse instrument: an insurance coverage mandate. As discussed earlier, all states excluding Texas currently mandate that employers provide workers' compensation insurance. Motivated by the prevalence of workers' compensation mandates, we next consider a hypothetical insurance mandate in the Texas workers' compensation insurance market. Because this counterfactual is further outside of the variation we use to estimate demand, naturally these estimates will be more sensitive to the parametric assumptions regarding the demand curve and one should be more cautious in interpreting the results of this counterfactual. With that caveat in mind, our estimates indicate that an insurance mandate would substantially decrease welfare. The precise magnitude of the reduction in welfare relative to the status quo depends on the specification: the linear specification indicates a decline of $0.21 per $100 of risk-adjusted payroll, while the constant elasticity specification indicates a decline of $0.12 per $100 of risk-adjusted payroll. Scaling this by $50K, these estimates imply that a mandate would decrease welfare by approximately $103 annually per worker based on the linear specification or $59 annually per worker based on the constant elasticity specification. This welfare decrease is large relative to the mean cost insured within this market: the welfare loss from a mandate amounts to 13.2% of the mean cost based on the linear specification and 7.5% of the mean cost based on the constant elasticity specification.

5.2.3 Externalities

Next we turn to a remaining traditional market failure rationale for government intervention to expand coverage: positive externalities. For example, positive externalities may arise in an insurance market if some of the costs covered by insurance would have fallen on external parties (outside the relevant consumers and producers) in the absence of insurance. Under the assumption that consumer choice in the workers' compensation market jointly reflects the preferences of employers and their employees, an externality to the workers' compensation insurance purchase decision would be an external cost borne by parties other than the insurer, the employer, or the workers.[49] In the setting of workers' compensation insurance, it is plausible that there are positive externalties that accrue to formal or informal health insurers because of the presence of workers' compensation coverage.[50] Approximately 60% of workers' compensation claim costs are due to medical bills associated with workplace injury. If an individual has workers' compensation coverage, the workers' compensation insurer is the first-payer for these medical costs. In the absence of workers' compensation insurance, external parties such as health insurers, hospitals, or other sources of charity care may pick up the bill for some of the costs that would have otherwise been covered under workers' compensation insurance. Thus, if external parties such as health insurers bear some of the costs that would otherwise be covered by workers' compensation insurance and there are no adjustments to make consumers internalize these costs, there is an externality in this market: workers' compensation insurers and consumers do not account for the fact that workers' compensation coverage can drive down the costs of formal or informal health insurers.

While prior studies have shown that health insurance expansions lead to reductions in workers' compensation insurance medical expenditures (Dillender (2015), Bronchetti and McInerney (2017)), there is no evidence from the prior literature to guide us in assessing how workers' compensation insurance expansions affect health care expenditures borne by external parties. Further, data is not available to quantify this externality using our variation. Thus, we are left to speculate about the importance of this potential externality.[51] While this potential externality may exist, there are several reasons why the externality is likely quantitatively small in practice. First, the externality is mitigated to the extent that health insurers can successfully recover medical costs associated with workplace injury through suing liable employers. Second, this potential externality is also limited by the extent to which employer health insurance costs reflect workers' compensation insurance coverage (e.g., through actuarial adjustments to health insurance premiums, through experience rating for employer-provided health insurance, through self-insurance of employee health coverage, etc.). Given these extensive mechanisms to internalize this externality in the

[49]We also note that, if the parties of the workers' compensation purchase decision include insurers, workers, and employers, externalities would not include uncompensated losses that are borne by workers or their families. Rather, externalities would derive from costs borne by other third parties not involved in the workers' compensation purchase decision, for example private health insurers, government health insurance programs, and hospitals that provide charity care to the uninsured.

[50]Externalities across different types of insurance products can arise in several types of settings. For instance, an externality can arise when two types of insurance products may be eligible to pay for the same costs (such as medical costs associated with workplace injury that could be eligible for payment through either health insurance or workers' compensation insurance). Alternatively, externalities across insurers can arise if insurance products cover complementary costs, as is the case with Medicare and private Medigap coverage (Cabral and Mahoney, 2018).

[51]Regarding a seemingly related phenomenon, many have speculated that the increase in workers' compensation claims on Mondays reflects a shifting of uninsured medical expenses for off-the-job injuries to workers' compensation insurance. However, Card and McCall (1996) analyze the "first reports" of injuries filed with the Minnesota Department of Labor and find that employees with low probability of medical coverage are no more likely to report Monday injuries than others.

setting of employer-provided health insurance, this externality may be most prevalent among those with health insurance through other sources (e.g., a spouse's employer, Medicaid, charity care, etc). Third, the externality is mitigated to the extent that injured employees themselves pay their own medical bills out-of-pocket, due to incomplete health insurance coverage. Fourth, this externality may be quantitatively small if many of the medical expenditures within the workers' compensation system would not have occurred in the absence of workers' compensation. Some medical costs within workers' compensation are specific to that setting and are irrelevant outside of workers' compensation insurance. For instance, workers' compensation claims require a medical exam to assess the scope of the injury and the employee's work limitations. More generally, moral hazard responses may lead individuals to claim medical expenditures under workers' compensation that would not have occurred in the absence of this coverage.

While data limitations prevent us from estimating this externality in this setting, we assess the potential quantitative importance of externalities on formal and informal health insurers through conservative back-of-the-envelope calculations. In these calculations, we are interested in the potential externality rationale for government intervention to increase coverage. While there may be other externalities associated with workers' compensation coverage, there is almost no research on this topic and the limited research that does exist suggests that some other natural external parties are either unaffected or potentially adversely affected by workers' compensation coverage.[52] In the absence of evidence of other positive externalities, we focus on the external impacts of workers' compensation coverage on formal and informal health insurers as the most plausible source of positive externalities in this setting.

We repeat the welfare analysis above under various conservative assumptions on the magnitude of the externality on formal or informal health insurers. Specifically, we model this externality as a constant shift downward in the social marginal cost curve relative to the private marginal cost curve faced by workers' compensation insurers. In these calculations, we assume that health insurers do not make actuarial adjustments to premiums based on workers' compensation coverage, and we assume that health insurers (broadly defined as being inclusive of formal health insurance and charity care) provides 70% actuarial value coverage of medical costs while workers' compensation provides 100% actuarial value coverage of medical costs.[53]

[52]For instance, workers' compensation insurance may generate externalities for providers of public or private disability insurance. However, because workers' compensation coverage is primarily aimed at providing temporary benefits while disability insurance covers longer spells after a waiting period, it is ex ante theoretically ambiguous the direction of the externality. Further, prior work has shown that tightening of workers' compensation insurance programs does not appear to be associated with increased disability insurance claims (McInerney and Simon (2012)). Aside from work on potential externalities on disability insurance, we know of no evidence of other externalities associated with workers' compensation coverage, and we note this is an important area for future research. In the absence of any such evidence, we focus on broadly defined health insurers as the most likely source of positive externalities in this setting.

[53]We make the approximation that formal and informal health insurance provides 70% actuarial value coverage; this is consistent with recent evidence that the uninsured pay in the range of 20% to 35% of their cost of care (e.g., Coughlin et al. (2014), Finkelstein, Hendren and Luttmer (2018)).

Table 8 reports the results of these additional calculations for both linear and constant elasticity demand specifications. For reference, the baseline results with no externality are displayed in columns 1 and 2 for the linear specification and columns 9 and 10 for the constant elasticity specification. The remaining columns display the results when repeating the welfare calculations assuming that 25%, 50% or 75% of workers' compensation medical claim costs would have otherwise occurred and been eligible for coverage through a formal or informal health insurer. Figure 5 Panel B graphically depicts these back-of-the-envelope welfare calculations using both the fitted linear and constant elasticity demand curves.

Inspecting Table 8, we see that the optimal quantity insured increases modestly with the magnitude of the externality on health insurers, but in no scenario does the optimal quantity insured approach full insurance. Between 73% and 74% of risk-adjusted payroll would be optimally insured if there were no externality, while the optimally insured increases to 75% based on a linear extrapolation (or 76% constant elasticity extrapolation) if a quarter of the medical claim costs would have been eligible for payment by external health insurers. In the extreme case (and in our view unrealistic case) where 75% of medical claim costs would have been eligible for payment by external health insurers, we see that the optimal insured only increases to 79% under the linear specification (or 81% in the constant elasticity specification). We note that this calculation—under the more extreme 75% assumption—results in a projected optimal quantity insured at the edge of the identifying variation, so more caution should be exercised when interpreting these estimates. While the precise welfare estimates for the counterfactuals depend on the size of the externality, the main lessons of this analysis are robust across the specifications. Specifically, regardless of which externality assumption is employed, the analysis suggests that: (i) mandating workers' compensation coverage would not increase welfare relative to the status quo, (ii) the optimal allocation provides only a small increase in welfare relative to the status quo, and (iii) a subsidy to support the optimal allocation funded by a tax with marginal deadweight loss of 25% would decrease welfare relative to the status quo. Overall, these calculations suggest that externalties may not provide a compelling justification for further government intervention to increase coverage.

5.3 Discussion

The key take-away from the analysis above is that classic market failures examined here—adverse selection, market power, and externalities—do not appear to justify further government intervention to expand coverage through a subsidy or mandate in the setting of Texas workers' compensation insurance. Below, we discuss two possible interpretations for these findings.

One interpretation of the evidence above is that there is no rationale for mandating coverage in this setting. If we interpret the estimated demand curve as representing the value of this insurance to consumers, some segment of the population is optimally uninsured as their willingness-to-pay for coverage lies below the cost of providing this coverage. Thus, one interpretation of the findings above is that indeed some segment of the population is optimally outside the workers' compensation system and government intervention to expand coverage in this setting would harm welfare. It is certainly plausible that some segment of risk averse consumers (jointly, employers and employees) may be optimally outside the workers' compensation insurance system. For instance, consumers may not value workers' compensation coverage above the cost of providing this coverage because of factors such as moral hazard and/or administrative costs. Moral hazard is a plausible explanation for the low valuations in this setting, as a large body of prior research (e.g., Krueger (1990*b*), Krueger (1990*a*), Meyer, Viscusi and Durbin (1995)) has suggested that there may be substantial scope for moral hazard in workers' compensation insurance.[54] Consistent with the notion that some workers may value of workers' compensation insurance below the cost of this coverage because of moral hazard, Bronchetti (2012) analyzes the drop in consumption experienced by workers upon injury and uses calibrations to illustrate that typical workers' compensation insurance replacement rates are more generous than would be optimal under a range of plausible risk aversion values and moral hazard elasticities. As discussed above, the welfare analysis above accounts for administrative costs, as the level of costs are inferred from combining administrative premium data and market-level reported combined insurer loss ratios. Thus, administrative costs may also be a contributing factor to the estimated low valuations relative to costs in the analysis above. It is also important to emphasize that this is not a classic vertically differentiated insurance setting where a consumer either has insurance or no insurance for some underlying risk. Instead, this is a setting with horizontally differentiated options for recourse for work-related injuries: workers' compensation insurance or legal recourse. In any setting with horizontally differentiated options, there is not necessarily an ex ante reason to believe that consumers should all prefer one option over the other, even beyond considerations such as moral hazard and administrative costs.

Another interpretation of the findings above is that there may still exist alternative justifications for mandating coverage if the estimated demand curve does not fully capture the value of this insurance to consumers (jointly employers and employees in this setting). There are a few potential reasons why the demand curve may not fully reflect consumer valuations in this setting. First, consumers in this setting may have limited information or be subject to behavioral biases which lead them to inappropriately weigh risks associated with workplace injury within the workers' compensation system and outside of the system.[55]

[54]Because all of the prior literature examining the elasticity of claims with respect to the benefit level investigate changes within mandated workers' compensation systems, none of these studies provide the elasticity of interest in this setting: how do the costs from work-related injuries (i.e., lost wages and medical costs) respond to the existence of workers' compensation insurance? Unfortunately, comparable data on workplace injuries is not available for covered and uncovered firms, so we are unable to estimate moral hazard using our variation.

[55]One potentially important aspect of consumer information is the extent to which workers understand the outside option of legal recourse. Workers might have inaccurate beliefs about options for pursuing compensation for injuries through the tort system in

If consumers inappropriately value this coverage, traditional welfare analysis using demand curves may not be appropriate, as revealed preference may not reliably indicate the true valuation of insurance in such cases. Note that this concern is not particular to this setting. Any study that uses demand in welfare analysis must confront the fact that behavioral biases may influence demand in such a way that the distribution of true consumer valuations departs from the estimated demand curve. Second, there may be labor market frictions (e.g., worker mobility frictions, bargaining frictions between employers and employees, informational asymmetries between workers and firms, etc.) that lead employer workers' compensation insurance purchase decisions to not reflect the joint valuation of this insurance to employers and employees.

While the precise welfare estimates discussed above are not directly applicable if the demand curve does not reflect consumer valuations of insurance, it is important to note that many of the broader conclusions from the analysis above are equally applicable. In particular, regardless of whether we can interpret the demand curve as representing consumer valuations in this setting, the cost estimates discussed above indicate there is no evidence of adverse selection in this setting, and thus adverse selection may not be a compelling justification for expanding coverage through a subsidy or mandate. Additionally, given the small observed markups in this setting and the limited quantitative importance of externalities, market power and externalities are unlikely justifications for a government coverage mandate in this setting even if the demand curve does not accurately reflect consumer valuations. Of course, if consumer valuations for insurance systematically exceed those implied by the estimated demand curve, the underlying reasons for the departure between the demand curve and consumer valuations— for example, underlying behavioral biases or labor market frictions—may themselves provide an alternative justification for government intervention in the form of a subsidy or mandate.[56] We are aware of no research on the importance of limited consumer information and behavioral biases in the setting of workers' compensation insurance. Prior studies have found that mean wages respond sharply to changes in the actuarial value of mandated workers' compensation benefits (Gruber and Krueger (1991)) and the establishment of workers' compensation sys-

contrast to workers' compensation. One example of a subtle issue that might not be salient to workers before an injury occurs is that a worker might have difficulty recovering costs through the tort system for injuries at a small employer with too few assets. That is, small employers might have de facto limited legal liability in the tort system. This sort of misinformation could lead workers to undervalue workers' compensation insurance. On the other hand, some workers may not be aware that they have options to recover damages through the tort system when working for a non-participating employer or that they forgo these options when working at a participating employer, which could lead some workers to inaccurately overvalue workers' compensation insurance. As with other behavioral biases or sources of limited consumer information, we are not aware of evidence on the extent to which workers understand or account for the implications of non-participation.

[56]The National Commission on State Workmen's Compensation Laws (1972) endorsed universal coverage of workers as one of the four basic objectives of workers' compensation policy. Among other arguments, the National Commission cited labor market imperfections and the bounded rationality of workers as justifications for a coverage mandate. "For several reasons we do not find the freedom-to-contract plea convincing. A classic point against that plea is that employees do not have equal bargaining power with their employers, particularly when employees are not unionized. An even more compelling reason for mandatory insurance is that the task of selecting a job is complex. Most workers are unlikely to assess properly the probabilities of being exposed to work-related impairments. Often employees and employers are contemptuous of the risks they assume. We believe that society can appropriately mandate workmen's compensation coverage as a way of insuring that those injured at work do not become destitute." (National Commission on State Workmen's Compensation Laws, 1972, pg. 36)

tems (Fishback and Kantor (1995)), suggesting that labor market frictions may be limited on average.[57] Our data and variation do not allow us to explore such alternative justifications, and thus we cannot assess the potential quantitative importance of these potential alternative rationale in this setting. We note this is an important area for future research.

While typical insurance market failure rationale for mandating coverage do not appear to be particularly compelling in this setting, it is important to note that consumers may highly value the option to buy workers' compensation from the regulated voluntary market. Recall that a large segment of consumers (jointly employees and employers) appear to value workers' compensation coverage more than the mean cost of providing this coverage: approximately 70% of risk-adjusted payroll is covered by workers' compensation insurance in the absence of a mandate. Moreover, based on our modest estimated demand elasticity, many of these consumers are not close to indifferent between purchasing or not purchasing this coverage at the market price. Thus, while the revealed preference welfare analysis indicates that some consumers may be optimally uninsured, the estimates suggest that some consumers derive significant surplus from this coverage and on average consumers appear to value workers' compensation insurance more than the cost of providing this coverage. For instance, if we extrapolate based on a parametric linear demand curve, the estimates suggest that on average consumers value workers' compensation coverage at 166% of the mean cost of providing this coverage.[58] In summary, the revealed preference welfare analysis suggests that mandated workers' compensation insurance may improve welfare over the absence of any workers' compensation insurance system, but a coverage mandate may reduce welfare relative to the existing regulated, voluntary market for workers' compensation insurance.[59]

[57] While these prior studies suggest that mean wages respond to changes in the actuarial value of mandated workers' compensation benefits (Gruber and Krueger (1991)) and the establishment of workers' compensation systems (Fishback and Kantor (1995)), there could be heterogeneity in responses across firms and workers. Our estimates suggest substantial heterogeneity in the value of workers' compensation coverage across firms and workers.

[58] Estimating the mean value of this coverage requires extrapolating far from the identifying variation, and thus appropriate caution should be used in interpreting this estimate. For a constant elasticity specification, the willingness-to-pay is not bounded for quantities near zero, so the mean implied willingness-to-pay is divergent over (0,1). In a constant elasticity specification, the mean willingness-to-pay is an order of magnitude larger than in a linear specification over the truncated interval (0.01,1).

[59] In this way, our results connect with those of prior studies on workers' compensation which analyzes the incidence of changes in the actuarial value of mandated workers' compensation benefits (Gruber and Krueger (1991)) and the incidence of the establishment of workers' compensation systems (Fishback and Kantor (1995)). Gruber and Krueger (1991) reveal evidence suggesting that the cost of mandated workers' compensation coverage expansions are on average passed-through to employees nearly dollar-for-dollar within select high-risk occupations. Fishback and Kantor (1995) show that the establishment of workers' compensation systems (which were often voluntary rather than mandated) lead to substantial wage offsets in select occupations. While there are many differences between the present setting and the setting of these prior studies, our results in this setting suggest that either a voluntary or mandated workers' compensation insurance system generates positive net surplus relative to no workers' compensation insurance, indicating that there may be scope to reduce mean employee wages to offset the costs of coverage associated with a voluntary or mandated workers' compensation insurance system. Importantly, our revealed preference welfare analysis suggests there is substantial heterogeneity in the valuation of this coverage across firms and workers.

6 Conclusion

This paper provides the first estimates of the demand for workers' compensation insurance and evidence on the potential rationale behind government intervention to increase coverage through subsidies or a mandate. To estimate the demand for workers' compensation insurance, we leverage the unique voluntary feature of the Texas workers' compensation insurance system and policy-induced variation in premiums paired with administrative data on the Texas workers' compensation insurance market. Though there is no coverage mandate in this setting, voluntary participation is high: approximately 66% of private sector employers participate in the workers' compensation insurance system representing roughly 78% of private sector employees. Utilizing regulatory updates to relative premiums across industry-occupation classifications, the difference-in-differences analysis reveals that the demand for coverage is price-sensitive: a 10% increase in premiums leads to approximately a 3% decline in covered payroll and the number of covered firms. Utilizing these demand estimates and data on costs among the insured, we analyze potential rationale for an insurance coverage mandate in this setting. Our analysis suggests that classic insurance market failures—such as adverse selection, market power, and externalities—do not appear to justify further government intervention to expand coverage through a subsidy or mandate in this setting. Importantly, we note that our empirical strategy does not allow us to rule out (or rule in) alternative justifications for a coverage mandate, such as behavioral biases or labor market frictions, that go beyond the classic market failure rationale we investigate in the revealed preference welfare analysis. More broadly, this evidence may inform the ongoing policy debate among states seeking to repeal their coverage mandates in favor of a regulated voluntary workers' compensation market. For instance, one implication of our findings is that such debates may more productively focus on whether behavioral biases or labor market frictions could justify mandating coverage.

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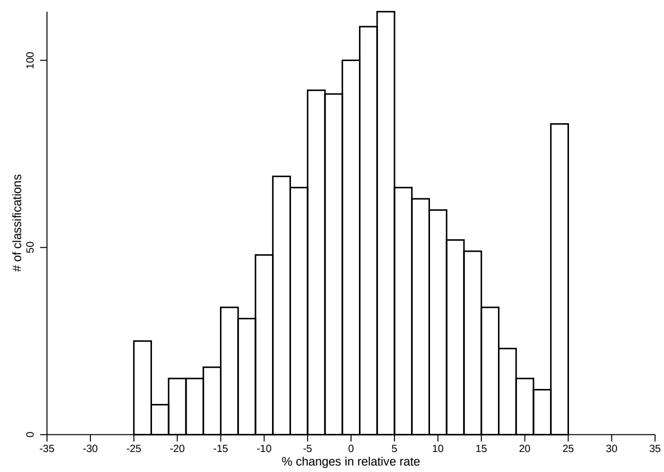
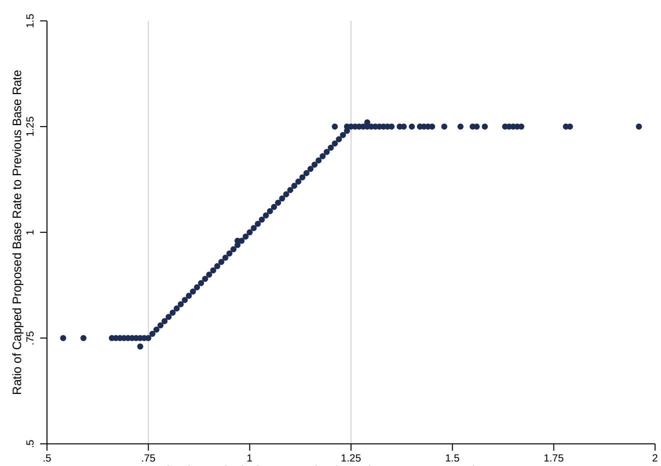
Figure 1: Histogram of Base Rate Updates



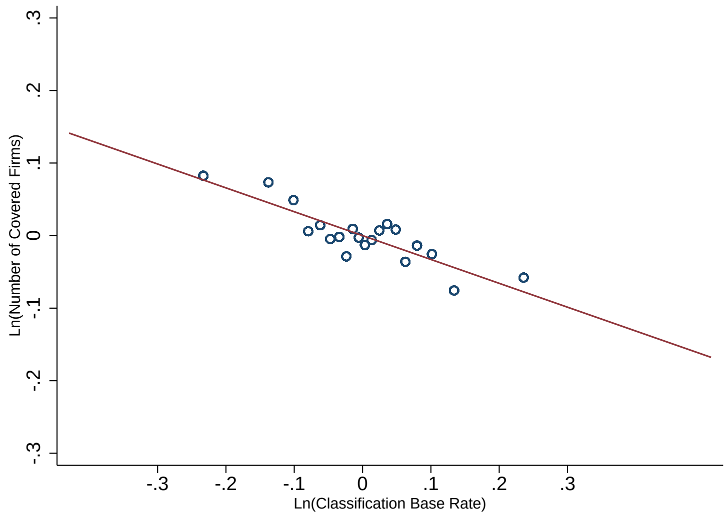
Notes: The above histogram describes the the proposed updates to the base rates (before any across-the-board adjustments) polling across all the updates in the sample period: 2006-2011. Following the definitions in Appendix Section A, the percent change here is defined as: $\frac{\text{Proposed Relative Base Rate}_j - curRel_j}{curRel_j}$ for classification j. Histograms by update year for the proposed updates are depicted in Appendix Figure A1, and the updates in the final implemented base rates (after across-the-board adjustments) are depicted in Appendix Figure A2.

Figure 2: Base Rate Updates: Proposed Capped Rates and Hypothetical Uncapped Rates

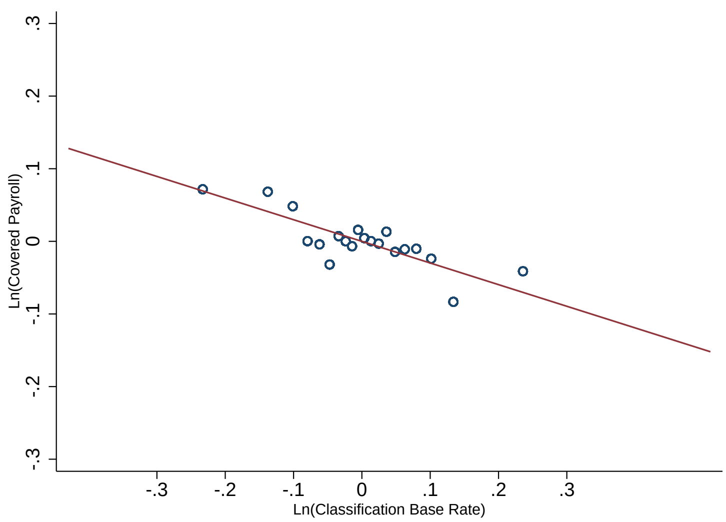


Notes: Each dot in the figure represents a classification update, where classification observations are pooled across updates in the sample period (2006-2011). The figure displays a scatter plot of the following two ratios: the ratio of capped proposed relative base rate to previous base rate ($\frac{proRel_j}{curRel_j}$ for classification j) and the ratio of hypothetical uncapped balanced base rate to previous base rate ($\frac{balRel_j}{curRel_j}$ for classification j). See Appendix Section A for more details on these inputs into the base rate update algorithm.

Figure 3: Graphical Depiction of Demand Estimates



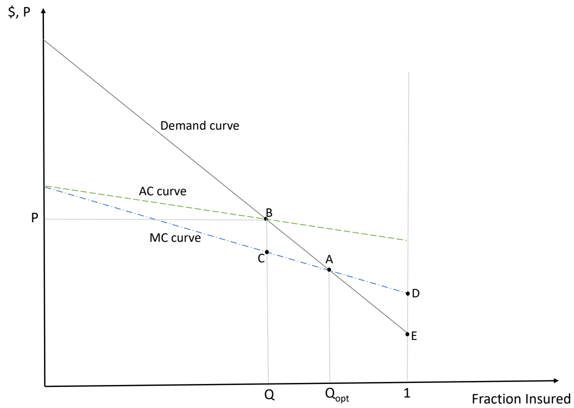
(a) Covered Firms



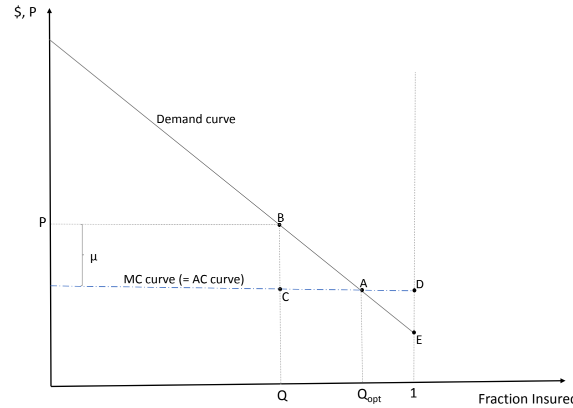
(b) Covered Payroll

Notes: This figure displays binned residual scatter plots for the baseline demand specifications. Each dot represents 5% of the classification-year observations in the baseline sample. Panel A displays the results for the number of covered firms (analogous to the estimates in Table 3 Panel A column 1) and Panel B displays the results for covered payroll (analogous to the estimates in Table 3 Panel B column 1).

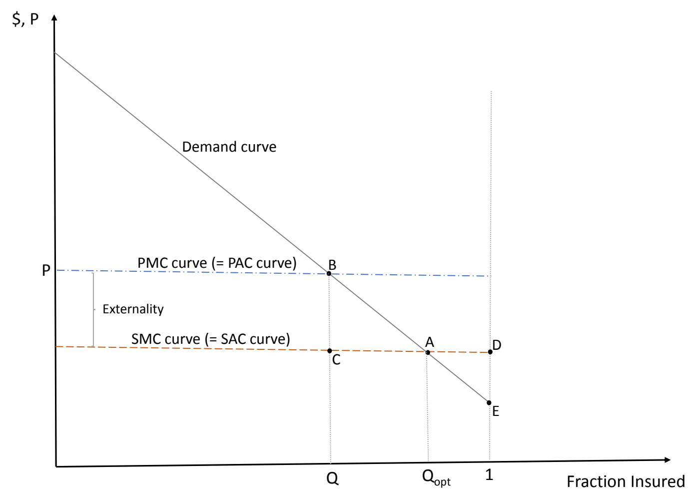
Figure 4: Potential Rationale for Government Intervention



(a) Adverse Selection



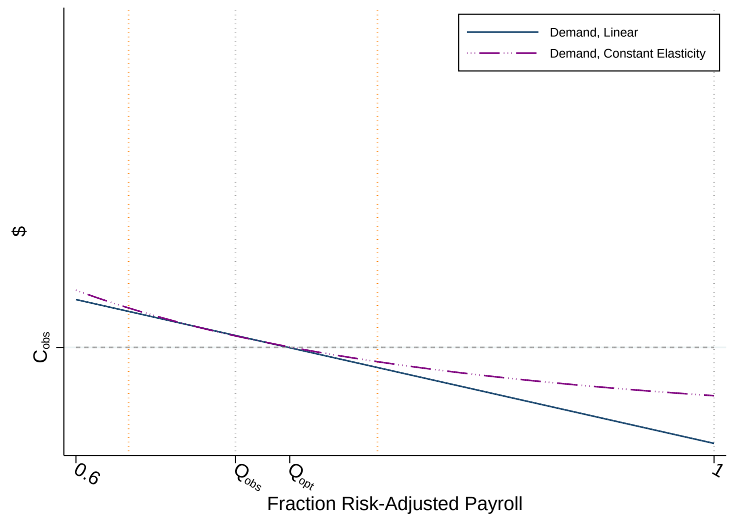
(b) Market Power



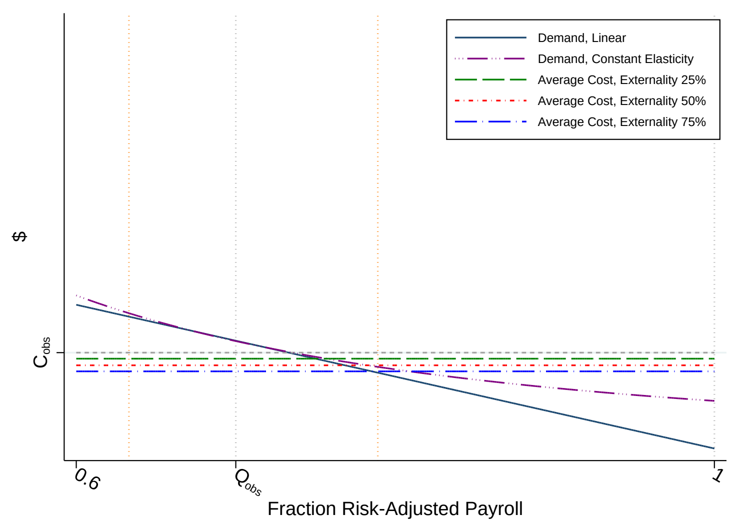
(c) Positive Externality

Notes: The above figures depict potential justifications for government intervention to increase coverage. Panel A depicts a competitive market in which there is adverse selection (characterized by a downward sloping marginal cost curve). Panel B depicts a setting with no selection but with market power, where μ represents the per unit profit. Panel C depicts a setting with no selection but with a positive externality associated with insurance; the figure depicts the case of a constant positive externality, where the social marginal cost curve is represented by shifting the private marginal cost curve downward by the size of the externality.

Figure 5: Welfare: Graphical Representation



(a) Baseline Welfare Calculation: No Selection



(b) Incorporating an Externality

Notes: The above figure depicts a graphical representation of demand based on the empirical estimates. As discussed in the text, we obtain these curves by combining the estimated elasticities and aggregate summary statistics from the overall market on mean premiums, mean insurer costs, and mean quantities. See Appendix Section C for further details on this estimation. Both panels depict the marginal cost and average cost curves as flat, given the selection estimates are consistent with no selection in this market. Both panels illustrate the observed quantity of risk adjusted covered payroll (70%). To give a sense of the range of variation used to identify demand, the figure also displays vertical reference lines indicating the quantities associated with a +/- 25% premium change based on the constant elasticity demand specification (63%, 79%). Panel A depicts a setting with no selection and no externality, where the optimal quantity insured would be between 73% and 74% in either specification. Panel B depicts the conservative back-of-the-envelope calculations regarding potential externalities on external parties that may bear some of the health care costs otherwise covered under workers' compensation.

Table 1: Summary Statistics: Workers' Compensation Take-Up

Source: TDI Survey on Employer Participation				
	Fraction Insured			
	Mean	2006	2008	2010
Statewide				
Employees	0.78	0.77	0.75	0.83
Employers	0.66	0.63	0.67	0.68
Employers by Firm Size				
1-4 employees	0.59	0.57	0.60	0.59
5-9 employees	0.68	0.64	0.69	0.70
10-49 employees	0.77	0.74	0.77	0.80
50-99 employees	0.82	0.81	0.82	0.84
100-499 employees	0.85	0.83	0.84	0.87
500+ employees	0.79	0.79	0.74	0.85
Employers by Industry				
Agriculture/Forestry/Fishing/Hunting	0.74	0.75	0.73	0.75
Mining/Utilities/Construction	0.77	0.79	0.72	0.81
Manufacturing	0.67	0.63	0.69	0.69
WholesaleTrade/Retail Trade/Transportation	0.67	0.63	0.71	0.68
Finance/Real Estate/Professional Services	0.67	0.67	0.67	0.67
Health Care/Educational Services	0.62	0.56	0.61	0.68
Arts/Entertainment/Accommodation/Food Services	0.54	0.48	0.54	0.60
Other Services Except Public Administration	0.60	0.58	0.64	0.58

Notes: This table displays reported summary statistics from an employer phone survey commissioned by the Texas Department of Insurance (TDI) to elicit information about the employer participation rate and associated employer characteristics. Data were obtained from a TDI report summarizing this employer survey: TDI (2014).

Table 2: Summary Statistics: Baseline Sample

Panel A: Annual Statewide Aggregates, 2006-2011					
	Mean	Std. Dev.	Median	25th pctile	75th pctile
Covered Payroll ($)	2.54E+11	9.16E+09	2.54E+11	2.48E+11	2.58E+11
Covered Payroll (%)	0.73	0.02	0.72	0.72	0.75
Number of Participating Employers	200,138	12,729	201,462	190,044	211,033
Mean Classification Base Rate ($ per $100 in payroll)	2.36	0.27	2.31	2.13	2.65
Mean Premium ($ per $100 in payroll)	1.79	0.31	1.70	1.55	2.05
Mean Cost, insurer and out-of-pocket ($ per $100 in payroll)					
All	2.11	0.08	2.13	2.01	2.15
Medical	1.26	0.11	1.24	1.15	1.38
Indemnity	0.84	0.14	0.78	0.75	0.97
Mean Claims (# per $50K in payroll)					
All	0.029	0.004	0.028	0.026	0.033
Serious	3.97E-04	8.95E-05	3.71E-04	3.28E-04	4.33E-04
Non-Serious	0.007	0.001	0.007	0.007	0.008
Medical Only	0.022	0.003	0.020	0.019	0.025

Panel B: All Classification-Year Observations (N=1,950), 2006-2011					
	Mean	Std. Dev.	Median	25th pctile	75th pctile
Covered Payroll ($)	7.82E+08	5.94E+09	8.64E+07	2.48E+07	3.06E+08
Number of Participating Employers	616	1985	85	26	324
Classification Base Rate ($ per $100 in payroll)	7.06	5.64	6.21	3.97	8.71
Mean Premium ($ per $100 in payroll)	5.75	4.88	4.96	3.04	7.09
Mean Cost, insurer and out-of-pocket ($ per $100 in payroll)					
All	6.64	6.99	5.13	2.61	8.28
Medical	4.07	4.54	3.20	1.64	5.11
Indemnity	2.57	3.41	1.75	0.78	3.07
Mean Claims (# per $50K in payroll)					
All	0.086	0.060	0.077	0.045	0.117
Serious	1.23E-03	2.12E-03	5.60E-04	0.00E+00	1.47E-03
Non-Serious	0.023	0.021	0.020	0.010	0.030
Medical Only	0.062	0.045	0.054	0.029	0.084

Notes: This table displays summary statistics for the data employed in this paper. Panel A describes the data, aggregated to annual level. In Panel A, the fraction of payroll insured is calculated by comparing administrative covered payroll data to aggregate payroll data from the Quarterly Census of Employment and Wages (QCEW). Further details on this data and the construction of these aggregates are in Appendix Section C. Panel B describes the classification-year sample used in the baseline demand analysis (N=1,950). The mean cost variable described above is the total claim cost (per $100 payroll), where this cost is inclusive of both insurer costs and employer out-of-pocket costs. In the above table, dollar quantities are adjusted using the CPI-U to be 2006 dollars.

Table 3: Demand Estimates

Panel A: Dependent Variable: ln(total number covered firms$_{jt}$)						
	(1)	(2)	(3)	(4)	(5)	(6)
ln(relativeBaseRate$_{jt}$)	-0.329	-0.270	-0.325	-0.264	-0.335	-0.275
	(0.094)	(0.089)	(0.107)	(0.101)	(0.096)	(0.089)
	[0.001]	[0.003]	[0.003]	[0.010]	[0.001]	[0.002]
ln(relativeBaseRate$_{j,t+2}$)			-0.01	-0.015		
			(0.113)	(0.117)		
			[0.930]	[0.901]		
ln(uncappedRelativeBaseRate$_{jt}$)*I(capBinding$_{jt}$)					0.012	0.011
					(0.019)	(0.016)
					[0.534]	[0.515]
Controls						
Classification Fixed Effects	x	x	x	x	x	x
Year Fixed Effects	x	x	x	x	x	x
Classification-specific Time Trend, 2-digit		x		x		x
Mean Dep Var	4.57	4.57	4.57	4.57	4.57	4.57
Panel B: Dependent Variable: ln(total covered payroll$_{jt}$)						
	(1)	(2)	(3)	(4)	(5)	(6)
ln(relativeBaseRate$_{jt}$)	-0.298	-0.228	-0.378	-0.278	-0.303	-0.232
	(0.129)	(0.122)	(0.142)	(0.134)	(0.133)	(0.126)
	[0.022]	[0.063]	[0.008]	[0.040]	[0.023]	[0.067]
ln(relativeBaseRate$_{j,t+2}$)			0.196	0.135		
			(0.110)	(0.111)		
			[0.076]	[0.224]		
ln(uncappedRelativeBaseRate$_{jt}$)*I(capBinding$_{jt}$)					0.01	0.008
					(0.018)	(0.018)
					[0.586]	[0.651]
Controls						
Classification Fixed Effects	x	x	x	x	x	x
Year Fixed Effects	x	x	x	x	x	x
Classification-specific Time Trend, 2-digit		x		x		x
Mean Dep Var	18.32	18.32	18.32	18.32	18.32	18.32

Notes: The table above presents demand estimates from the difference-in-differences specifications as outlined in equations 2 through 5. The data used in these regressions cover the time period 2006-2011, where each observation represents a classification-year (N=1,950). Two different dependent variables are used to estimate the demand elasticities: ln(total number of covered firms) (Panel A) and ln(total covered payroll) (Panel B). Each column represents a separate regression, where the estimated coefficients are displayed along with the associated standard errors in parenthesis and p-values in brackets. These classification-year level regressions include controls as listed above: year fixed effects, classification fixed effects, and 2-digit classification specific time trends (for specifications in the even columns). While columns 1 and 2 report the baseline specifications, the remaining columns report alternative specifications with additional variables: leads of the legislated base rates (columns 3 and 4) and uncapped base rates that were not ultimately adopted (columns 5 and 6). These uncapped base rates correspond to the *balanced indicated relative base rates* discussed in Appendix Section A. Robust standard errors are clustered at the classification level.

Table 4: Demand Estimates: Additional Robustness Analysis

Panel A: Robustness, Alternative Assumption on Incidence of Workers' Compensation Premium Changes					
	Dependent Variable: ln(total covered payroll, normalized$_{jt}$)				
	% of premiums borne by employees				
	0% (baseline)	10%	25%	50%	100%
	(1)	(2)	(3)	(4)	(5)
ln(relativeBaseRate$_{jt}$)	-0.298	-0.293	-0.286	-0.274	-0.247
	(0.129)	(0.129)	(0.129)	(0.129)	(0.128)
	[0.022]	[0.024]	[0.027]	[0.034]	[0.056]
Mean Dep Var	18.32	18.32	18.33	18.35	18.38

Panel B: Robustness, Alternative Dependent Variable Definition						
	(1)	(2)	(3)	(4)	(5)	(6)
ln(relativeBaseRate$_{jt}$)	-0.329	-0.300	-0.333	-0.298	-0.356	-0.360
	(0.094)	(0.081)	(0.090)	(0.129)	(0.162)	(0.166)
	[0.001]	[0.000]	[0.000]	[0.022]	[0.029]	[0.031]
Dep Var	ln(number covered firms$_{jt}$)	ln(number covered firms$_{jt}$+1)	Inv Hyperbolic Sine (number covered firms$_{jt}$)	ln(total covered payroll$_{jt}$)	ln(total covered payroll$_{jt}$+1)	Inv Hyperbolic Sine (covered payroll$_{jt}$)
N	1,950	2,144	2,144	1,950	2,144	2,144
Mean Dep Var	4.57	4.34	4.98	18.32	16.66	17.29

Panel C: Robustness, Timing of Updates				
	Number of Covered Firms			
	(1)	(2)	(3)	(4)
ln(relativeBaseRate$_{jt}$)	-0.329	-0.145	-0.171	-0.207
	(0.094)	(0.047)	(0.040)	(0.048)
	[0.001]	[0.002]	[0.000]	[0.000]
Observation level	classification X year	classification X month	classification X month	classification X month
Dep Var	ln(number covered firms$_{jt}$)	ln(number firm policies orginated$_{jt}$)	ln(number firm policies orginated$_{jt}$ +1)	Inv Hyperbolic Sine (number firm policies orginated$_{jt}$ +1)
N	1,950	19,830	23,400	23,400
Mean Dep Var	4.57	2.45	2.24	2.69

Notes: The table above presents robustness analysis from the difference-in-differences demand estimation outlined in equation 2. The data used in these regressions cover the time period 2006-2011, and each regression includes year fixed effects and classification fixed effects. Each column represents a separate regression, where the estimated coefficients are displayed along with the associated standard errors in parenthesis and p-values in brackets. Panel A displays robustness analysis under alternative assumptions on the incidence of changes in workers' compensation premiums. Specifically, these additional specifications repeat the baseline payroll regression replacing the dependent variable with the natural logarithm of normalized covered payroll: $ln(\frac{\text{payroll}_{jt}}{1-\theta\times\text{premium}_{jt}})$, where premium_{jt} represents the mean premium per dollar of payroll for classification j in year t and θ represents the fraction of premiums shifted to workers in the form of reduced wages. The corresponding assumption on the incidence of premium changes (the value of θ) is denoted in each column. Panel B displays robustness analysis using alternative dependent variables: a $ln(x+1)$ transformation and an inverse hyperbolic sine transformation of the total number of covered firms and total covered payroll. Panel C displays robustness analysis using an alternative level of observation for the analysis. The baseline analysis utilizes data at the classification-year level, where observations represent the data for policies purchased during the relevant year. Because some updates in relative base rates occur mid-year, we investigate the robustness of this analysis by utilizing monthly data on covered firms to re-estimate the difference-in-differences specification. For reference, column (1) reports the baseline classification-year estimates, while columns (2) through (4) report the corresponding estimates using the classification-month data. In all panels, robust standard errors are clustered at the classification level.

Table 5: Selection Estimates

Panel A: Selection Estimates				
	InvHypSine($\frac{Cost_{jt}}{riskAdjust_{jt} \times Payroll_{jt}}$)		ln(riskAdjust$_{jt}$ x Payroll$_{jt}$)	
	(1)	(2)	(3)	(4)
ln(relativeBaseRate$_{jt}$)	-0.018	0.047	-0.431	-0.363
	(0.163)	(0.175)	(0.131)	(0.122)
	[0.914]	[0.790]	[0.001]	[0.003]
Controls				
Classification Fixed Effects	x	x	x	x
Year Fixed Effects	x	x	x	x
Classification-specific Time Trend, 2-digit		x		x
Mean Dep Var	2.34	2.34	18.87	18.87

Panel B: Welfare Cost of Selection				
	Linear		Constant Elasticity	
	Est	Std Err	Est	Std Err
	(1)	(2)	(3)	(4)
Welfare Cost of Selection, Version 1 (Table 6 Panel A column 1)				
Quantity (fraction risk-adjusted payroll covered)				
Optimal	0.722	(0.127)	0.724	(0.308)
Perfect Competition	0.733	(0.010)	0.737	(0.012)
Difference	-0.011	(0.123)	-0.012	(0.304)
Welfare per $100 payroll (relative to status quo)				
Optimal	0.0020	(0.0747)	0.0021	(0.0684)
Perfect Competition	0.0016	(0.0203)	0.0017	(0.0219)
Difference	0.0004	(0.0638)	0.0004	(0.0555)
Welfare Cost of Selection, Version 2 (Table 6 Panel A column 2)				
Quantity (fraction risk-adjusted payroll covered)				
Optimal	0.762	(0.160)	0.772	(0.536)
Perfect Competition	0.729	(0.011)	0.733	(0.013)
Difference	0.032	(0.155)	0.039	(0.531)
Welfare per $100 payroll (relative to status quo)				
Optimal	0.0137	(0.1116)	0.0148	(0.1291)
Perfect Competition	0.0103	(0.0235)	0.0110	(0.0256)
Difference	0.0034	(0.0944)	0.0038	(0.1125)

Notes: The table above presents estimates relating to the degree of selection in this market. In Panel A, the coefficients reported above are from a difference-in-difference specification as outlined in equation 2. These classification-year level regressions include controls as listed above: year fixed effects, classification fixed effects, and 2-digit classification specific time trends (for specifications in the even columns). Each column represents a separate regression, where the estimated coefficients are displayed along with the associated standard errors in parenthesis and p-values in brackets. Robust standard errors are clustered at the classification level. The data used in these regressions cover the time period 2006-2011, where each observation represents a classification-year (N=1,950). The dependent variables are as listed in the table above, where overall costs are measured per $100 of risk-adjusted payroll. In columns (1) and (2), we take an inverse hyperbolic sine of mean costs to include all classification-year observations in the baseline sample. See Appendix Section C for more details on risk-adjustment used in this analysis. Panel B displays estimates pertaining to the welfare cost of selection utilizing the elasticities reported in Panel A and aggregate summary statistics from the overall market on mean premiums, mean insurer loss ratios, and mean quantities. For the purpose of these welfare calculations, we measure the quantity insured as the fraction of risk-adjusted payroll that is insured. See Appendix Section C for more details on the welfare analysis and associated data inputs. The counterfactuals are conducted using two alternative parametric demand specifications: linear demand (displayed in columns 1 and 2) and constant elasticity demand (displayed in columns 3 and 4). The table reports welfare measured in dollars per $100 of risk-adjusted payroll. The table reports bootstrapped standard errors clustered at the classification level, where 1,000 randomly drawn bootstrap samples are used.

Table 6: Robustness: Selection Estimates

Panel A: Baseline sample (inverse hyperbolic sine)				
	InvHypSine($\frac{Cost_{jt}}{riskAdjust_{jt} \times Payroll_{jt}}$)		ln(riskAdjust$_{jt}$ x Payroll$_{jt}$)	
	(1)	(2)	(3)	(4)
ln(relativeBaseRate$_{jt}$)	-0.018	0.047	-0.431	-0.363
	(0.163)	(0.175)	(0.131)	(0.122)
	[0.914]	[0.790]	[0.001]	[0.003]
Controls				
Classification Fixed Effects	x	x	x	x
Year Fixed Effects	x	x	x	x
Classification-specific Time Trend, 2-digit		x		x
Panel B: Robustness, observations with nonzero costs				
	ln($\frac{Cost_{jt}}{riskAdjust_{jt} \times Payroll_{jt}}$)		ln(riskAdjust$_{jt}$ x Payroll$_{jt}$)	
	(1)	(2)	(3)	(4)
ln(relativeBaseRate$_{jt}$)	0.037	0.039	-0.328	-0.293
	(0.199)	(0.207)	(0.102)	(0.095)
	[0.853]	[0.850]	[0.001]	[0.002]
Controls				
Classification Fixed Effects	x	x	x	x
Year Fixed Effects	x	x	x	x
Classification-specific Time Trend, 2-digit		x		x
Panel C: Robustness, baseline sample (ln(x+1) transformation)				
	ln($\frac{Cost_{jt}}{riskAdjust_{jt} \times Payroll_{jt}}$ +1)		ln(riskAdjust$_{jt}$ x Payroll$_{jt}$)	
	(1)	(2)	(3)	(4)
ln(relativeBaseRate$_{jt}$)	-0.019	0.034	-0.431	-0.363
	(0.134)	(0.146)	(0.131)	(0.122)
	[0.888]	[0.817]	[0.001]	[0.003]
Controls				
Classification Fixed Effects	x	x	x	x
Year Fixed Effects	x	x	x	x
Classification-specific Time Trend, 2-digit		x		x

Notes: The table above presents additional estimates relating to the degree of selection in this market. The coefficients reported above are from a difference-in-difference specification as outlined in equation 2. These classification-year level regressions include controls as listed above: year fixed effects, classification fixed effects, and 2-digit classification specific time trends (for specifications in the even columns). Each column represents a separate regression, where the estimated coefficients are displayed along with the associated standard errors in parenthesis and p-values in brackets. Robust standard errors are clustered at the classification level. The data used in these regressions cover the time period 2006-2011, where each observation represents a classification-year (N=1,950). The dependent variables are as listed in the table above, where overall costs are measured per $100 of risk-adjusted payroll. See Appendix Section C for more details on on risk-adjustment used in this analysis. For some classification-year observations, there are no costs in a given year. The panels above take three different approaches to handling this issue. Panel A displays the baseline estimates where we include all classification-year observations with non-zero covered payroll and use an inverse hyperbolic sine transformation for the cost variables to include observations with no costs. Panel B repeats the analysis limiting the sample to those classification-year observations with non-zero claim costs (N=1,929). Panel C repeats the analysis on the baseline sample using a $ln(x+1)$ transformation.

Table 7: Baseline Welfare Calculations

Panel A: Welfare Calculations				
	Linear		Constant Elasticity	
	Est	Std Err	Est	Std Err
	(1)	(2)	(3)	(4)
Counterfactuals				
Quantity (fraction risk-adjusted payroll covered)				
Mandate	1.000	-	1.000	-
Perfect Competition (Optimal)	0.734	(0.010)	0.737	(0.012)
Welfare (relative to status quo)				
Mandate				
per $100 of risk-adjusted payroll	-0.2070	(0.0939)	-0.1175	(0.0502)
scaled by $50,000	-103.48	(46.97)	-58.76	(25.10)
% of mean cost	-13.16%	(5.97%)	-7.47%	(3.19%)
Perfect Competition (Optimal)				
per $100 of risk-adjusted payroll	0.0041	(0.0011)	0.0043	(0.0012)
scaled by $50,000	2.03	(0.56)	2.16	(0.62)
% of mean cost	0.26%	(0.07%)	0.27%	(0.08%)
Subsidy to support optimal allocation--25% MDWL of taxation				
per $100 of risk-adjusted payroll	-0.0363	(0.0006)	-0.0362	(0.0021)
scaled by $50,000	-18.15	(0.28)	-18.12	(1.04)
% of mean cost	-2.31%	(0.04%)	-2.30%	(0.13%)

Panel B: Underlying Data and Corresponding Demand Curve				
	Linear		Constant Elasticity	
	Est	Std Err	Est	Std Err
	(1)	(2)	(3)	(4)
Demand Curve				
Constant	5.9434	(1.43)	0.7746	(0.18)
Slope	-5.9593	(2.05)	-2.3204	(0.80)
Status Quo				
Quantity	0.697		0.697	
Price	1.79		1.79	
Expenses as a % of Premiums	88%		88%	

Notes: The table above presents welfare calculations as discussed in Section 5. Panel A displays the welfare calculations, while panel B reports the underlying summary statistics and corresponding fitted demand curve. As discussed in the text, we obtain these curves by combining the estimated elasticities from the baseline specification (excluding classification-specific time trends) and aggregate summary statistics from the overall market on mean premiums, mean insurer loss ratios, and mean quantities. For the purpose of these welfare calculations, we measure the quantity insured as the fraction of risk-adjusted payroll that is insured. See Appendix Section C for more details on the welfare analysis and associated data inputs. In Panel B, the reported "constant" and "slope" in the constant elasticity specification ($P = AQ^{\beta}$) refer to A and β, respectively; in the linear specification ($P = A + \beta Q$), the "constant" and "slope" refer to A and β, respectively. Because our empirical analysis indicates there is no meaningful selection in this market, we do these calculations under the assumption of no selection, meaning that there is a flat market-level average/marginal (risk-adjusted) cost curve. Appendix Table A7 illustrates that the findings are similar when employing cost curves based on the estimates in Table 5. The counterfactuals are conducted using two alternative parametric demand specifications: linear demand (displayed in columns 1 and 2) and constant elasticity demand (displayed in columns 3 and 4). The table reports welfare measured in dollars per $100 of risk-adjusted payroll. In addition, the table reports two scaled measures of welfare to ease interpretation: (i) welfare as a percent of the mean cost of the insured in the status quo (one measure of the size of the market), and (ii) welfare measures scaled by $50K, approximately the mean annual earnings for this population in 2011. The table reports bootstrapped standard errors clustered at the classification level, where 1,000 randomly drawn bootstrap samples are used.

Table 8: Welfare Calculations: Incorporating Potential Externality

	Welfare Calculations															
	Linear								Constant Elasticity							
	Fraction Medical Costs Otherwise Covered By HI								Fraction Medical Costs Otherwise Covered By HI							
	0% (baseline)		25%		50%		75%		0% (baseline)		25%		50%		75%	
	Est	Std Err	Est	Std Err	Est	Std Err	Est	Std Err	Est	Std Err	Est	Std Err	Est	Std Err	Est	Std Err
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Counterfactuals																
Quantity (fraction risk-adjusted payroll covered)																
Mandate	1.000	-	1.000	-	1.000	-	1.000	-	1.000	-	1.000	-	1.000	-	1.000	-
Perfect Competition (Optimal)	0.734	(0.010)	0.751	(0.015)	0.769	(0.020)	0.786	(0.025)	0.737	(0.012)	0.760	(0.018)	0.784	(0.026)	0.811	(0.034)
Welfare (relative to status quo)																
Mandate																
per $100 of risk-adjusted pa	-0.2070	(0.0939)	-0.1754	(0.0939)	-0.1439	(0.0939)	-0.1124	(0.0939)	-0.1175	(0.0502)	-0.0860	(0.0420)	-0.0545	(0.0422)	-0.0230	(0.0425)
scaled by $50,000	-103.48	(46.97)	-87.72	(46.97)	-71.96	(46.97)	-56.20	(46.97)	-58.76	(25.10)	-43.00	(21.01)	-27.24	(21.12)	-11.48	(21.25)
% of mean cost	-13.16%	(5.97%)	-11.16%	(5.97%)	-9.15%	(5.97%)	-7.15%	(5.97%)	-7.47%	(3.19%)	-5.47%	(2.67%)	-3.46%	(2.69%)	-1.46%	(2.70%)
Perfect Competition (Optimal)																
per $100 of risk-adjusted pa	0.0041	(0.0011)	0.0088	(0.0024)	0.0154	(0.0042)	0.0238	(0.0065)	0.0043	(0.0012)	0.0097	(0.0028)	0.0174	(0.0051)	0.0279	(0.0082)
scaled by $50,000	2.03	(0.56)	4.41	(1.21)	7.69	(2.12)	11.88	(3.27)	2.16	(0.62)	4.83	(1.39)	8.72	(2.53)	13.94	(4.10)
% of mean cost	0.26%	(0.07%)	0.56%	(0.15%)	0.98%	(0.27%)	1.51%	(0.42%)	0.27%	(0.08%)	0.61%	(0.18%)	1.11%	(0.32%)	1.77%	(0.52%)
Subsidy to support optimal allocation--25% MDWL of taxation																
per $100 of risk-adjusted pa	-0.0363	(0.0006)	-0.0521	(0.0012)	-0.0669	(0.0021)	-0.0808	(0.0033)	-0.0362	(0.0021)	-0.0519	(0.0031)	-0.0665	(0.0043)	-0.0800	(0.0056)
scaled by $50,000	-18.15	(0.28)	-26.03	(0.61)	-33.45	(1.06)	-40.42	(1.64)	-18.12	(1.04)	-25.94	(1.57)	-33.24	(2.15)	-40.02	(2.82)
% of mean cost	-2.31%	(0.04%)	-3.31%	(0.08%)	-4.25%	(0.13%)	-5.14%	(0.21%)	-2.30%	(0.13%)	-3.30%	(0.20%)	-4.23%	(0.27%)	-5.09%	(0.36%)

Notes: The table above presents welfare calculations as discussed in Section 5.2.3. This table repeats the welfare analysis in Table 7 under various alternative assumptions regarding the fraction of the medical costs covered by workers' compensation insurance that in the absence of coverage fall to an external party (e.g., health insurance, charity care). For the purpose of this robustness analysis, we use "health insurance" to refer to any external party that may bear these medical costs in the absence of workers' compensation, which may include formal health insurance but also could include informal insurance (e.g., charity care). In these calculations, we assume that health insurers do not make actuarial adjustments to premiums based on workers' compensation coverage, and we assume that health insurance provides 70% actuarial value coverage of medical costs while workers' compensation provides 100% actuarial value coverage of medical costs. For the linear specification, the baseline results with no externality are displayed in columns 1 and 2, where the results in the remaining columns assume that 25%, 50% or 75% of workers' compensation medical claim costs would otherwise be eligible for coverage under health insurance. The analogous results for the constant elasticity specifications are reported on columns 9 through 16. The table reports bootstrapped standard errors clustered at the classification level, where 1,000 randomly drawn bootstrap samples are used. See Table 7 and Appendix Section C for further details on the welfare calculations.

FOR ONLINE PUBLICATION

APPENDIX

A Description of Base Rate Update Algorithm

Below we describe the algorithm used by the Texas Department of Insurance Workers' Compensation office to update base rates. The data associated with the base rate update algorithm (e.g., inputs, outputs, intermediate outputs) come from the Texas Department of Insurance Workers' Compensation Annual Relativities Studies. Studies from recent years are posted online, and studies from earlier years are available through an open records request.[60] We are thankful to employees of the Texas Department of Insurance Actuarial Office for several helpful discussions as we worked to understand the details of the rate update process. We first outline the steps for updating base rates in a typical year with a revenue neutral update, and we then explain how this update algorithm is adjusted in years in which the overall level of base rates is adjusted (i.e., "re-basing years").

Step 1: The initial inputs into the algorithm are: (i) the raw loss experience for relevant policy years, which is a five year window lagged by three years and (ii) the current base rates ($crtRel_j$). For example, for base rates in 2007, the raw loss experience considered is the loss experience from policy years 2000 to 2004. Below, we will represent the year the update will take effect as t, thus the window used as input is $[t-7, t-3]$. Indemnity losses were grouped into categories depending on the injury type. These categories are serious (i.e., death, permanent total and major permanent partial) and non-serious (i.e., minor permanent partial and temporary total). Medical losses are similarly grouped into serious, non-serious, and medical only categories.

Step 2: Raw losses were adjusted to exclude all amounts in excess of $350,000 per claim, $700,000 per accident. These adjusted amounts are referred to as limited losses. The purpose of limiting the losses is to reduce the possibility of large random fluctuations that might otherwise occur from the occurrence or non-occurrence of a single large accident.

Step 3: The limited losses for each of the policy years are adjusted to a common level. The common level is determined to equal the average level underlying the current base rates.

Step 4: The adjusted limited losses summed across all the input policy years for each classification ($\text{AggLimitedLoss}_{jc}$) are used to determine a set of experience relative base rates. These experience relative base rates are then credibility weighted against the current relative base rates. The experience relative base rate, $expRel_{jc}$, for classification j and category c is defined as follows

$$expRel_{jc} = \frac{(\text{AggLimitedLoss})_{jc} \times 100}{\text{AggPayroll}_j} \tag{1}$$

These experience relative base rates are then weighted depending on whether a specified number of claims threshold is met using the following weights:

$$Cred_{jc} = \begin{cases} 1, & \text{if full credibility number of claim threshold met} \\ \left(\frac{(\text{AggPayroll}_j \times crtRel_j)/100}{\text{full credibility losses}}\right)^{0.4}, & \text{otherwise} \end{cases}$$

where $crtRel_{jc}$ is the current relative base rate and the full credibility threshold is in Texas Department of Insurance Documentation (Annual Relativities Study, Exhibit 21). Lastly, the *weighted relative base rate*, $wgtRel$, is defined as follows:

[60] See https://www.tdi.texas.gov/reports/report9.html

$$wgtRel_{jc} = Cred_{jc}expRel_{jc} + (1 - Cred_{jc})crtRel_{jc} \tag{2}$$

The final step works with the overall base rates, which is simply the sum across categories c. We denote overall base rates by dropping the c subscript.

Step 5: Next, the *balanced indicated relative base rate*, $balRel$, is calculated as follows:

$$balRel_j = \left(\frac{\Sigma_j crtRel_j \times \text{payroll in t-3}_j}{\Sigma_j wgtRel_j \times \text{payroll in t-3}_j}\right) wgtRel_j \tag{3}$$

Lastly, the relative rates are capped at at most a 25% change in either direction, to create the *limited relative base rate*, $limRel$:

$$limRel_j = \begin{cases} 1.25 \times crtRel_j, & \text{if } balRel_j > 1.25 \times curRel_j \\ 0.75 \times crtRel_j, & \text{if } balRel_j < 0.75 \times curRel_j \\ balRel_j, & \text{otherwise} \end{cases}$$

In these terms, the *proposed relative base rate*, $proRel_j$, is:

$$proRel_j = \begin{cases} limRel_j, & \text{if } balRel_j > 1.25 \times curRel_j \text{ or } balRel_j < 0.75 \times curRel_j \\ \left(\frac{\Sigma_j crtRel_j \times \text{payroll in t-3}_j}{\Sigma_j limRel_j \times \text{payroll in t-3}_j}\right) limRel_j, & \text{otherwise} \end{cases}$$

Within the Texas Department of Insurance Workers' Compensation Annual Relativities Study, the balanced relative base rates are summarized on Exhibit 23, and Exhibit 24 provides a similar summary of the limited relative base rates. Note the above calculation yields a new set of relative base rates that are approximately revenue neutral.[61]

Step 6: Three updates during our sample (2008, 2009, and 2011) included across-the-board decreases in the level of base rates. These level decreases are made *after* all of the other steps described above. An X% drop in base rates is achieved by an adjustment of the following form:

$$\text{Final Base Rate}_j = (1 - X) proRel_j. \tag{4}$$

In a year with no across-the-board reduction, the *final base rate* is simply the proposed base rate ($X = 0$).

B Monthly Regressions

Table 4 in the text displays monthly regression results where we regress the number of new policies initiated in a given month on the base rate in effect in that month. Below, we present monthly regressions in an event study figure where we zoom in on the months just surrounding a rate update to illustrate that the change in workers' compensation coverage takes place in the months after the update takes effect. Let us consider the eight months on either side of each rate update, pooling across all the rate updates during the sample period. We normalize the time surrounding the updates such that the update is implemented in month 1 of event time. Let t denote calendar months and n denote two-month bins of event time. We estimate the following regression:

$$ln(y_{ct}) = \Sigma_n \beta_n (ln(b_1) - ln(b_0)) + \gamma_t + \alpha_c + \epsilon_{ct}, \tag{5}$$

[61] In practice, there are two reasons why these rates may depart from revenue neutral updates slightly. First, in some years there seem to be some slight deviations from the above Step 5 description due to rounding error. Second, Step 5 described above produces relative base rates that are close to (but not perfectly) revenue neutral. This is because the "capped" classifications are not re-normalized in the final stage. In practice, this will not make a difference because it is so close to revenue neutral.

where $ln(b_1) - ln(b_0)$ represents the update that is implemented in month 1 of event time. For the dependent variable $ln(y_{ct})$, we will analyze the natural logarithm of the number of newly initiated workers' compensation policies in month t for classification c. While policies are initiated throughout the calendar year, there is some clustering in January. Further, for smaller classifications it is common to have months with no newly initiated policies. Thus, we will also estimate specifications with an inverse hyperbolic sine transformation to include these zeros and specifications that focus on a subsample of large classifications. The coefficients of interest β_n describe how the regulatory updates to premiums are related to newly initiated policies, both before and after the update is implemented, where we normalize to zero the coefficient representing the two months just before the update is implemented.

Figure A3 presents the results. Panel A displays estimates based on all classifications in the baseline sample. Because there are several smaller classifications with no newly initiated policies in a given month, we include these observations by using an inverse hyperbolic sine transformation. The remaining panels focus on relatively large classifications, for which this zero observation issue is not a major concern. Specifically, in these specifications, we restrict attention to classifications with more than five workers' compensation policies initiated in each month of 2006, the first year of our sample. For these relatively large classifications, there are few months over the sample for which there are zero policies initiated, and thus the results are similar when using a $ln(x)$ transformation (Panel B) or an inverse hyperbolic sine transformation (Panel C).

Though there is considerable noise in the high-frequency monthly analysis, there are a few important take-aways from this figure. First, the estimated β_n coefficients for the months leading up to the update implementation are small and statistically indistinguishable from zero. These results suggest that the rate updates were not related to coverage rates before the updates were implemented, providing support for the identification assumption. Second, the pattern of the β_n estimates indicate that coverage responds to regulatory rate updates, with a 10% increase in premiums leading to a 3-5% drop in newly initiated workers' compensation insurance policies by three months after the implementation. The estimates suggest a larger effect on monthly policies initiated among larger classifications, a pattern that is expected given these classifications have non-trivial enrollment in each month of the first year of the sample (and hence are less likely to be constrained at zero in any given month).

C Welfare Analysis: More Details on Empirical Implementation

C.1 Approach

The approach to empirically implementing the welfare analysis follows Einav and Finkelstein (2011), adapting the framework to accommodate the risk adjusted premiums observed in this setting. Throughout the discussion below, the risk adjustment we refer to is employer-level experience rating. To ease notation, let us represent risk adjusted payroll units as: $\mathbb{Q} \equiv AR(Q)Q$. Specifically, we use the variation in classification base rates to estimate reduced form elasticities in terms of risk-adjusted payroll for demand ($\epsilon_{\mathbb{Q},b} \equiv \frac{\partial \mathbb{Q}}{\partial b} \cdot \frac{b}{\mathbb{Q}}$) and average cost ($\epsilon_{AC,b} \equiv \frac{\partial AC(\mathbb{Q})}{\partial b} \cdot \frac{b}{AC(\mathbb{Q})}$). We can combine these elasticities to get the elasticity of the average cost curve with respect to risk-adjusted payroll:

$$\frac{\partial AC(\mathbb{Q})}{\partial \mathbb{Q}} \cdot \frac{\mathbb{Q}}{AC(\mathbb{Q})} = \frac{\frac{\partial AC(\mathbb{Q})}{\partial b} \cdot \frac{b}{AC(\mathbb{Q})}}{\frac{\partial \mathbb{Q}}{\partial b} \cdot \frac{b}{\mathbb{Q}}}. \tag{6}$$

Suppose that marginal costs are monotonic in $\mathbb{Q}$. Then, the sign of the above elasticity in equation 6 offers a test for selection: $\frac{\partial AC(\mathbb{Q})}{\partial \mathbb{Q}} > 0$ indicates advantageous selection and $\frac{\partial AC(\mathbb{Q})}{\partial \mathbb{Q}} < 0$ indicates adverse selection.

To go beyond a test for selection in the quantitative welfare analysis, we need to make parametric assumptions on the form the demand and cost curves. We proceed by making such assumptions and combining the reduced form elasticities with market-level data reported by TDI on mean premiums, mean quantities, and mean combined insurer loss ratios to trace out the empirically relevant curves in this setting (analogous to those presented in the graphical illustration in Figure 4). Consider two different parametric forms for the demand and cost curves as a function of $\mathbb{Q}$: constant elasticity and linear.

We take as inputs, our two elasticity estimates ($\epsilon_{\mathbb{Q},b} \equiv \frac{\partial \mathbb{Q}}{\partial b} \cdot \frac{b}{\mathbb{Q}}$); $\epsilon_{AC,b} \equiv \frac{\partial AC(\mathbb{Q})}{\partial b} \cdot \frac{b}{AC(\mathbb{Q})}$) and market-level aggregates from TDI on mean premium per risk adjusted unit (p^*), mean cost per risk adjusted unit (c^*)[62] and mean risk adjusted quantity ($\mathbb{Q}^*$).

- **Linear**: We use the reduced form estimates along with the aggregate TDI data and a linear parametric extrapolation to back out the parameters in the demand and average cost curves: $D(p) = A + Bp$; $AC(p) = C + Ep$. We can derive the MC curve from these curves using:

$$MC(p) = (\frac{\partial D}{\partial p})^{-1}\frac{\partial(AC(p) \times D(p))}{\partial p} \tag{7}$$

  Using this relationship, we get that:

$$MC(p) = \frac{AE}{B} + C + 2Ep \tag{8}$$

  We can re-write these in terms of $\mathbb{Q}$,

  - $P(\mathbb{Q}) = \frac{\mathbb{Q}}{B} - \frac{A}{B}$
  - $AC(\mathbb{Q}) = C - \frac{AE}{B} + \frac{\mathbb{Q}E}{B}$
  - $MC(\mathbb{Q}) = C - \frac{AE}{B} + \frac{2E\mathbb{Q}}{B}$

  We can back-out these parameters with our reduced form elasticity estimates and the available aggregates: $A \equiv \mathbb{Q}^*(1 - \epsilon_{\mathbb{Q},b})$; $B \equiv \epsilon_{\mathbb{Q},b}(\frac{\mathbb{Q}^*}{p^*})$; $C \equiv c^*(1 - \epsilon_{AC,b})$; $E \equiv \epsilon_{AC,b}(\frac{c^*}{p^*})$.

- **Constant Elasticity**: We use the reduced form estimates along with the aggregate TDI data and a constant elasticity parametric extrapolation to back out the parameters in the demand and average cost curves: (i) $AC(p) = Ap^{e_c}$ and (ii) $D(p) = Bp^{e_d}$. We can derive the MC curve from these curves using:

$$MC(p) = (\frac{\partial D}{\partial p})^{-1}\frac{\partial(AC(p) \times D(p))}{\partial p} \tag{9}$$

  Using this relationship, we get that:

$$MC(p) = \frac{e_c + e_d}{e_d}AC(p) \tag{10}$$

  So, we can write, $MC(p) = Cp^{e_c}$, where $C \equiv A\frac{e_c+e_d}{e_d}$. In terms of $\mathbb{Q}$ we can express the inverse demand and cost curves as:

  - $P(\mathbb{Q}) = (\frac{\mathbb{Q}}{B})^{\frac{1}{e_d}}$
  - $AC(\mathbb{Q}) = A(\frac{\mathbb{Q}}{B})^{\frac{e_c}{e_d}}$
  - $MC(\mathbb{Q}) = A\frac{e_c+e_d}{e_d}(\frac{\mathbb{Q}}{B})^{\frac{e_c}{e_d}}$

  We can back-out these parameters with our reduced form elasticity estimates and the available aggregates: $e_c \equiv \epsilon_{AC,b}$; $e_d \equiv \epsilon_{\mathbb{Q},b}$; $A \equiv \frac{c^*}{(p^*)^{\epsilon_{AC,b}}}$; $B \equiv \frac{\mathbb{Q}^*}{(p^*)^{\epsilon_{\mathbb{Q},b}}}$.

C.2 Definition of Data Elements

While Section 2.2 describes our data sources, this section elaborates on the available data and the definition of several variables of interest in our analysis. The administrative data focuses on information about employers and payroll covered by workers' compensation insurance. To conduct the welfare analysis described in the text, we additionally need to measure the size of the market: the total eligible payroll that could be covered by the workers' compensation system. Following the methodology used by TDI for internal research on participation rates (Choi, 2011), we measure the size of the market through comparing the administrative covered payroll data to private sector covered payroll data from the Quarterly Census

[62] The mean costs are inferred from the reported mean combined insurer loss ratio and mean premiums.

on Employment and Wages (QCEW). Because the administrative data on covered payroll excludes certified self-insured employers, we adjust the denominator of private sector payroll to exclude payroll represented by the 95 certified self-insured employers during our analysis period. Because there is no covered payroll information for the certified self-insured employers, we approximate covered payroll at these firms by combining administrative data on the number of covered employees at these firms with data on mean earnings in private sector employment from the QCEW.

Recall that premiums in this market are represented as in equation 1 described in Section 3 of the main text. We have data on several components of these premiums. We use data on regulatory base rates ($b_t(c_j)$) in our primary estimation. In addition, we use a dataset obtained through a TDI open records request which includes classification-year level data on mean manual premiums (mean value of premiums before experience rating is applied) and mean final premiums (mean value of premiums after experience rating is applied). Following a similar methodology as that used by TDI for internal research on experience rating (Choi, 2011), we construct a proxy for the experience rating multiplier (also referred to in the text as the risk adjustment modifier) by using data at the classification-year level and taking the ratio of the mean final premiums and the mean manual premiums. The welfare analysis measures quantity in units of risk-adjusted (experience-rated) payroll. In practice, we do this re-scaling by predicting the average risk adjustment modifier in the market using estimated reduced form regressions relating: (i) the mean risk adjustment modifier to base rates and (ii) the mean covered payroll to base rates; we do this re-scaling based on a linear extrapolation from these estimated elasticities.

D Additional Robustness Analysis

D.1 Workers' compensation classification coding

The identification strategy outlined in the main text takes workers' compensation classification coding of employers as exogenous. In this appendix section, we investigate the possibility of problematic endogenous coding related to our identifying variation. Let j represent an employer and t represent year. Specifically, we estimate specifications such as the following:

$$I(c_{j,t} \neq c_{j,t-1}) = \beta \Delta ln(b)_{c_{j,t-1}} + \tau_t + \gamma_j + \Theta X_{jt} + \epsilon_{jt}, \tag{11}$$

where $c_{j,t}$ represents the classification of employer j in year t and $\Delta ln(b)_k$ is defined as the difference in log base rate for classification k between year t and $t-1$ $\big(\Delta ln(b)_k \equiv ln(b_{k_t}) - ln(b_{k_{t-1}})\big)$. As noted above, additional controls include year fixed effects (τ_t), employer fixed effects (γ_j), and additional controls in some specifications (X_{jt}). Robust standard errors are clustered at the classification-level.

As noted in the text, in practice employers may have multiple classifications if they have a diverse workforce. In the employer-level data we utilize, we observe the employer's primary classification, often referred to as the *governing classification*, which covers most of the employer's payroll. Actual premiums paid are adjusted to account for the fraction of the employer's workforce dedicated to other categories (most commonly clerical and transportation services), and the percent of payroll allocated to each classification is subject to verification with ex post payroll auditing. In the analysis here, we focus on whether there is endogenous coding of an employer's governing classification (e.g., an employer's primary classification). We note that any observed changes in the governing classification of an employer could represent true underlying changes in the workforce composition of an employer.

With the inclusion of employer fixed effects, the coefficient β in equation 11 measures the degree to which employer classification switching is correlated with regulatory base rate increases associated with an employer's classification. Specifically, a positive and significant coefficient estimate for β would indicate that employers are more likely to switch away from a particular classification when the relative price increases for this classification. Appendix Table A2 presents the results. There are a few important things to note. First, changes in employer governing classifications are uncommon. Among the classification-year observations in this sample, 91% represent employers who have same classification in this year as in the prior year. Second, there is no detectable association between the base rate variation and classification switching. Appendix Table A2 columns (1) through (3) present estimates from specifications with progressively more controls; each of these specifications yield estimates for β that are both small and statistically indistinguishable from zero.

D.2 Exclusion of certified self-insured employers

Our baseline analysis excludes certified self-insured employers and associated employee payroll. We make this exclusion for two key reasons: (i) our identification strategy leverages variation in the premiums for coverage purchased from workers' compensation insurance providers, and (ii) the administrative data on covered payroll and claims are only available for the payroll covered through policies purchased from a workers' compensation insurance provider. As discussed in the text, there are strict requirements to become a certified self-insured firm. Perhaps because of these requirements, very few employers take up this option: only 95 firms are ever self-insured during our analysis period (2006-2011). Among these 95 firms that are ever self-insured from 2006-2011, 89 firms are continuously self-insured for the entire time period. In other words, there are only a handful of firms who ever switch between being self-insured and another status (purchased policy or no insurance). While the persistence in self-insurance implies it is unlikely that the exclusion of these firms affects our demand estimates, we directly analyze the robustness of results with respect to our baseline sample definition as described below.

We have administrative data on the identity of each certified self-insured firm in addition to each employer with a purchased policy. Thus, we can repeat the analysis analyzing the number of participating employers, either excluding or including the certified self-insured firms. The baseline analysis reported in Table 3 Panel A in the main text excludes certified self-insured firms, and Appendix Table A3 displays the analysis including all participating employers (both those with purchased policies and the certified self insured). Comparing these results, we see the results are nearly identical.

D.3 Eligible population of firms and workers

Our baseline analysis utilizes dependent variables (the natural logarithm of covered payroll, the natural logarithm of covered firms) which are constructed solely from the administrative data. As discussed in Section 3, there is no administrative data on the universe of eligible firms and workers in each classification, so it is not possible to estimate demand in terms of the fraction of payroll insured (or the fraction of firms insured). A more detailed explanation is below. The ideal demand estimation would be in terms of share of eligible firms or eligible payroll that is covered:

$$ln(\frac{\text{TotInsured}_{jt}}{\text{TotEligible}_{jt}}) = \gamma + \pi ln(b_{jt}) + \lambda_j + \tau_t + \mu_{jt}. \quad (12)$$

Re-arraging terms we get:

$$ln(\text{TotInsured}_{jt}) = \gamma + \pi ln(b_{jt}) + \lambda_j + \tau_t - ln(\text{TotEligible}_{jt}) + \mu_{jt}, \quad (13)$$

where $ln(\text{TotEligible}_{jt})$ is unobserved. Suppose we can represent this term as:

$$ln(\text{TotEligible}_{jt}) = \phi + \rho ln(b_{jt}) + \eta_j + \sigma_t + e_{jt}. \quad (14)$$

Substituting this into the ideal demand specification we get:

$$ln(\text{TotInsured}_{jt}) = (\gamma + \phi) + (\pi + \rho) ln(b_{jt}) + (\eta_j + \lambda_j) + (\sigma_t + \tau_t) + (e_{jt} + \mu_{jt}). \quad (15)$$

Thus, the feasible regression will provide an estimate of $\pi + \rho$. This is a consistent estimate of the true demand elasticity π if and only if $\rho = 0$. Thus, to interpret the baseline estimates as reflecting the demand for insurance, a key assumption is that the eligible population of workers and firms in each classification is not changing in response to the identifying premium variation (i.e., $\rho = 0$). While the lack of classification-level data on the eligible population prevents us from testing this directly, we present some supporting evidence for this assumption by utilizing NAICS industry-year level data on the Texas workforce from the Quarterly Census of Employment and Wages (QCEW) and relating this to the classification-year level variation in workers' compensation premiums utilizing a crosswalk derived from the administrative data.

Specifically, we take aggregate data on the universe of firms and workers at the NAICS industry-year level from the QCEW. We then match this to the classification-year level workers' compensation premium variation utilizing a crosswalk that is derived from the administrative data. We construct this crosswalk using the administrative data described in Section 2.2 on all policies purchased by firms participating in the

Texas workers' compensation system. Importantly, this data includes the workers' compensation classification code for each firm and this data also includes information on the NAICS 6-digit industry code.

In practice, there are a few challenges to creating a crosswalk from industry codes to classification codes. First, the NAICS industry code field is missing for approximately one third of observations. Second, each NAICS code does not always map nicely to one workers' compensation classification code. In the face of these challenges, we proceed as follows. Starting with the pooled data across our analysis period, we use the observed NAICS industry-classification pairs to construct a frequency-weighted crosswalk under the assumption that the missing industry values are not selected. To remove outliers that may represent measurement error, we exclude industry-classification pairs that represent fewer than 50 observations or fewer than 5% of the observations associated with a particular NAICS industry code.

We examine whether the eligible population is related to the identifying variation by estimating variants of the following equation:

$$ln(y_{it}) = \alpha + \beta ln(b_{it}) + \delta_i + \theta_t + \lambda_i t + \epsilon_{it}, \tag{16}$$

where i is a NAICS industry and t is a year. In this specification, $ln(b_{it})$ represents the natural logarithm of the mean base rate applicable in the industry based on a crosswalk between NAICS-classification codes described above. All specifications include year and industry fixed effects, and we estimate specifications with an additional control: a 4-digit NAICS industry-specific time trend.

Appendix Table A4 presents the results. Overall, the results suggest that neither the aggregate number of firms nor the aggregate number of workers in an industry are responsive to the premium variation in classifications associated with the industry. This evidence builds confidence in our interpretation of the primary baseline regressions as reflecting the demand for insurance.

D.4 Selection analysis and additional robustness

Appendix Table A5 presents additional specifications utilizing several alternative measures of claims: overall costs (the baseline measure), medical costs, income benefit costs, total claims, serious claims, non-serious claims, and "medical only" claims (i.e., claims with no income benefits). We also report results for a "predicted costs" measure, where we predict costs in that classification-year by taking the observed number of claims in the classification-year in each category (serious, non-serious, and medical only) and associate with each claim the mean cost of claims in those categories within the classification across the sample period. Across all the specifications, the coefficient estimates on the base rate are small and statistically indistinguishable from zero.

Appendix Table A6 displays additional robustness analysis for the selection specifications. Panel A reports regression estimates for costs relative to risk adjusted payroll, and Panel B reports regression estimates for risk adjusted payroll. Columns (1) and (2) report the baseline selection estimates with and without classification-specific time trends (from Table 5 in the text). Columns (3) and (4) report the results for analogous specifications with an extra term included: the natural logarithm of the base rate in effect two years prior. Columns (5) and (6) report the results from analogous specifications with an additional term: the hypothetical uncapped base rate if not for the final step in the update algorithm. If the baseline identification assumption holds, including these extra terms should not affect the main results. The qualitative findings are the same across these specifications. The coefficient estimates associated with the contemporaneous base rate in the cost specifications are small and statistically indistinguishable from zero.

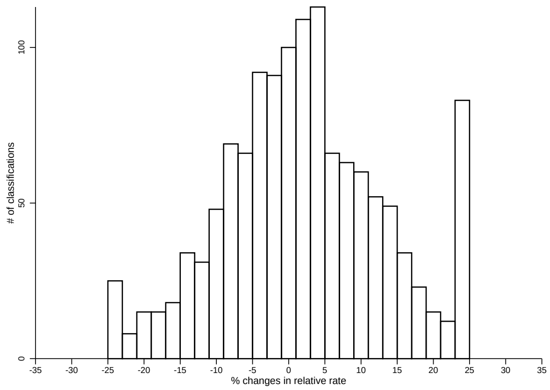
D.5 Welfare analysis and empirical cost curves

Based on the empirical analysis which finds no evidence of selection in this market, the primary welfare calculations in the text are conducted under the assumption of no selection, meaning that there is a flat market-level average/marginal (risk-adjusted) cost curve. Appendix Table A7 presents the same welfare analysis if instead we employ the small (and statistically indistinguishable from zero) risk-adjusted cost elasticity estimates reported in Table 5. The table presents two sets of estimates, using the selection point estimates from a specification without a time trend (Table 5 Panel A column 1) and the selection point estimates from a specification with a time trend (Table 5 Panel A column 2). Both sets of estimates are quantitatively small, and the key results are similar as in the baseline welfare analysis in Table 7.

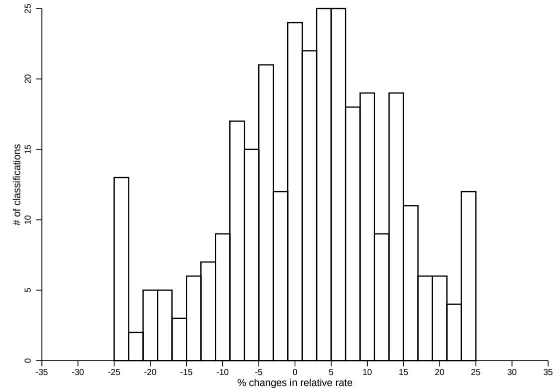
D.6 Welfare analysis and alternative incidence assumptions

Table 4 in the text presents additional analysis investigating the robustness of the covered payroll demand specifications under alternative incidence assumptions. Appendix Table A8 presents the selection estimates and Appendix Table A9 presents the welfare estimates under alternative incidence assumptions. These results are quantitatively and qualitatively similar to the baseline selection and welfare estimates.

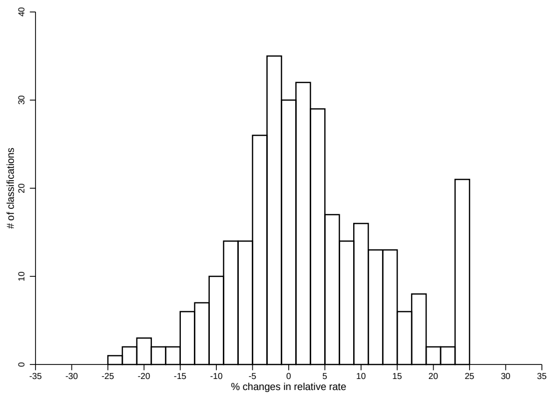
Figure A1: Histogram of Proposed Base Rate Updates



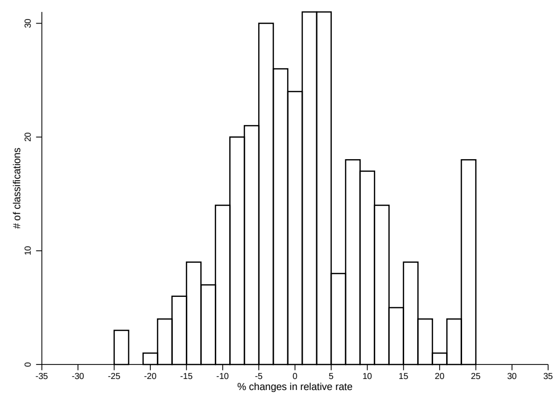
(a) Pooled



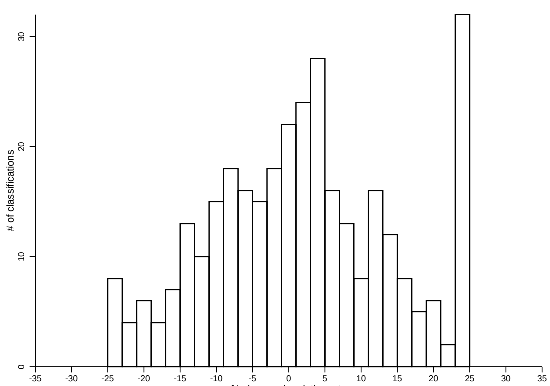
(b) Update 2007



(c) Update 2008



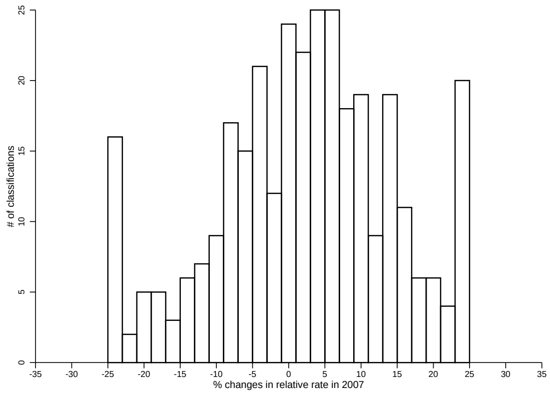
(d) Update 2009



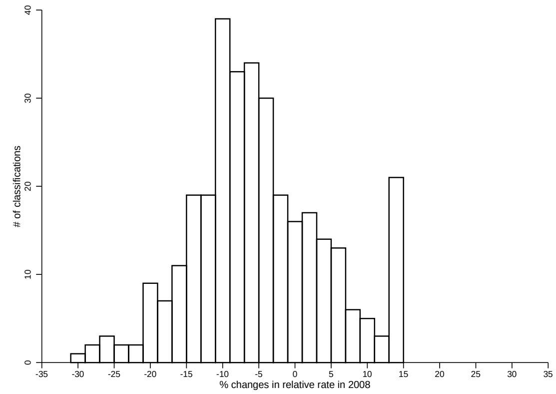
(e) Update 2011

Notes: The above histograms describe the the proposed updates to the base rates (before any across-the-board adjustments). Following the definitions in Appendix Section A, the percent change here is defined as: $\frac{\text{Proposed Relative Base Rate}_j - curRel_j}{curRel_j}$ for classification j. The updates in the final implemented base rates (after across-the-board adjustments) are depicted in Appendix Figure A2.

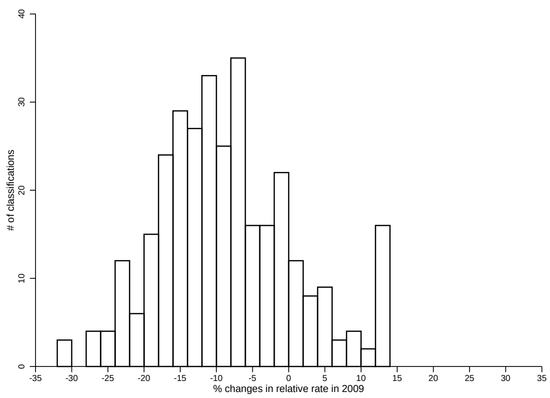
Figure A2: Histogram of Percent Change in Final Base Rates



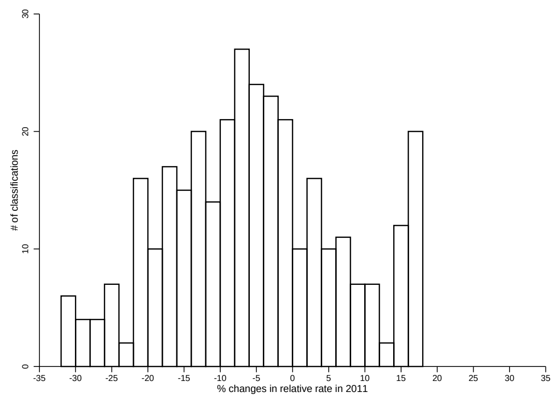
(a) Update 2007



(b) Update 2008



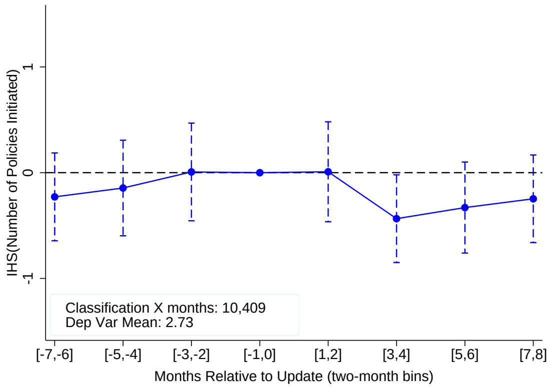
(c) Update 2009



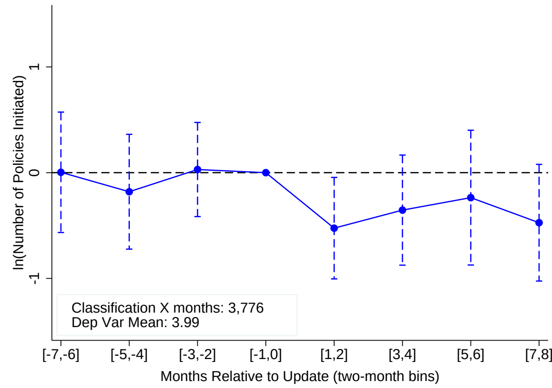
(d) Update 2011

Notes: The above histograms describe the change in the final relative base rates. These histograms focus on the change in the final implemented base rates (after any across-the-board adjustments). Following the definitions in Appendix A, the percent change here is defined as: $\frac{\text{Final Relative Base Rate}_{j-curRel_j}}{curRel_j}$ for classification j.

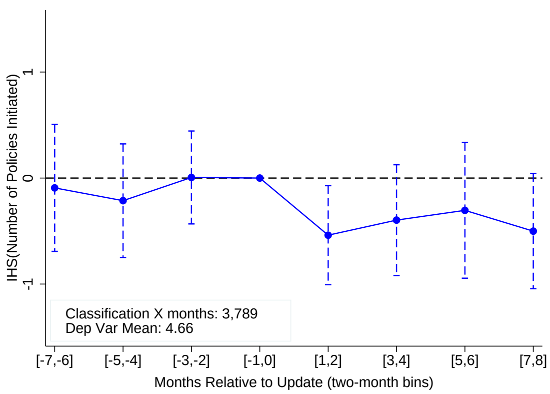
Figure A3: Demand for Coverage: Monthly Analysis



(a) All Classifications



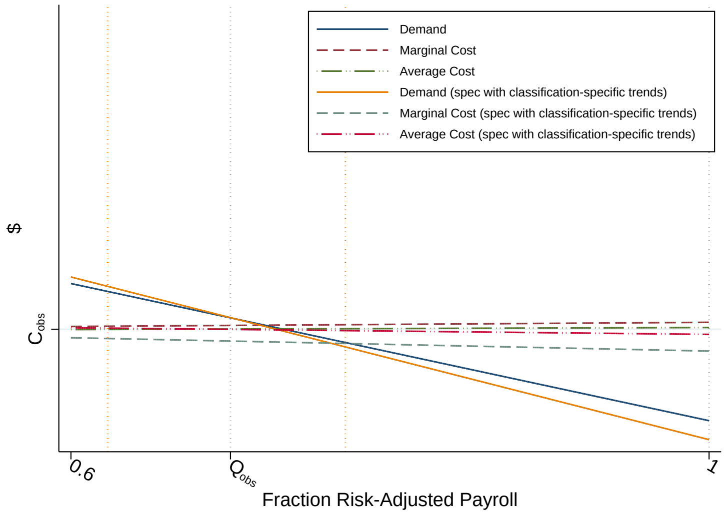
(b) Relatively Large Classifications



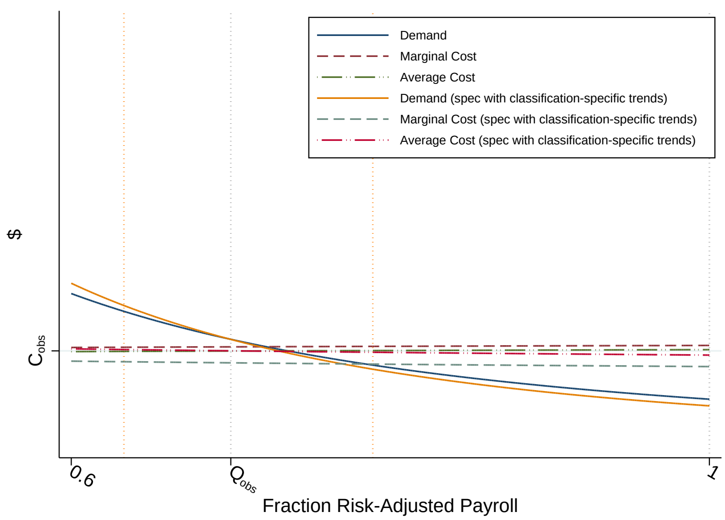
(c) Relatively Large Classifications

Notes: This figure presents monthly regressions in an event study framework zooming in on the months just surrounding a rate update to illustrate that the change in workers' compensation coverage takes place in the months after the update takes effect. Consider the eight months on either side of each rate update, pooling across all the rate updates during the sample period. In this figure, event time is normalized such that the update is implemented in month 1. This figures plots the coefficient estimates of β_n from appendix equation 5. Panel A displays estimates based on all classifications in the baseline sample. Because there are several smaller classifications with no newly initiated policies in a given month, we include these observations by using an inverse hyperbolic sine transformation. The remaining panels focus on relatively large classifications, for which this zero observation issue is not a major concern. Specifically, these specifications restrict attention to classifications with more than five workers' compensation policies initiated in each month of 2006, the first year of our sample. For these relatively large classifications, there are few months over the sample for which there are zero policies initiated, and thus the results are similar when using a $ln(x)$ transformation (Panel B) or an inverse hyperbolic sine transformation (Panel C).

Figure A4: Selection: Graphical Illustration of Range of Magnitudes From Estimates



(a) Linear



(b) Constant Elasticity

Notes: The above figure depicts a graphical representation of demand and costs based on the empirical estimates in Table 5. While the selection estimates presented in the text are not statistically distinct from zero, this figure plots the implied marginal and average cost curves based on the point estimates from specifications with and without classification-specific time trends to give a sense of the small magnitude of the estimates. As discussed in the text, we obtain these curves by combining the estimated elasticities and aggregate summary statistics from the overall market on mean premiums, mean insurer costs, and mean quantities. Panel A plots the estimates based on a linear extrapolation, while panel B presents estimates based on a constant elasticity extrapolation. See Appendix Section C for further details on this calculation.

Table A1: Largest Classifications in Top and Bottom of Base Rate Distribution

Classification Code	Description	Payroll	Normalized Base Rate
	Panel A: Largest Classifications in Lowest 5% of Base Rates		
8810	CLERICAL OFFICE EMPLOYEES	9.82E+10	0.17
8742	SALESPERSONS, COLLECTORS OR MESSENGERS	2.01E+10	0.30
8832	PHYSICIAN & CLERICAL	6.34E+09	0.28
8868	COLLEGE: PROFESSIONAL EMPLOYEES & CLERICAL	5.66E+09	0.41
8601	ARCHITECT OR ENGINEER - CONSULTING	5.33E+09	0.30
	Panel B: Largest Classifications in Highest 5% of Base Rates		
6202	OIL OR GAS WELL & DRIVERS	1.50E+09	6.91
7538	ELECTRIC LIGHT OR POWER LINE CONSTRUCTION & DRIVERS	1.18E+08	11.42
5551	ROOFING - ALL KINDS & YARD EMPLOYEES, DRIVERS	1.10E+08	7.44
6238	CASING INSTALLATION - OIL WELL & DRIVERS	6.65E+07	8.89
3081	FOUNDRY - FERROUS - NOC	4.06E+07	6.96

Notes: The table above describes a selection of classifications with high and low relative base rates. Specifically, Panel A describes the largest classifications (as defined by 2006 covered payroll) within the lowest 5% of classifications in terms of the level of base rates. Panel B describes the largest classifications (as defined by 2006 covered payroll) within the highest 5% of classifications in terms of the level of base rates. The “Normalized Base Rate” reported in the table is the classification base rate divided by the mean based rate among covered payroll insured in 2006.

Table A2: Robustness: Workers' Compensation Classification Coding

	Dependent Variable: $I(c_{j,t} \neq c_{j,t-1})$	
	(1)	(2)
$\Delta ln(relativeBaseRate)_{c_{j,t-1}}$	-0.022	0.008
	(0.039)	(0.027)
	[0.579]	[0.768]
Controls		
Employer Fixed Effects	x	x
Year Fixed Effects	x	x
Classification Fixed Effects		x
N	943,160	943,160
Mean Dep Var	0.089	0.089

Notes: The table above presents estimates from specifications as outlined in appendix equation 11. These employer-year level regressions include controls as listed above: employer fixed effects, year fixed effects, and classification fixed effects (in column 2). Each column represents a separate regression, where the estimated coefficients are displayed along with the associated standard errors in parenthesis and p-values in brackets. The data used in these regressions cover the time period 2006-2011. For this analysis, the sample is employer-year observations where the employer is insured both in year t and year $t-1$. Standard errors are clustered at the classification level. Both the classification-level clustering and the classification fixed effects described above are based on the classification in the prior year, $c_{j,t-1}$.

Table A3: Robustness: Demand Estimates Including Certified Self-Insured Employers

	Dependent Variable: ln(total number covered firms $_{jt}$)					
	(1)	(2)	(3)	(4)	(5)	(6)
ln(relativeBaseRate$_{jt}$)	-0.328	-0.269	-0.324	-0.264	-0.335	-0.274
	(0.094)	(0.089)	(0.107)	(0.101)	(0.096)	(0.089)
	[0.001]	[0.003]	[0.003]	[0.010]	[0.001]	[0.002]
ln(relativeBaseRate$_{j,t+2}$)			-0.01	-0.015		
			(0.113)	(0.118)		
			[0.927]	[0.898]		
ln(uncappedRelativeBaseRate$_{jt}$)*I(capBinding$_{jt}$)					0.012	0.011
					(0.019)	(0.016)
					[0.533]	[0.515]
Controls						
Classification Fixed Effects	x	x	x	x	x	x
Year Fixed Effects	x	x	x	x	x	x
Classification-specific Time Trend, 2-digit		x		x		x

Notes: This table repeats the demand analysis in Table 3 Panel A using a broader sample that includes the certified self-insured employers as well as the employers purchasing insurance from workers' compensation insurers. The data used in these regressions cover the time period 2006-2011, where each observation represents a classification-year (N=1,950). The dependent variable is: ln(total number of covered firms). Each column represents a separate regression, where the estimated coefficients are displayed along with the associated standard errors in parenthesis and p-values in brackets. These classification-year level regressions include controls as listed above: year fixed effects, classification fixed effects, and 2-digit classification specific time trends (for specifications in the even columns). While columns 1 and 2 report the baseline specifications, the remaining columns report alternative specifications with additional variables: leads of the legislated base rates (columns 3 and 4) and uncapped base rates that were not ultimately adopted (columns 5 and 6). These uncapped base rates correspond to the *balanced indicated relative base rates* discussed in Appendix Section A. Robust standard errors are clustered at the classification level.

Table A4: Robustness: Eligible Population of Workers and Firms

Panel A: Entire Sample				
	ln(Total Number of Establishments)		ln(Total Number of Workers)	
	(1)	(2)	(3)	(4)
ln(relativeBaseRate$_{jt}$)	-0.012	-0.008	-0.012	0.001
	(0.007)	(0.007)	(0.012)	(0.019)
	[0.105]	[0.307]	[0.338]	[0.951]
Controls				
Industry Fixed Effects	x	x	x	x
Year Fixed Effects	x	x	x	x
Industry-specific Time Trend		x		x
N	1,170	1,170	1,138	1,138
Mean Dep Var	5.35	5.35	8.39	8.39
Panel B: Sample Restricted to NAICS Industries Mapping to One Classification				
	ln(Total Number of Establishments)		ln(Total Number of Workers)	
	(1)	(2)	(3)	(4)
ln(relativeBaseRate$_{jt}$)	-0.086	-0.008	-0.166	-0.086
	(0.061)	(0.084)	(0.134)	(0.155)
	[0.164]	[0.920]	[0.215]	[0.579]
Controls				
Industry Fixed Effects	x	x	x	x
Year Fixed Effects	x	x	x	x
Industry-specific Time Trend		x		x
N	352	352	331	331
Mean Dep Var	4.66	4.66	7.73	7.73

Notes: The table above presents estimates from specifications as outlined in appendix equation 16. In this table, i is a 6-digit NAICS industry and t is a year. In this specification, $ln(b_{it})$ represents the natural logarithm of the mean base rate applicable in the industry based on a crosswalk between NAICS-classification codes. All specifications include year and industry fixed effects, and we estimate specifications with an additional control: a 4-digit NAICS industry-specific time trend. Each column represents a separate regression, where the estimated coefficients are displayed along with the associated standard errors in parenthesis and p-values in brackets. The dependent variables are as indicated in the table. To analyze these variables, we take aggregate data on the universe of firms and workers at the NAICS industry-year level from the Quarterly Census of Employment and Wages (QCEW) . We then match this to the classification-year level workers' compensation premium variation utilizing a crosswalk that is derived from the administrative data. Starting with the pooled data across our analysis period, we use the observed NAICS industry-classification pairs to construct a frequency-weighted crosswalk under the assumption that the missing industry values are not selected. To remove outliers that may represent measurement error, we exclude industry-classification pairs that represent fewer than 50 observations or fewer than 5% of the observations associated with a particular NAICS industry code. Panel A presents the results for the entire sample, and Panel B focuses on the sample where there is a one-to-one match between the NAICS industry code and the workers' compensation classification code.

Table A5: Robustness: Selection Estimates With Additional Claim Measures

Panel A: Cost Outcomes, Dep Var: InvHypSine(Measure)								
	Measure ($ per $100 risk-adjusted payroll)							
	Overall Costs (baseline)		Medical Costs		Income Benefit Costs		Predicted Costs	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ln(relativeBaseRate$_{jt}$)	-0.018	0.047	-0.019	0.025	0.013	0.074	-0.119	-0.076
	(0.163)	(0.175)	(0.145)	(0.161)	(0.149)	(0.154)	(0.129)	(0.131)
	[0.914]	[0.790]	[0.894]	[0.877]	[0.928]	[0.631]	[0.358]	[0.564]
Controls								
Classification Fixed Effects	x	x	x	x	x	x	x	x
Year Fixed Effects	x	x	x	x	x	x	x	x
Classification-specific Time Trend, 2-digit		x		x		x		x
Mean Dep Var	2.34	2.34	1.91	1.91	1.44	1.44	2.18	2.18

Panel B: Claim Outcomes, Dep Var: InvHypSine(Measure)								
	Measure (# per $50K risk-adjusted payroll)							
	Claims		Serious Claims		Non-Serious Claims		Medical Only Claims	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ln(relativeBaseRate$_{jt}$)	0.00194	0.00908	0.00024	-0.00006	-0.00030	0.00371	0.00212	0.00570
	(0.01079)	(0.01177)	(0.00058)	(0.00059)	(0.00367)	(0.00439)	(0.00881)	(0.00980)
	[0.857]	[0.441]	[0.683]	[0.917]	[0.934]	[0.399]	[0.810]	[0.561]
Controls								
Classification Fixed Effects	x	x	x	x	x	x	x	x
Year Fixed Effects	x	x	x	x	x	x	x	x
Classification-specific Time Trend, 2-digit		x		x		x		x
Mean Dep Var	0.097	0.097	0.001	0.001	0.026	0.026	0.069	0.069

Notes: The table above presents additional estimates relating to the degree of selection in this market. The coefficients reported above are from a difference-in-difference specification as outlined in equation 2 in the paper. These classification-year level regressions include controls as listed above: year fixed effects, classification fixed effects, and 2-digit classification specific time trends (for specifications in the even columns). Each column represents a separate regression, where the estimated coefficients are displayed along with the associated standard errors in parenthesis and p-values in brackets. Robust standard errors are clustered at the classification level. The data used in these regressions cover the time period 2006-2011, where each observation represents a classification-year (N=1,950). The dependent variables are as listed in the table above. The "Predicted Cost" measure predicts costs in that classification-year by taking the observed number of claims in the classification-year in each category (serious, non-serious, and medical only) and associates with each claim the mean cost of claims in those categories within the classification across the sample period. See Appendix Section C for more details on risk-adjustment used in this analysis.

Table A6: Additional Robustness: Selection Estimates

	Panel A: Dependent Variable: InvHypSine$(\frac{Cost_{jt}}{riskAdjust_{jt} \times Payroll_{jt}})$					
	(1)	(2)	(3)	(4)	(5)	(6)
ln(relativeBaseRate$_{jt}$)	-0.018	0.047	-0.004	0.070	-0.010	0.048
	(0.163)	(0.175)	(0.172)	(0.190)	(0.168)	(0.180)
	[0.914]	[0.790]	[0.979]	[0.713]	[0.953]	[0.790]
ln(relativeBaseRate$_{j,t-2}$)			-0.023	-0.041		
			(0.158)	(0.175)		
			[0.885]	[0.813]		
ln(uncappedRelativeBaseRate$_{jt}$)*I(capBinding$_{jt}$)					-0.015	-0.003
					(0.048)	(0.050)
					[0.762]	[0.958]
Controls						
Classification Fixed Effects	x	x	x	x	x	x
Year Fixed Effects	x	x	x	x	x	x
Classification-specific Time Trend, 2-digit		x		x		x
Panel B: Dependent Variable: ln(riskAdjust$_{jt}$ x Payroll$_{jt}$)						
	(1)	(2)	(3)	(4)	(5)	(6)
ln(relativeBaseRate$_{jt}$)	-0.431	-0.363	-0.369	-0.316	-0.432	-0.365
	(0.131)	(0.122)	(0.119)	(0.110)	(0.134)	(0.126)
	[0.001]	[0.003]	[0.002]	[0.004]	[0.001]	[0.004]
ln(relativeBaseRate$_{j,t-2}$)			-0.108	-0.083		
			(0.089)	(0.081)		
			[0.225]	[0.302]		
ln(uncappedRelativeBaseRate$_{jt}$)*I(capBinding$_{jt}$)					0.002	0.003
					(0.017)	(0.018)
					[0.916]	[0.852]
Controls						
Classification Fixed Effects	x	x	x	x	x	x
Year Fixed Effects	x	x	x	x	x	x
Classification-specific Time Trend, 2-digit		x		x		x

Notes: The table above presents additional robustness analysis for the selection estimation. The coefficients reported above are from a difference-in-difference specification as outlined in equation 2 in the paper. These classification-year level regressions include controls as listed above: year fixed effects, classification fixed effects, and 2-digit classification specific time trends (for specifications in the even columns). Each column represents a separate regression, where the estimated coefficients are displayed along with the associated standard errors in parenthesis and p-values in brackets. Robust standard errors are clustered at the classification level. The data used in these regressions cover the time period 2006-2011, where each observation represents a classification-year (N=1,950). The dependent variables are as listed in the table above, where overall costs are measured per $100 of risk-adjusted payroll. Panel A reports regression estimates for costs relative to risk adjusted payroll, and Panel B reports regression estimates for risk adjusted payroll. Columns (1) and (2) report the baseline selection estimates with and without classification-specific time trends (from Table 5 in the text). Columns (3) and (4) report the results for analogous specifications with an extra term included: the natural logarithm of the base rate in effect two years prior. Columns (5) and (6) report the results from analogous specifications with an additional term: the hypothetical uncapped base rate if not for the final step in the update algorithm.

Table A7: Robustness: Welfare Calculations with Empirical Cost Curves

Panel A: Welfare Calculations				
	Linear		Constant Elasticity	
	Est	Std Err	Est	Std Err
	(1)	(2)	(3)	(4)
Counterfactuals-Baseline (No Selection)				
Quantity (fraction risk-adjusted payroll covered)				
Mandate	1.000	-	1.000	-
Perfect Competition (Optimal)	0.734	(0.010)	0.737	(0.012)
Welfare per $100 payroll (relative to status quo)				
Mandate	-0.2070	(0.0939)	-0.1175	(0.0502)
Perfect Competition (Optimal)	0.0041	(0.0011)	0.0043	(0.0012)
Counterfactuals-Empirical Cost Curves, Version 1 (Table 6 Panel A column 1)				
Quantity (fraction risk-adjusted payroll covered)				
Mandate	1.000	-	1.000	-
Optimal	0.722	(0.127)	0.724	(0.308)
Perfect Competition	0.733	(0.010)	0.737	(0.012)
Welfare per $100 payroll (relative to status quo)				
Mandate	-0.2347	(0.2429)	-0.1407	(0.2027)
Optimal	0.0020	(0.0747)	0.0021	(0.0684)
Perfect Competition	0.0016	(0.0203)	0.0017	(0.0219)
Counterfactuals-Empirical Cost Curves, Version 2 (Table 6 Panel A column 2)				
Quantity (fraction risk-adjusted payroll covered)				
Mandate	1.000	-	1.000	-
Optimal	0.762	0.160	0.772	0.536
Perfect Competition	0.729	(0.011)	0.733	(0.013)
Welfare per $100 payroll (relative to status quo)				
Mandate	-0.1705	(0.3070)	-0.0710	(0.2309)
Optimal	0.0137	(0.1116)	0.0148	(0.1291)
Perfect Competition	0.0103	(0.0235)	0.0110	(0.0256)

Panel B: Underlying Data		
Status Quo		
Quantity	0.70	0.70
Price	1.79	1.79
Expenses, % of Premiums	88%	88%

Panel C: Corresponding Demand and Cost Curves				
	Linear		Constant Elasticity	
	Est	Std Err	Est	Std Err
	(1)	(2)	(3)	(4)
Demand Curve				
Constant	5.94	(1.43)	0.77	(0.18)
Slope	-5.96	(2.05)	-2.32	(0.80)
Average Cost Curve, Version 1				
Constant	1.51	(0.55)	1.59	(0.20)
Slope	0.09	(0.78)	0.04	(0.35)
Marginal Cost Curve, Version 1				
Constant	1.51	(0.55)	1.66	(0.79)
Slope	0.18	(1.57)	0.04	(0.35)
Demand Curve, Version 2				
Constant	6.72	(2.14)	0.66	(0.20)
Slope	-7.07	(3.06)	-2.75	(1.19)
Average Cost Curve, Version 2				
Constant	1.77	(0.66)	1.50	(0.24)
Slope	-0.29	(0.95)	-0.13	(0.42)
Marginal Cost Curve, Version 2				
Constant	1.77	(0.66)	1.31	(0.90)
Slope	-0.58	(1.90)	-0.13	(0.42)

Notes: The table above presents an alternative specification of the welfare calculations as discussed in Section 5 utilizing the implied empirical cost curves based on the elasticities in Table 5 Panel A. Panel A displays the welfare calculations, Panel B reports the underlying summary statistics, and Panel C reports the corresponding point estimates. In Panel C, the reported "constant" and "slope" in the constant elasticity specification ($P = AQ^{\beta}$) refer to A and β, respectively; in the linear specification ($P = A + \beta Q$), the "constant" and "slope" refer to A and β, respectively. The counterfactuals are conducted using two alternative parametric specifications for demand and costs: linear (displayed in columns 1 and 2) and constant elasticity (displayed in columns 3 and 4). The table reports welfare measured in dollars per $100 of risk-adjusted payroll. In addition, the table reports two scaled measures of welfare to ease interpretation: (i) welfare as a percent of the mean cost of the insured in the status quo (one measure of the size of the market), and (ii) welfare measures scaled by $50K, approximately the mean annual earnings for this population. The table reports bootstrapped standard errors clustered at the classification level, where 1,000 randomly drawn bootstrap samples are used. See Table 7 and Appendix Section C for further details on the welfare calculations.

Table A8: Robustness: Selection Estimates Under Alternative Incidence Assumptions

Panel A: Risk Adjusted Covered Payroll, $\ln(riskAdjust_{jt} \times NormalizedPayroll_{jt})$

	% of premiums borne by employees									
	0% (baseline)		10%		25%		50%		100%	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
$\ln(relativeBaseRate_{jt})$	-0.431	-0.363	-0.426	-0.359	-0.419	-0.352	-0.407	-0.340	-0.380	-0.313
	(0.131)	(0.122)	(0.131)	(0.122)	(0.131)	(0.122)	(0.131)	(0.122)	(0.130)	(0.122)
	[0.001]	[0.003]	[0.001]	[0.004]	[0.002]	[0.004]	[0.002]	[0.006]	[0.004]	[0.011]
Controls										
Classification Fixed Effects	x	x	x	x	x	x	x	x	x	x
Year Fixed Effects	x	x	x	x	x	x	x	x	x	x
Classification-specific Time Trend, 2-digit		x		x		x		x		x

Panel B: Risk Adjusted Costs, $\text{IHS}(\frac{Cost_{jt}}{riskAdjust_{jt} \times NormalizedPayroll_{jt}})$

	% of premiums borne by employees									
	0% (baseline)		10%		25%		50%		100%	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
$\ln(relativeBaseRate_{jt})$	-0.018	0.047	-0.013	0.051	-0.007	0.058	0.005	0.070	0.030	0.097
	(0.163)	(0.175)	(0.163)	(0.175)	(0.163)	(0.176)	(0.164)	(0.176)	(0.165)	(0.179)
	[0.914]	[0.790]	[0.935]	[0.772]	[0.967]	[0.743]	[0.978]	[0.694]	[0.855]	[0.589]
Controls										
Classification Fixed Effects	x	x	x	x	x	x	x	x	x	x
Year Fixed Effects	x	x	x	x	x	x	x	x	x	x
Classification-specific Time Trend, 2-digit		x		x		x		x		x
Implied $\frac{\partial IHS(\frac{Cost_{jt}}{riskAdjust_{jt} \times NormalizedPayrolljt})}{\partial \ln(riskAdjust_{jt} \times NormalizedPayrolljt)}$	0.042	-0.129	0.031	-0.142	0.017	-0.165	-0.012	-0.206	-0.079	-0.310

Notes: The table above presents additional robustness analysis relating to the degree of selection in this market. This robustness analysis repeats the analysis in Table 5 under alternative incidence assumptions for the underlying demand estimates. These classification-year level regressions include controls as listed above: year fixed effects, classification fixed effects, and 2-digit classification specific time trends (in even columns only). Each column represents a separate regression, where the estimated coefficients are displayed along with the associated standard errors in parenthesis and p-values in brackets. The data used in these regressions cover the time period 2006-2011, where each observation represents a classification-year (N=1,950). The dependent variables are as listed in the table above, where overall costs are measured per $100 of risk-adjusted payroll. Robust standard errors are clustered at the classification level.

Table A9: Robustness: Welfare Analysis Under Alternative Incidence Assumptions

	Welfare Calculations											
	Linear						Constant Elasticity					
	% of premiums borne by employees						% of premiums borne by employees					
	0% (baseline)		50%		100%		0% (baseline)		50%		100%	
	Est	Std Err	Est	Std Err	Est	Std Err	Est	Std Err	Est	Std Err	Est	Std Err
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Counterfactuals												
Quantity (fraction risk-adjusted payroll covered)												
Mandate	1.000	-	1.000	-	1.000	-	1.000	-	1.000	-	1.000	-
Perfect Competition (Optimal)	0.734	(0.010)	0.738	(0.010)	0.743	(0.010)	0.737	(0.012)	0.742	(0.012)	0.746	(0.012)
Welfare (relative to status quo)												
Mandate												
per $100 of risk-adjusted payroll	-0.2070	(0.0939)	-0.2100	(0.1137)	-0.2161	(0.1360)	-0.1175	(0.0502)	-0.1192	(0.0436)	-0.1223	(0.0679)
scaled by $50,000	-103.48	(46.97)	-105.01	(56.87)	-108.05	(67.99)	-58.76	(25.10)	-59.60	(21.82)	-61.14	(33.97)
% of mean cost	-13.16%	(5.97%)	-13.36%	(7.23%)	-13.74%	(8.65%)	-7.47%	(3.19%)	-7.58%	(2.77%)	-7.78%	(4.32%)
Perfect Competition (Optimal)												
per $100 of risk-adjusted payroll	0.0041	(0.0011)	0.0039	(0.0011)	0.0036	(0.0012)	0.0043	(0.0012)	0.0041	(0.0035)	0.0039	(0.0026)
scaled by $50,000	2.03	(0.56)	1.94	(0.57)	1.82	(0.58)	2.16	(0.62)	2.06	(1.74)	1.94	(1.30)
% of mean cost	0.26%	(0.07%)	0.25%	(0.07%)	0.23%	(0.07%)	0.27%	(0.08%)	0.26%	(0.22%)	0.25%	(0.17%)
Subsidy to support optimal allocation--25% MDWL of taxation												
per $100 of risk-adjusted payroll	-0.0363	(0.0006)	-0.0367	(0.0006)	-0.0372	(0.0006)	-0.0362	(0.0021)	-0.0367	(0.0037)	-0.0372	(0.0060)
scaled by $50,000	-18.15	(0.28)	-18.37	(0.29)	-18.61	(0.29)	-18.12	(1.04)	-18.35	(1.85)	-18.58	(2.98)
% of mean cost	-2.31%	(0.04%)	-2.34%	(0.04%)	-2.37%	(0.04%)	-2.30%	(0.13%)	-2.33%	(0.24%)	-2.36%	(0.38%)

Notes: This table repeats the welfare analysis in Table 7 under various alternative assumptions regarding the incidence of workers' compensation premium changes. For the linear specification, the baseline results with 0% of premium changes borne by employees are displayed in columns 1 and 2, where columns 3 and 4 repeat the analysis assuming that 50% of premium changes are borne by employees, and columns 5 and 6 repeat the analysis under the assumption that 100% of premium changes are borne by employees. The analogous results for the constant elasticity specifications are reported on columns 7 through 12. The table reports bootstrapped standard errors clustered at the classification level, where 1,000 randomly drawn bootstrap samples are used. See Table 7 and Appendix Section C for further details on the welfare calculations.