NBER WORKING PAPER SERIES

THE MINIMUM WAGE, FRINGE BENEFITS, AND WORKER WELFARE

Jeffrey Clemens
Lisa B. Kahn
Jonathan Meer

Working Paper 24635
http://www.nber.org/papers/w24635

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
May 2018

We thank Jason Abaluck, Julie Cullen, Roger Gordon, and seminar participants at Cornell, Federal Reserve Board of Governors, George Washington, Harvard Business School (E\&M), Harvard Medical School (Health Care Policy), San Diego State, UC Santa Barbara, University of Maryland, and the World Bank for helpful comments and conversations. The views expressed herein are those of the authors and do not necessarily reflect the views of the National Bureau of Economic Research.

The Minimum Wage, Fringe Benefits, and Worker Welfare
Jeffrey Clemens, Lisa B. Kahn, and Jonathan Meer
NBER Working Paper No. 24635
May 2018
JEL No. I13,J23,J32,J33

ABSTRACT

This paper explores the relationship between the minimum wage, the structure of employee compensation, and worker welfare. We advance a conceptual framework that describes the conditions under which a minimum wage increase will alter the provision of fringe benefits, alter employment outcomes, and either increase or decrease worker welfare. Using American Community Survey data from 2011-2016, we find robust evidence that state-level minimum wage changes decreased the likelihood that individuals report having employer-sponsored health insurance. Effects are largest among workers in very low-paying occupations, for whom coverage declines offset 9 percent of the wage gains associated with minimum wage hikes. We find evidence that both insurance coverage and wage effects exhibit spillovers into occupations moderately higher up the wage distribution. For these groups, reductions in coverage offset a more substantial share of the wage gains we estimate.

Jeffrey Clemens
Department of Economics
University of California, San Diego
9500 Gilman Drive #0508
La Jolla, CA 92093
and NBER
jeffclemens@ucsd.edu

Jonathan Meer
Department of Economics
TAMU 4228
College Station, TX 77843
and NBER
jmeer@econmail.tamu.edu

Lisa B. Kahn
Yale University
School of Management
P. O. Box 208200
New Haven, CT 06520
and NBER
lisa.kahn@yale.edu

The minimum wage has risen in prominence among the policy instruments intended to improve well-being for low-skilled individuals. But policy discussions about the minimum wage often conflate impacts on employment with welfare effects. While the employment margin is of first-order importance, there are limitations to what one can conclude from employment alone.[1] In particular, the impact of minimum wage policy on non-wage job attributes has received little attention, even though such attributes are important for understanding how workers value employment arrangements (Sorkin, 2017; Mas and Pallais, 2017).[2]

In this paper, we explore the theoretical and empirical relationship between the minimum wage and fringe benefits, with a focus on employer-sponsored health insurance. We develop a conceptual framework where firms may optimally shift compensation from non-cash attributes to wages in the presence of a minimum wage increase. This force impacts worker welfare, even absent any effects on employment. In our analysis using American Community Survey (ACS) data from 2011-2016, we show that state-level minimum wage increases are associated with losses in employer provided health insurance. This suggests the welfare effects highlighted in our model are empirically relevant.

In our model, compensation consists of a combination of cash and non-cash attributes, and depends on worker productivity. We also allow for the possibility of a bargaining wedge whereby the firm pays less in total compensation (cash and non-cash benefits) than a worker's marginal product.[3] When the minimum wage rises above the prevailing wage (cash payment) but below a worker's marginal product, the firm will

[1]These limitations have been recognized in an older theoretical literature (Wessels, 1980; McKenzie, 1980).

[2]A handful of papers have either directly or indirectly analyzed minimum wage effects on training and earnings trajectories (Hashimoto, 1982; Acemoglu and Pischke, 1999; Rosen, 1972; Clemens and Wither, 2014). Simon and Kaestner (2004), which we discuss in more detail below, analyze the relationship between the minimum wage and health insurance coverage over an earlier period, 1979-2000.

[3]Bargaining position is linked, in turn, to how closely the market approximates perfect competition.

shift the mix of compensation towards cash and away from non-cash benefits, but will still find it worthwhile to employ the worker. This distortion can create losses to worker welfare which, if large enough, will push workers to prefer their outside option of non-work.

We also show that, in the presence of a bargaining wedge, the welfare effects of minimum wage increases are non-monotonic. In general, wage gains associated with increases in worker bargaining power will tend to improve welfare, while wage gains that are accommodated through reductions in non-cash benefits can reduce welfare. Finally, for firms that hire both low- and high-skilled workers, benefits packages may be set collectively.[4] This commonality may lead minimum wage increases to have spillover effects on the compensation packages of higher-skilled workers.

Our empirical analysis focuses primarily on the relationship between minimum wage increases and the prevalence of employer-sponsored health insurance, a major component of non-wage compensation. We exploit recent state-level minimum wage increases and the large samples available in the ACS from 2011-2016. To isolate the workers most likely to be impacted by minimum wage policy, we categorize them based on typical wages in their current or most recent occupation. We focus especially on occupations that we categorize as Very Low (e.g., food service), Low (e.g., retail sales), and Modest-paying (e.g., clerks and supervisors of food service workers). The former are more likely to be directly impacted by minimum wage increases, while the latter tend to earn just above, but adjacent to, minimum wages. We also explore more traditional categorizations of low-skilled individuals based on their demographics (e.g., age and education).

Using a difference-in-differences research design, we estimate that recent minimum wage increases are accompanied by significant declines in employer coverage. For those

[4] Administrative costs and anti-discrimination law may make it costly for firms to offer worker-specific benefits packages.

in Very Low and Low paying occupations, we find that a $1 minimum wage increase is associated with a 1 to 2 percentage point (2 to 4%) reduction in the probability of coverage. We also estimate a 1 percentage point (1.5%) loss in coverage for those in Modest paying occupations, suggesting a non-trivial role for spillovers. Losses in employer coverage manifest largely among employed workers, rather than through impacts of the minimum wage on employment.

Our estimates are robust to controlling flexibly for factors related to the implementation of the Affordable Care Act (ACA). They are similarly robust to controlling for proxies of aggregate economic and labor market conditions. Controlling for these factors increases the precision of our estimates without substantially altering the point estimates. Estimates are also very similar when we employ a triple-difference estimation strategy, using those in high wage occupations to control flexibly for state-time variation in employer coverage.

To benchmark the magnitudes of employer coverage losses, we compare them to estimated wage gains associated with the minimum wage. We use Occupational Employment Statistics (OES) data, an employer-based survey administered by the Bureau of Labor Statistics, which has large sample sizes, even at disaggregated levels (such as state-occupation). Relative to household surveys, employer surveys likely suffer less from the canonical measurement error problems that can frustrate efforts to estimate impacts of the minimum wage on the earnings distribution (see, for example, Lee (1999); Autor, Manning, and Smith (2016)).

We find that a $1 minimum wage increase generates significant wage increases for workers in low-to-modest paying occupations. At the 10th percentile, increases are on the order of 12% and 9% for Very Low and Low paying occupations, respectively, and even 3% for Modest paying occupations. We also see sizable increases at the mean wage for both Very Low and Low paying occupations. Importantly, the wage increases we

estimate are substantially larger than what would be required to comply with the new prevailing wage. For example, based on the wage distribution in 2011-2013, a $1 minimum wage increase would have required a $0.50 wage increase at the mean for Very Low paying occupations, yet our estimate implies a $0.90 increase. Wage increases for Low and Modest-wage occupation groups also tend to be $0.30 to $0.40 larger than what would have been required due to compliance alone. This again implies that minimum wage policy spills over onto modestly higher earners. Our model rationalizes these spillover effects as driven by shifts from non-wage compensation. These findings may also be driven by several other forces, including truncation of the wage distribution due to employment losses, spillover effects associated with wage hierarchies, and substitution towards more skilled labor. Clemens, Kahn, and Meer (2018) find evidence of the latter using data on job vacancy postings, in addition to employment data.

When we compare wage changes to changes in employer coverage, we find that coverage declines offset a modest 9% of wage gains for Very Low wage occupations and a larger fraction for the Low and Modest groups (16% and 57%, respectively). The offsets we estimate are, unsurprisingly, much larger for the latter groups that experienced relatively small wage gains following minimum wage hikes. Since we cannot reliably measure changes in employer contributions on the intensive margin, which may also decrease in response to minimum wage hikes, these estimates are likely lower bounds.

Our finding of sizeable losses to employer health insurance coverage suggest that welfare effects due to changes in non-wage attributes can be important. We therefore contribute to the literature on the welfare consequences of compensation regulation (Stigler, 1946; Wessels, 1980; McKenzie, 1980; Lee and Saez, 2012). Our framework succinctly merges intuitions connected to bargaining frictions, non-wage job attributes, and the conditions under which a minimum wage increase will tend to increase versus decrease individual welfare. These insights on the welfare implications of non-wage job attributes

also connect to the literature on benefit incidence (Summers, 1989; Gruber, 1994; Clemens and Cutler, 2014; Kolstad and Kowalski, 2016).

On the empirical side, our analysis contributes to a surprisingly small literature on the relationship between the minimum wage and non-wage job attributes. Driven by analyses of general and firm-specific human capital, early papers focused on job training (Rosen, 1972; Hashimoto, 1982; Acemoglu and Pischke, 1999). The evidence from these papers is mixed. In more recent work, Simon and Kaestner (2004) find no evidence that minimum wage increases affected employer insurance coverage in an analysis spanning the 1980s and 1990s.[5]

Finally, we contribute to the growing literature on the role of firms as mediators of the effects of labor market shocks on individual outcomes.[6] Specifically, we illustrate how benefit arrangements may lead the effects of minimum wage changes to spill over from the least-skilled individuals to the compensation of moderately higher-skilled individuals. Such spillovers are important for interpreting the effects of the minimum wage on earnings and benefit receipt across skill groups.

This paper proceeds as follows. In section 1, we present a conceptual framework for assessing the welfare implications of minimum wage changes, through effects on wages, non-wage compensation, and employment. Section 2 describes the data we use to analyze the effect of minimum wage changes on employer-sponsored health insurance

[5]Bucila (2008) and Marks (2011) explore heterogeneity in this finding (see also Royalty (2001)). Our empirical analysis differs from these papers along several dimensions. First, we harness the insurance coverage variables in the ACS, which has annual samples roughly 20 times that of the March supplements of the Current Population Survey (CPS) used in Simon and Kaestner (2004) and the other papers. Second, we analyze a time period during which a large number of substantial minimum wage changes were enacted over a small number of years. Benefit arrangements may have been poised for redesign over this time period due to the contemporaneous implementation of the ACA. Third, we highlight the theoretical and empirical relevance of spillover effects that may emerge across firms, occupations, and industries. Fourth, we connect our empirical insurance coverage analysis to one exploring the impact of the minimum wage on wage rates in order to quantify that magnitude of the associated offset to compensation costs.

[6]See, for example Chetty, Friedman, Olsen, and Pistaferri (2011); Abowd, Kramarz, and Margolis (1999); Song, Price, Guvenen, Bloom, and Von Wachter (2015); Card, Cardoso, Heining, and Kline (2018).

and wage rates. Section 3 presents our empirical strategy, and section 4 presents our results. We conclude in section 5 by discussing some additional implications of our results.

1 A Framework For Analyzing the Effects of Minimum Wage Regulation on Worker Welfare

1.1 Basic Set-up

Suppose a worker has an exogenous productivity level a, the value of the output he or she produces when employed. The individual also has a reservation value v, which reflects his or her valuation of leisure and the consumption that could be financed through social insurance transfers.[7]

Assume for now that compensation consists entirely of wage income. Bargaining frictions, perhaps due to search costs, enable firms to pay workers wage rates equal to fraction θ of the value of their output.[8] The wage is thus $w = \theta a$ unless the firm is constrained by the minimum wage. Firms maximize profits by employing all individuals they can retain at wage rates less than or equal to the value of their output.

Under these conditions, the minimum wage causes job loss when it exceeds the value of a worker's production. It can also increase earnings when bargaining frictions create wedges between unconstrained wage rates and the value of output. It is also possi-

[7]In a framework that explicitly models search, the outside option will also be a function of the value of the matches the individual might find if he or she turns down employment at some initial firm.

[8]If expressed as in a Nash bargaining problem in which the bargaining parameters are α and $1-\alpha$, we would have $w = \theta a = \alpha a + (1-\alpha)v$. The relationship between our "reduced form bargaining parameter" and a standard Nash bargaining parameter is thus $\theta = \frac{\alpha a + (1-\alpha)v}{a}$. The wage equals the individual's marginal product under perfectly competitive conditions, which are captured through either of two channels. First, $w = a$ if the individual's outside option v equals the value of his or her output a, perhaps due to an absence of search frictions. Second, $w = a$ if the Nash bargaining parameter equals 1, which implies that the reduced form bargaining parameter also equals 1.

ble for bargaining wedges to create settings in which a minimum wage hike increases employment.[9]

1.2 Extension To Non-Cash Benefits

Suppose now that compensation includes a combination of cash wages w and non-cash benefits b. For simplicity, let worker utility be $U(w, b) = u(w) + g(b)$, with both u and g assumed to be strictly increasing, concave, and twice continuously differentiable, and with $g(0) = u(0) = 0$. That is, worker utility is separable in wages and benefits.[10] The optimal division of compensation between wages and benefits sets the wage equal to w^* such that $u'(w^*) = g'(\theta a - w^*)$. Compensation packages that satisfy this condition minimize the firm's cost for providing the worker with a given level of utility. In this setting, the effect of the minimum wage depends on its value relative to a, as well as the bargaining wedge, $1 - \theta$.

Consider first the case of perfect competition, when $\theta = 1$ (i.e., the bargaining wedge is 0). Figure 1 illustrates the relationship between the minimum wage and worker utility for an individual with productivity a under this assumption. When the minimum wage falls between 0 and w^*, it is non-binding. For minimum wages greater than a, firms cease offering employment, as in the base case illustrated above. Utility then equals the reservation utility, v.

---

[9]See the 2016 revision of Clemens and Wither (2014) for a more fleshed out discussion of these cases. The minimum wage can increase employment if there are firms that make wage offers that individuals are unwilling to accept even when those individuals would be willing to work at wage rates that are less than or equal to the value of what they can produce. That is, there are cases in which $a > v$, but $a\theta < v$. This implies that, absent the minimum wage, employment fails to materialize in cases in which it would be bilaterally efficient. This can arise in "wage posting" models, but would not occur in standard "ex post bargaining" models (Manning, 2011).

[10]This formulation embeds the possibility that the firm may be able to provide benefits more cheaply than it would cost the worker to buy with cash (e.g., due to tax preference or risk pooling in the case of health insurance). The separate utility functions, u and g, allow a worker to value a dollar spent on benefits differently than a dollar spent on cash.

The nuance of taking into account non-wage compensation arises for the region w^* to a. Here, the minimum wage binds the mix of compensation between wages and non-wage benefits, but does not exceed the value of worker output. Firms are thus willing to offer employment, but the utility from compensation with a wage of w_{min} and benefit of $b = a - w_{min}$ falls short of $U(w^*, a - w^*)$. The concavity of u and g implies that the cost of this distortion will rise with the minimum wage in this region (between w^* and a). Figure 1 illustrates two possibilities. Individuals may continue to work because $U(w_{min}, a - w_{min}) > v$ even as w_{min} approaches a (the red dashed line). Alternatively, they may exit employment because the minimum wage passes a level w_v defined such that $U(w_v, a - w_v) = v$ (the blue solid line).

Thus, in the perfect competition case, allowing for cash and non-cash benefits yields two additional implications. First, worker welfare is weakly decreasing in the minimum wage whenever it binds on the mix of compensation and benefits, and this is true even when there is no impact on employment. Furthermore, effects are likely to be non-linear in the minimum wage (i.e., decreasing at an increasing rate). Second, employment effects can arise through the traditional channel (the minimum wage exceeding worker productivity), but also when utility from the mix of wages and benefits falls below the worker's reservation wage. This latter force can offset job shortage effects that are emphasized in traditional models that ignore non-wage job attributes.

Next consider the imperfect competition case. Here, firms have more flexibility to absorb mandated wage increases. Figure 2 illustrates an example in which, absent a binding minimum wage, workers are paid less than the value of their output due to the existence of a bargaining wedge. As before, the minimum wage is non-binding between 0 and w^*, and, for $w_{min} > a$, firms cease offering employment.

Between w^* and $a\theta$, the minimum wage binds on the mix of compensation but not on the total cost of compensation to the firm. We depict the case in which $U(w_{min}, a\theta -$

$w_{min}) > v$ throughout this region. Effects are analogous to the w^* to a region in the perfect competition case.[11]

Between $a\theta$ and a, the minimum wage binds on the total value of compensation, but does not exceed the value of worker output. Firms would then optimally respond by maintaining employment and increasing total compensation. The concavity of u implies that utility will increase with w_{min} at a decreasing rate over this interval. We depict the case in which there is a region over which $U(w_{min}, 0) > U(w^*, a\theta - w^*)$, implying a net improvement in the individual's welfare.

The case of imperfect competition illustrates several important features. First, welfare effects are non-monotonic in the minimum wage. As we have drawn it, welfare first decreases (at an increasing rate) as w_{min} first exceeds w^*. Welfare then rises back towards and eventually above its initial level before declining sharply when the individual loses employment. Naturally, other outcomes are possible. For example, there may be no interval over which welfare improves. There may also be an interval where workers are pushed below their reservation wage, v, in which case there will be employment effects driven by labor supply.

The existence of various regions, their length, and the size of the potential welfare gains and losses depend crucially on the bargaining wedge $(1 - \theta)$ and a. Our simple framework illustrates that the welfare effects of minimum wage changes can be quite nuanced when jobs have non-wage attributes. First, the minimum wage can affect worker welfare in the absence of effects on either the total cost of compensation or the extensive margin of employment. Second, welfare effects can be negative even when compensation

[11]Here we assume that θ does not change when the minimum wage does not bind on total compensation. Other outcomes are possible. For example, if the new mix of compensation and benefits pushes workers below their reservation wage, v, then firms may respond by increasing θ. Or, the existence of the wedge may allow firms flexibility, for example, to raise wages for small minimum wage increases, without adjusting benefits (effectively increasing θ), if they find that to be an easier path. In these instances, the description for the region $a\theta$ to a may be more applicable to the w^* to $a\theta$ region as well.

costs rise and no jobs are lost.

1.3 Further Considerations

The analysis thus far assumes that there is just one type of worker, with productivity a and preferences described by u and g. However, firms frequently employ workers of multiple skill types and/or workers with different preferences for wage income relative to health insurance benefits. In these cases, firms may choose to design benefits packages collectively, rather than on an individual basis, because of administrative costs and for legal reasons. Provisions in the Affordable Care Act (ACA), for example, make it difficult for employers to provide less generous health insurance benefits to low wage employees by making smaller contributions to their premiums.[12] Empirically, most firms use the same benefits plans for all workers or for broad categories of workers.[13]

When firms offer a common benefits package to workers of multiple skill types, minimum wage increases may alter the compensation packages offered to both minimum wage and non-minimum wage workers. Indeed, the optimal mix of pay and benefits will tend to trade off the utility cost of distortions to compensation packages for all types of workers, in proportion to their relative shares of a firm's workforce. This has both empirical and welfare implications.

Empirically, reductions in the generosity of benefit packages will also affect individuals higher up the skill distribution. When firms substitute cash for non-cash compensation, cash incomes will rise for both minimum wage workers and workers higher up in the skill distribution. Changes in non-cash compensation can thus generate a "ripple

[12]More specifically, coverage fails the ACA's affordability requirements if the employee must contribute an amount in excess of 9.5 percent of their gross income. Note, however, that because most minimum wage workers do not work full time schedules, employers will tend not to be subject to penalties for failing to provide them with access to affordable insurance.

[13]For example, roughly half of firms that provide health insurance offer only one plan (Summary Table II.a.2.d, 2016 Medical Expenditure Panel Survey).

effect," whereby minimum wage increases result in wage gains for non-minimum wage workers (Lee, 1999; Autor, Manning, and Smith, 2016).[14]

Changes in the mix of compensation can have nuanced welfare implications. Initial compensation packages will involve mixes of cash and non-cash benefits that are excessively weighted towards cash from the perspective of some workers and towards benefits from the perspective of others. When firms shift from non-cash to cash compensation due to an increase in the minimum wage, the former group's welfare will rise while the latter group's welfare will decline.

The intuition that impacts on worker welfare may be non-monotonic in the minimum wage still holds in settings where firms set one benefits package for multiple types of workers. For workers whose initial preference was for greater cash relative to benefits, welfare will first rise with the minimum wage before falling as compensation shifts excessively away from benefits. Welfare gains and losses will depend on the initial mix of compensation and benefits, as well as on which types of workers are further distorted by firms' responses to the minimum wage. There may be additional implications for firm behavior; for example, minimum wage increases may push firms to alter production technology so that they can produce with a more homogenous workforce. While these issues are outside the scope of our framework, we briefly return to them in this paper's conclusion.

1.4 Empirical Implications

We conclude this section by summarizing the empirical implications of the theoretical considerations developed above. First, the most direct empirical implication of our model is that wage increases generated by minimum wage changes may be partially

[14]There are, naturally, many proposed mechanisms that can generate wage increases for non-minimum wage workers. We discuss these in more detail in section 4.2.

offset by changes in non-cash compensation. We test for this directly in the context of employer provided health insurance. While our theoretical framework does not specify the dynamics or mechanisms through which such changes might take place, we have several in mind. Individual firms may choose to drop coverage, though because such adjustments are costly for firms, they may accrue only gradually (Meer and West, 2016). Over the time period we study, however, implementation of the ACA may have provided opportunities for firms to change benefits arrangements. Firms with large shares of employment in minimum wage jobs may have chosen not to *add* coverage, even while employer coverage expanded as a whole over this time period. Changes in the pool of firms themselves is also likely to be important, as new firms may be less likely to sponsor insurance coverage when faced with higher minimum wages. As in the "putty-clay" model emphasized by Sorkin (2015) and Aaronson, French, Sorkin, and To (2018), newly-entering firms tend to be more flexible than existing firms. In addition, sorting of workers across firms may play a role, especially in these notoriously high-turnover minimum age jobs.

Second, our framework highlights the possibility that both wage and benefit arrangements may exhibit spillovers to individuals whose wage rates are not mechanically bound by changes in the minimum wage. We test for such spillovers by investigating wage and benefits outcomes for individuals in occupations that tend to earn above the minimum wage. The most direct mechanism for such effects in our model involves firm-level shifts towards cash and away from benefits in cases where benefit packages are set in common across workers of multiple skill types.

Finally, we explore the dollar value of these benefit offsets. A one-for-one offset would imply that the reduction in costs associated with benefits payout equal the increase in costs from wage hikes. We hypothesize that offsets will be closer to one-for-one for spillover-driven changes in wage rates and insurance coverage than for the minimum

wage's mechanical effects on wage rates. This reflects two theory-driven factors. First, wage gains that accrue to very low skilled individuals may stem in part from improvements in their bargaining position and thus may not be offset at all. Second, wage changes that occur at the occupation level, which is the focus of our empirical analysis, may stem in part from the employment of modestly higher skilled individuals in place of very low skilled individuals. By contrast, spillover-driven changes in wage rates may be a direct consequence of changes in benefit arrangements, in which case a one-for-one exchange would be predicted in a competitive market setting.

2 Data and Setting

We explore the impact of state-level minimum wage changes on employer-sponsored health insurance and wage rates, as well as heterogeneity in these effects across worker characteristics. We focus on the years 2011-2016, a time period in which we have individual-level data on health insurance coverage and substantial variation in statutory minimum wage policies. In this section, we describe the key data sets and variables, characterize variation in minimum wage laws, and present summary statistics. See appendix A for more detail.

2.1 Key Variables

We use data from the American Community Survey (ACS) to measure employer-sponsored insurance coverage. The ACS is a household-based survey, which began a battery of health insurance questions in 2008. These questions ask whether a respondent has health insurance at the time of the interview and, if so, its source. We focus on the probability that an individual reports having coverage through an employer or union, among the working age population (16-64). The ACS allows us to maintain relatively

large samples, even within state-time-occupation cells. This contrasts with the March supplement to the Current Population Survey (CPS), which has much smaller samples (roughly one-twentieth the size of the ACS), though we explore robustness to this sample as well.

Because individuals vary in the likelihood that their compensation will be directly influenced by a minimum wage hike, we isolate subgroups based on worker characteristics. Previous literature has focused on population groups such as teenagers and adults with low levels of education.[15] Much of our empirical analysis focuses on occupations as a way to categorize workers.[16] We use data from Occupational Employment Statistics (OES) to identify occupations that are more likely to be affected by minimum wage increases. The OES is a large employer-based survey produced by the Bureau of Labor Statistics (BLS). It provides information on wage distributions for narrowly defined occupations at both the national and state levels. Wage rates in the OES incorporate tips and overtime pay, but exclude benefits.

We divide occupations into deciles based on the 10th percentile of their 2006 wage distribution.[17] This wage distribution predates both the variation in minimum wages that we analyze and the Great Recession. Occupations whose lowest earners are at the bottom of this distribution are the most likely to be mechanically impacted by minimum wage increases.

We describe three groups of relatively low wage occupations in table 1. Within the bottom decile, we distinguish between "Very Low" (e.g., food and beverage servers) and "Low" wage (e.g., retail sales) occupations, comprising the bottom and top half of

[15]See, for example, Neumark and Wascher (1992); Card (1992b,a).

[16]Aaronson and Phelan (2017) similarly focus their analysis on occupations to explore the relationship between minimum wage increases and technological substitution.

[17]We use four-digit Standard Occupation Classification (SOC) codes and define deciles using ACS population weights across occupations in our estimation sample.

occupations in the decile, respectively.[18]

We group the remaining deciles into three roughly equally sized groups, namely a "Modest" wage group (deciles 2 through 4), a "Middle" wage group (deciles 5 through 7), and a "High" wage group (deciles 8 through 10). We also present estimates for the disaggregated set of 10 deciles. Modest wage occupations are also listed in table 1. These are recognizable as relatively low-paying jobs as well, but higher paying than the bottom group (e.g., the first-line supervisors of food and beverage serving workers).

We map OES data to ACS data using four-digit SOC occupation codes. In the ACS, these codes correspond to an individual's primary or most recent occupation (if unemployed). We use the full population of experienced workers as our sample, estimating the probability of having employer-sponsored health insurance for those currently or previously employed in a given occupation. This allows for the minimum wage to influence coverage due to both job loss and changes to coverage conditional on employment; we explore both channels. We unfortunately cannot measure changes in employer contributions, conditional on coverage. The latter is likely an important margin of adjustment as well, but difficult to measure accurately in datasets with worker characteristics.

In addition to analyzing low-wage occupations, we analyze samples selected on the basis of age and education. These samples are more comparable to those analyzed in previous minimum wage research, and allow us to relax the restriction that individuals must be connected to an occupation.

A benefit of the occupation-based approach is that it allows us to track the wage response to minimum wage laws using OES data. We explore movement in average hourly wages, as well as 10th and 25th percentiles, by occupation, state, and time period. Although we have explored movement in individual-level wages using CPS and ACS

[18]To make this divide, we simply group half the occupations into each subcategory, so that each subgroup comprises three (four-digit SOC) occupations. The Very Low wage occupations make up one-quarter of weighted ACS observations in the decile, while Low wage occupations make up the rest.

data, we find that the OES more faithfully tracks minimum wage increases among the lowest earning occupations. This is likely in part because the OES is larger and in part because, as an employer-based survey, it measures hourly wages with less noise than household survey data. Since OES annual statistics are based on 3-year moving averages, we include only 2013 and 2016 in our wage estimation sample, so that the moving averages contain no overlap. This comparison works well with the timing of the policy changes we exploit, see below.

2.2 Variation in State Minimum Wages

We focus our attention on state-level minimum wage changes that occur after 2011.[19] As discussed by Clemens and Strain (2017), there was a lull in minimum wage policy making between the Great Recession and 2013. From 2011 through 2013, all minimum wage increases were linked to inflation indexing provisions. Since January 2013, over a dozen states have increased their minimum wages through new legislation. Data from 2011 through 2013 thus provide a base period after which states' minimum wage policies diverged substantially. We link state-level minimum wages in July of a given year to the ACS on an annual basis.[20] In the OES data, we apply the 3-year moving average of the July minimum wage rates in effect over 2011-2013 and 2014-2016 time periods, to align with the OES data structure.

Appendix table 3 summarizes minimum wage changes by state, listing the minimum wage change across the full time period for each state that had a change. We also list the

[19]The sources underlying our minimum wage series include Meer and West (2016), Vaghul and Zipperer (2016) and Clemens and Strain (2017), and are further described in appendix A.

[20]Respondents in the ACS may be surveyed at any time during the calendar year, but the survey date is not available in the public-use files. Since we cannot pinpoint with certainty what the prevailing minimum wage was at the time a respondent was surveyed, we impute with the midpoint of the year. However, we believe this problem is small, since all but a handful of minimum wage changes over this time period were in January of a given year.

number of years in which a change occurred (on a July-to-July basis) and the year of the first change. States with inflation indexing provisions had increases in almost every year in the sample, while those with new legislation tend to have fewer increases beginning later in the sample. Across the states in which minimum wage changes occurred, the average change was roughly $1.35 from July 2011 to July 2016 and $0.87 using 3-year moving averages from 2011-2013 to 2014-2016. Note that while our analysis does not explicitly incorporate sub-state minimum wage changes, we report estimates in which we exclude states in which such changes have been enacted.

2.3 Summary Statistics

Table 2 provides summary statistics separately by the occupation groups described above – Very Low, Low, Modest, Middle, and High wages. ACS data reveal that employer insurance coverage rates are substantial among all occupation groups. Even in the Very Low wage group, 46 percent of respondents had employer provided insurance. This includes coverage obtained through a family member's employer as well as through one's own. When we restrict to households with no adults associated with higher earning occupations, the employer coverage rate is a more modest 37 percent. To the extent that some low wage individuals already obtain coverage through relatives, and are therefore unaffected by the benefits policies of their own employers, our results will be attenuated. Coverage rates rise as one moves up the occupational wage distribution. For example, among the High wage occupations, the average coverage rate was 81 percent.

We also report the total insurance coverage rates by occupation group. Those not covered by employers can purchase private health insurance or receive coverage through public programs such as Medicaid. In Very Low and Low wage occupations, roughly three-quarters of respondents are covered by some form of health insurance. This insur-

ance rate still falls well below that in higher wage occupations, but substantially narrows the gap in employer coverage.

Respondents that can be linked to Very Low and Low wage occupations are also less likely to be currently employed. Recall that the occupation link is based on the current or most recent occupation; while nearly 90 percent of those linked to a High wage occupation are employed at the survey date, the same is true of only 72 percent of those linked to Very Low and Low wage occupations. These workers are also younger and less educated. For example, in Very Low wage occupations, 35 percent of respondents are between 16 and 21 years old and 60 percent have no higher education. In panel B, the OES wage data reveal that the 10th and 25th percentile wage rates for the Very Low wage occupations were between $8 and $9, with the mean wage at $10.21 per hour. Low wage occupations have a similar range of wages but a slightly higher mean.

Table A.1 provides more detail on how the minimum wage increases enacted over this time period compare to prevailing wages. For each occupation group, we first list the average minimum wage change across the 2011-2013 base and 2014-2016 post periods. We restrict the table to states with minimum wage changes over this time period. The average minimum wage increase was roughly $0.85.[21] The remainder of the table reports the average amount by which wages would have needed to rise in order to comply with minimum wage laws. That is, we calculate the gap between wages in the pre-period (2011-2013) and the level of the minimum wage in the post-period (2014-2016). In rows 2-4 of table A.1, we summarize this gap for 10th, 25th, and 50th percentile, respectively, in each occupation group.[22] For most occupation groups and for most parts of the

[21]Statistics are weighted by average employment in the occupation-state from 2011-2016. Average minimum wage changes will vary across occupation groups only because of this weighting – states have different representation across occupation groups. The mean here is somewhat smaller than the full change over our time period, reported above as $1.35. Again, because the OES is a 3-year moving average, variables reflect the means of 2011-2013 and 2014-2016, rather than the full change from 2011 to 2016.

[22]We calculate the gap between the 2014-2016 minimum wage and the 2011-2013 10th, 25th, and 50th percentile wage. For each moment, we define a variable that is the maximum of this gap and zero, and

pay distribution, pre-period wages are already well above the eventual minimum wage. However, for the very bottom of the wage distribution among Very Low and Low wage occupations, this gap is non-trivial.

For example, in Very Low wage occupations, the average 10th percentile wage in the pre-period was $0.44 below the new post-period minimum wage, among states that had minimum wage increases. That is, the bottom decile of Very Low wage occupations needed to rise by about half the average minimum wage increase to be in compliance with the new laws. At the 25th percentile, wages would have needed to rise by $0.20 to keep up with the law change, relative to what workers were earning in 2011-2013. At the median, workers were earning just a few cents below the new minimum wage in the pre-period, so these workers would hardly have been mechanically impacted by the law changes.

Low wage occupations exhibit about half the exposure of Very Low wage occupations at the 10th percentile: their wages should have risen by $0.26 to comply with minimum wage laws. However, they have very little direct exposure higher up in the wage distribution. Other occupation groups are unlikely to experience direct, mechanical impacts of the minimum wage – that is, workers in these occupations were unlikely to have wages below the minimum wage in 2014-2016.

In summary, Very Low and Low wage occupation groups are directly exposed to minimum wage increases, since the lowest earners in these occupations were earning less than the eventual minimum wage in 2014-2016. Individuals in other occupations, as well as the highest paid individuals in Low and Very Low wage occupations, would not tend to experience any mechanical impacts of minimum wage increases. Of course, this does not rule out indirect impacts of the minimum wage on these groups. Note, however that our estimates of effective minimum wage changes are upper bounds since they do not

---

then take the mean across occupation-states for states with non-zero minimum wage increases.

take into account any nominal wage growth that might have otherwise occurred across time periods. Compared to this benchmark, our estimates will, if anything, understate the role played by spillover effects.

3 Methods

We begin with the following regression specification:

$$\begin{aligned} Y_{i,o,s,t} = \beta \text{Minimum Wage Policy}_{s,t} + \mathbf{State_s}\alpha_1 + \mathbf{Time_t}\alpha_2 \\ + \mathbf{Occupation_o}\alpha_3 + \mathbf{X_{s,t}}\gamma + \varepsilon_{i,o,s,t} \end{aligned} \tag{1}$$

where i indexes individuals, o indexes occupations, s indexes states, and t indexes years. The variable Minimum Wage Policy$_{s,t}$ describes variation in state-level minimum wage policies. In our main specification, we use continuous variation in the level of the minimum wage (recall we use the prevailing minimum wage in July of a given year because the ACS does not report the month during which an individual was surveyed). We estimate separate regressions for each occupation wage group.

We explore two key outcome variables: (1) whether individuals report having employer-sponsored health insurance, as measured in ACS data from 2011-2016, and (2) wage rates, obtained from the OES. Specifications using ACS data are estimated on individual-level observations. Specifications using OES data are estimated on occupation-state-year observations, the level at which the OES data are reported.[23] We weight ACS regressions using sample weights and OES regressions by occupation-state-year employment.

[23]We restrict observations to OES estimates in 2013 and 2016 to ensure independent observations across survey years, since OES data report 3-year rolling averages. We apply the 3-year moving average of the July minimum wage rates in effect over the 2011-2013 and 2014-2016 time periods. Time-varying control variables are also constructed as 3-year moving averages across each period.

Our baseline specification includes state, occupation, and time fixed effects (the vectors α_1, α_2, and α_3). The coefficient of interest, β, is therefore a difference-in-differences estimator of the effect of changes in the minimum wage on outcome, Y. This most basic set of fixed effects accounts for national-level time shocks and baseline differences in outcomes across states and occupations. The identifying assumption is that the outcome of interest would have followed similar trends across states if not for differential changes in their minimum wage policy regimes.

If occupation-state pairs trend differently for other reasons, this identifying assumption may not hold. We augment the basic specification with controls that proxy for at least a subset of such potential confounding factors. For instance, we add state-by-occupation and occupation-by-year fixed effects. The former allow for differences in outcomes across state-by-occupation cells. This may be relevant if, for example, retail sales workers in California are more likely to have health insurance than those in Mississippi. The latter allow outcomes to trend differently across occupations on a national basis; this may be relevant if, for example, retail sales workers have become increasingly more likely to receive health insurance. Not controlling for these trends would be problematic if they were also correlated with minimum wage policy.

We further control for a range of other factors ($\mathbf{X_{s,t}}$) that may have shaped employer insurance coverage decisions over this time period. To control for variation across states in the evolution of macroeconomic well-being, such as differences in economic recoveries following the Great Recession, we add controls for state-level employment rates (obtained from the BLS), log income per capita (from the Bureau of Economic Analysis), and a median house price index (from the Federal Housing Finance Agency). These controls are important because both wages and the generosity of benefit arrangements tend to fluctuate with market conditions, and the latter may be correlated with minimum wage policy. Indeed, Clemens and Strain (2017) document that market conditions

improved more strongly over this time period in states that increased their minimum wage rates than in those that did not. Failure to account for the underlying condition of state economies would thus tend to bias our wage estimates towards larger positive values and our insurance estimates towards less negative values.

We also control for multiple factors related to the evolution of insurance markets across states. Over the time period we analyze, the prevalence of employer health insurance coverage grew from 58.6 to 60.3 percent across the working age population, according to the ACS. This varied across states for several reasons. We capture one relevant source of variation by controlling for states' decisions regarding the ACA's Medicaid expansion. These controls are potentially relevant because Medicaid expansions were more common in states that increased minimum wages. Specifically, we include an indicator equalling one if an ACA Medicaid expansion is in effect in the given year, and we include a second indicator that allows this effect to vary after 2013, when the ACA's key coverage provisions were in effect.[24] We also control for state-time variation in market concentration across the providers of insurance to both large and small employers, as changes in insurer market power may affect coverage rates. Because changes in insurance market concentration are only modestly correlated with minimum wage policy, these controls have only modest effects on our results.[25]

To further account for factors that potentially vary across states and over time, we explore a triple-difference framework specified in equation (2).

[24]The key provisions, implemented in January 2014, include generous federal reimbursement for Medicaid expansion-driven coverage, as well as ACA exchange subsidies. Several states enacted Medicaid expansions prior to 2014, but take-up would have likely been lower before these ACA provisions were in effect. We have explored a range of approaches that allow for flexibility in the time path of the Medicaid expansion impact, all yielding similar results. However, any of these controls will absorb some of the main effect of interest, since minimum wage increases were more prevalent both later in our time period and in states that implemented Medicaid expansions. As an alternative approach, we present specifications in which we limit the sample to states that implemented Medicaid expansions.

[25]We take data on the market shares of the three largest insurers in states' large and small group marketplaces from Kaiser: https://www.kff.org/state-category/health-insurance-managed-care/insurance-market-competitiveness/

$$
\begin{aligned}
Y_{o,d(o),s,t} = & \sum_{d(o) \neq High} \beta_{d(o)} \text{Minimum Wage}_{s,t} \times \text{Decile}_{d(o)} + \mathbf{State_s} \times \mathbf{Occupation_o} \alpha_1 \\
& + \mathbf{Time_t} \times \mathbf{Occupation_o} \alpha_2 + \mathbf{Time_t} \times \mathbf{State_s} \alpha_3 \\
& + \mathbf{X_{s,t}} \times \mathbf{Decile_{d(o)}} \gamma + \varepsilon_{o,d(o),s,t}. \qquad (2)
\end{aligned}
$$

In equation (2), we pool all occupation groups in one regression, and estimate interactions between the minimum wage and occupation group dummies ($\beta_{d(o)}$). These regressions also include state-by-year fixed effects. The regressions thus use High wage occupations, the omitted occupation group, as a within-state-time control group. This triple-difference approach is useful if states are in fact trending differently over this time period, but in a similar manner across occupation groups. For example, employer coverage may be rising more quickly in states with larger minimum wage increases due to a dimension of macroeconomic conditions for which our covariates have failed to account. As long as these trends are similar for both high- and low-wage occupations, the triple-difference will control for this effect.

4 Results

This section presents our estimates of the effects of recent minimum wage changes on employer insurance coverage (section 4.1) and wages (section 4.2). We discuss magnitudes and the relationship between the insurance and earnings estimates in section 4.3.

4.1 Employer Insurance Coverage

Figure 3 gives a general sense of the relationship between state-level minimum wage changes and changes in employer coverage. The five panels present this relationship separately for each of the five occupation groups we analyze. The changes are calculated from the "base" period (2011-2013) to the "post" period (2014-2016) – the period in which the statutory minimum wage increases occur. We also plot the (unweighted) best linear fit across states. For the Very Low wage occupations (top left), this line is downward sloping and steep. Washington, DC, and Rhode Island, for example, had large minimum wage increases that were accompanied by large declines in insurance coverage. In contrast, coverage for individuals in Very Low wage occupations increased on average in states with no minimum wage changes. The slope of the relationship between minimum wage changes and insurance coverage becomes successively less steep as we examine higher-skilled occupations. For our High wage occupations, the line is essentially flat. These relationships are consistent with our expectation that effects will be stronger for workers who are closer to earning the minimum wage.

Table 4 presents regression estimates of equation (1). The five panels correspond with the five occupation groups. The specification in column 1 controls for state, year, and occupation fixed effects. Column 2 adds two-way fixed effects at the occupation-by-year and occupation-by-state levels. Columns 3 and 4 add macroeconomic and insurance market controls, respectively.

Minimum wage increases were associated with substantial declines in employer-sponsored insurance across Very Low, Low, and Modest wage occupations. Beginning with Very Low wage occupations in panel A, we estimate that a $1 minimum wage increase reduces the probability of employer provided insurance by 1.4 to 2.3 percentage points. All estimates are significant at the 5% or 1% level. With full controls (column 4), the estimate of -0.0188 (with a standard error of 0.006) implies a nearly 2 percentage

point reduction in coverage, or a 4% decline.

Results for the Low wage group, reported in Panel B, are moderately smaller in magnitude and are statistically significant at the 5% or 1% level across all specifications. With full controls, we find a 1.2 percentage point reduction in coverage for this group, or 2.5%. We find a similarly large effect, reported in Panel C, among individuals in Modest wage occupations. Relative to Very Low wage occupations, effects on both Low and Modest groups are more likely to be driven by spillovers than by mechanical minimum wage effects (see table 3).

Moving to panels D and E, our estimates for Middle and High wage occupations are much smaller in magnitude. They range from -0.003 to -0.009 for Middle wage occupations, and -0.002 to -0.004 for High wage occupations. While a few point estimates are statistically significant, the general impression from these panels is a lack of robust or economically meaningful impacts on these groups. This is particularly true, as we would expect, of estimates associated with High wage occupations.

Figure 4 presents estimates separately for each wage decile, again disaggregating the bottom decile into Very Low and Low. We estimate equation (1) separately for each decile or group, using full controls (column 4). The figure confirms that we lose little information by aggregating occupations into groups, as in table 4. The Very Low and Low wage occupations exhibit a pronounced, negative relationship between minimum wage increases and employer-sponsored coverage. Estimates involving the next several deciles are smaller but non-trivially negative. Estimates involving the top few deciles are all quite close to zero.[26]

We show in appendix table A.2 that results are robust to different ways of specifying minimum wage policy. When using the log minimum wage (panel B), rather than the

[26]The one apparent anomaly in figure 4 is the estimate for the fourth decile, which is substantially more negative than those around it. This effect is driven by a single four-digit occupation group, Motor Vehicle Operators.

level, results are similar in significance and larger in magnitude. We can also categorize states by the type of minimum wage change enacted: changes driven by new statutory legislation over the time period, and inflation indexed changes. These groupings are important to explore since changes due to inflation indexing may be fundamentally different – they are small in magnitude (on the order of $0.15 per year) and anticipated. In panel C, we report coefficients on the interaction of these groupings and an indicator for whether the first minimum wage increase in the state (or any increase thereafter) is in effect. Results look quite consistent with our results using the linear specification: modest coefficients on indexers, and larger coefficients for statutory increasers. In panel D we show that our results are little changed when we exclude the 6 states with sub-state minimum wage changes during our sample period.

In panel E of appendix table A.2 we restrict to states that implemented ACA Medicaid expansions in order to understand the potential relevance of states' Medicaid expansion decisions for our results. Restricting the analysis sample to states that implemented the expansion is a complementary approach to reducing the exposure of our minimum wage analysis to any effects from the expansion. Reassuringly, estimates in the Medicaid expansion sample are similar to the baseline estimates reported in panel A.[27]

We next present results using the triple-difference specification in equation (2). As discussed earlier, this specification allows us to use High wage occupations as a state-time control, in case our previous control sets have accounted insufficiently for factors that influence compensation packages are correlated with minimum wage changes. In table 5, we report coefficients on interactions between the minimum wage and indicators for Very Low, Low, Modest, and Middle wage occupations. For column 1, the specification includes all standard two-way fixed effects: occupation-by-state, occupation-by-

[27]In these specifications we omit the Medicaid expansion controls since, as noted above, they potentially bias our minimum wage estimate. Nonetheless, we are reassured that this set of results is similar if time-varying Medicaid expansion controls are included in the specification.

time, and state-by-time. The reported coefficients give the differential impact of minimum wage increases on insurance outcomes for each occupation group, relative to High wage occupations (the omitted category). Columns 2 and 3 add macroeconomic and ACA controls, respectively. In each case, we interact the control sets with occupation-group indicators, allowing insurance outcomes to be differentially sensitive to economic conditions or ACA variables across occupation groups. For example, coverage in low wage occupations may be more sensitive to business cycle fluctuations.[28]

The results again show that minimum wage increases predict declines in employer-sponsored insurance among individuals in relatively low wage occupations. From column 3 (full controls), a $1 minimum wage increase predicts a 1.6 percentage point decline in employer coverage among individuals in Very Low wage occupations and declines of nearly 1 percentage point in Low and Modest wage occupations. This is roughly what one would predict by simply comparing coefficients across occupation groups from table 4 and differencing out the coefficient for High wage occupations.

Losses in employer insurance may be due to general employment losses associated with the minimum wage or losses in coverage conditional on employment. The latter could manifest because employers choose to stop offering health insurance, or because low-skilled workers become more likely to work for employers that never offered insurance.[29] Table 6 shows that the insurance declines we estimate are primarily associated with the employed. The table reproduces estimates for the adult population with full controls (column 4 of table 4) and compares these to estimates restricted to the sample of currently employed. We focus on the difference-in-differences results, though

[28]Indeed, in our difference-in-differences specifications a given change in macroeconomic conditions tends to predict a larger change in coverage among individuals in the lower paying occupation groups than among individuals in the higher paying groups.

[29]The latter margin connects conceptually to the "putty-clay" dynamics emphasized by Sorkin (2015) and Aaronson, French, Sorkin, and To (2018). The key insight is that some responses to minimum wage changes will occur through the production technology and compensation design choices of new firms, as they are more flexible, rather than through changes in the more rigid operations of continuing firms.

the triple-difference specification looks similar. The point estimates are slightly larger in magnitude for this sub-sample. For example, for Very Low wage occupations, a $1 increase in the state minimum wage is associated with a 2.0 percentage point reduction in the prevalence of employer provided insurance coverage among the employed population, compared to 1.9 percentage points for the whole population of those currently or previously employed in Very Low wage occupations. This is consistent with the fact that we do not see evidence of strong impacts on employment. In appendix table A.3, for example, we show that impacts of the minimum wage on employment, hours, and weeks worked in each of our occupation groups are small in magnitude and statistically insignificant.[30]

Appendix Table A.4 shows that our findings are robust to analyzing alternative subsamples and relaxing one of our primary sample inclusion criteria. The results presented thus far are restricted to respondents that can be linked to an occupation, which eliminates from the sample individuals who have not been employed in the recent past (5 years). We can instead analyze skill-groups selected on the basis of age and education, which avoids this restriction. Many previous analyses of the minimum wage have focused on young workers and adults with low education levels as groups that might be particularly impacted by minimum wage hikes.

Appendix tables A.4 and A.5 explore results based on these subgroups. We find that the relationship between minimum wage increases and employer insurance coverage is particularly large for young adults (age 16-21) and those with less education (high school or less). Controlling for worker demographics, within these categories, has little effect on the results. We also find that, though estimated effects on employment probability are quite small in economic magnitude for most subgroups, they are nontrivial for young adults: we estimate that a $1 minimum wage increase is associated with a 0.8 to 1.0

[30]We do, however, find evidence of reductions in the employment of young adults (see table A.4).

percentage point reduction in employment probability for young adults. Finally, in table A.5, we show that within Very Low wage occupations, coverage declines are strong for highly-educated adults as well as for younger workers. This reflects the substantial exposure of these occupations to minimum wage changes. In contrast, effects for other occupation groups tend to be concentrated in the low-skilled demographic groups.

In summary, we find robust evidence that minimum wage hikes are accompanied by losses in employer-sponsored health insurance. We conclude this subsection by exploring whether individuals offset these coverage declines via other sources. Appendix table A.6 presents results for three additional outcomes: whether the individual has any health insurance, public-sector health insurance, or privately purchased insurance. Here, using our full controls specification, we do not see any evidence of offsets from these other sources. Indeed the minimum wage coefficient on any coverage is similar in sign and magnitude to that for employer coverage, and impacts on public and private insurance are small in magnitude and generally insignificant. Many of the individuals in Very Low and Low wage occupations who lost coverage would be eligible for fairly generous subsidies through the ACA exchanges, but have elected to remain uninsured over the period under analysis.[31]

Finally, we investigate whether the coverage changes we estimate are influenced by the presence of family members who may provide alternative sources of employer-based coverage. In table A.7, we explore a range of sub-samples where we believe individuals are unlikely to have coverage from family members. In particular, we restrict to samples

[31]These results are somewhat sensitive to the inclusion of ACA controls. This is because the minimum wage changes are largely concentrated in Medicaid expansion states, in which a substantial fraction of low wage individuals obtained insurance through Medicaid in the later period. Not controlling for this would result in a positive relationship between the minimum wage and public insurance, and suggest some offset of the losses in employer coverage. However, the fact that our employer coverage results are less sensitive to ACA controls (table 4) suggests that, by and large, those transitioning to Medicaid were in jobs that did not have access to employer coverage. This is consistent with evidence from Duggan, Goda, and Jackson (2017) and Frean, Gruber, and Sommers (2017), who find that the ACA's Medicaid expansions did not substantively crowd out employer provided coverage.

in which there is no spouse, no working spouse, or no higher earning spouse, and to families in which there is no other adult (spouse included), no other working adult, or no higher earning adult. We present the results of this analysis for individuals employed in Very Low (panel A) and Low (panel B) wage occupations in table A.7. On average, the point estimates on sub-samples with a lower likelihood of access to coverage through others in their household are a bit larger in magnitude, especially for Very Low wage workers with no other adults in their household, though the difference is in no case statistically distinguishable from 0. Coverage through other members of low-skilled individuals' households thus appear to play a relatively minor role in the overall coverage changes we estimate.

4.2 Earnings Outcomes

In table 7, we explore the effect of minimum wage changes on wage rates for each of our occupation groups. We present estimates of equation (1) using our controls from column 3 of table 4 specification for three separate dependent variables: the log of the 10th percentile of wage rates, the log of the 25th percentile, and the log of the mean wage rate, in columns 1-3 respectively.

Column 1 of Panel A shows that, for Very Low wage occupations, a $1 minimum wage increase predicts a 0.117 increase in log hourly wages, or a 12% increase, at the 10th percentile for these occupations. Off a base of $8.26 (table 2), this reflects a $0.97 hourly pay increase. From columns 2 and 3 of panel A, we also observe effects up the wage distribution: roughly 8% increases at the 25th percentile and the mean, amounting to $0.65 and $0.82 increases (off bases of $8.62 and $10.21), respectively.

In Panel B, we find estimates that are somewhat smaller in magnitude, though still statistically significant, for Low wage occupations. Here, a $1 minimum wage increase predicts a 9% wage increase at the 10th percentile, or $0.74. Effects amount to nearly

4% at the 25th percentile, or $0.35, and 3% ($0.33) at the mean. Modest wage occupations (panel C) see a similar sized increase at their 10th percentile (3% or $0.33). They also experience effects amounting to about $0.10 at the 25th percentile and the mean, though only the former is (marginally) significant. Finally, for Medium and High wage occupations, effects are small in magnitude.

Figure 5 presents estimates separately for each decile of the distribution of occupations. The figure shows that we lose little information through the use of our more aggregated occupation grouping. For the 10th percentile wage outcome (top left panel), we find effects are positive and significant for the first several deciles and very close to zero for the rest. For the other outcomes (25th percentile and mean wages), effects are only significant in the Very Low and Low wage occupations, and at zero for the other deciles.

Wage effects are thus concentrated in the lowest paying occupations, in line with their proximity to the actual minimum wage changes. That is, in 2011-2013, these groups (Very Low wage and Low wage occupations) are more likely to be earning close to, or below, the eventual minimum wage in 2014-2016. Some of the wage raises experienced by these groups were necessary in order for firms to be in compliance with increases in minimum wage rates. However, the literature also recognizes that minimum wage laws may induce employers to raise wages for groups earning above the minimum wage, but proximate to it. Autor, Manning, and Smith (2016), for example, estimate that minimum wage increases compress 50-10 wage differentials despite not binding on 10th percentile wage rates directly. They are unable, however, to reject the possibility that these spillover effects are due to reporting artifacts. Our approach, using OES wage data, has two key advantages: (1) data are based on large, firm-level surveys; (2) hourly wage rates are likely to be reported with less error in the context of a firm survey than in a household survey.

To what extent do the wage increases we estimate reflect the mechanical effects of minimum wage changes and to what extent do they reflect spillovers? We can use our calculations of the gap between pre-period (2011-2013) wages and the level of the minimum wage in the post period (2014-2016) from table 3 to understand the relative contributions of mechanical effects and spillovers.

For Very Low Wage occupations, the average 10th percentile wage in the pre-period was $0.42 below the new post-period minimum wage, among states that had minimum wage increases, or about half of the actual minimum wage increase. For a $1 minimum wage increase, we might have then expected a $0.50 wage increase at the 10th percentile in pure compliance effects. Instead we find that 10th percentile wages for Very Low wage occupations increased by $0.97. Thus only a little more than half of our estimated wage increase can be accounted for by mechanical raises in compliance with new minimum wage laws.

For other parts of the distribution, the role of non-mechanical explanations is even larger. For example, for the 25th percentile of Very Low wage occupations, a $0.20 wage increase per $1 of minimum wage increase would be required to bring this group up to the prevailing wage in the post period.[32] Instead, we estimate a $0.65 increase.

For the 10th percentile of Low wage occupations, the purely mechanical effect would have amounted to a $0.28 increase per $1 of minimum wage hike. Instead, we observe an effect more than twice that size. Finally, for the 25th percentile of Low wage occupations and for the 10th percentile of Modest wage occupations, the purely mechanical effect would be negligible because wage rates were only a few cents below the eventual minimum wages. Instead, we estimate increases just over $0.30.

The wage increases in table 7 are thus primarily not driven by mechanical effects

[32]From table 3, we estimate that a $0.16 wage increase at the 25th percentile would be necessary, on average, to keep up with the average $0.80 minimum wage increase, or 20% of the full increase.

of the minimum wage. We cannot fully rule out the possibility that wages were, on the whole, growing faster in states that increased their minimum wage rates than in those that did not. However, triple difference estimates, which use the evolution of High wage occupations as a control for state-time variation in wages, are very similar (see appendix table A.8). Given this result and our controls for macroeconomic conditions, our reading of the evidence is that our wage estimates reflect a sizeable role for non-mechanical effects of minimum wage policy on higher wage workers. Note that for these groups, we also find sizeable impacts on insurance coverage, even though their mechanical exposure to minimum wage increases was minimal.

Minimum wage increases may affect compensation at above-minimum wage jobs through several channels. Past work emphasizes channels including firm-worker bargaining and compensation hierarchies (Akerlof and Yellen, 1990; Katz and Krueger, 1992). In the context of our model, spillovers arise when firms set benefits packages collectively for heterogeneous workers. Notably, the mechanism in our model can rationalize both the wage and insurance coverage spillovers we find. An additional potential mechanism is labor-labor substitution, wherein employers re-optimize the skill of their labor force, potentially leading to wage increases within occupation (Hamermesh and Grant, 1979). In concurrent work exploiting the same statutory minimum wage changes, (Clemens, Kahn, and Meer, 2018) we find a shift towards more educated and older workers among both job ads and employed workers for low-paying occupations.

4.3 To What Extent Do Coverage Declines Offset Wage Increases?

We now consider the extent to which declines in health insurance coverage offset the wage increases associated with the minimum wage. This requires an estimate of employer contributions to the cost of insurance coverage. We obtain such estimates from a combination of the March CPS supplements and the Kaiser Family Foundation's

(KFF) Employer Health Benefits Survey. The March CPS supplements contain worker self-reports of employer contributions to their health care plans, accompanied by basic demographic and employment data. In this survey, employer contributions to insurance plans rise moderately across our occupation groups. In Very Low wage occupations, the average employer contribution, conditional on a positive contribution, was $3,800.[33] For Low wage occupations, the estimate is $4,400; Modest wage occupations average $5,400; Medium wage occupations average $5,900; High wage occupations average $6,600 in employer contributions to their health care plans.[34] Though based on self-reports, these numbers are in line with estimates from the KFF surveys.[35]

For Very Low wage occupations, our estimates suggest that a $1 rise in the minimum wage increases mean hourly wages by 8% and reduces the likelihood of having employer provided coverage by 2 percentage points among employed workers (table 7 and 6, using specifications with full controls).[36] In the 2011-2013 ACS data, annual earnings among individuals associated with these occupations was $10,700. The implied effect of the minimum wage changes on annual earnings was thus an average of $860. The decline in employer insurance coverage reduces the cost of this group's compensation by an average of $75 per worker.[37] Therefore, 9% of the wage gains associated with

[33]This estimate includes all employed people age 16-64 in survey years 2012-2017, which cover the previous calendar year.

[34]The March CPS supplements have much smaller sample sizes than the ACS (roughly one-twentieth the number of observations), but contain sufficient information for a parallel analysis of the impact of minimum wage increases on employer coverage. We find qualitatively similar, though noisier estimates given the smaller samples. These estimates can be found in appendix table A.9.

[35]The KFF's 2017 Employer Health Benefits Survey found that employer contributions were just over $4,000 for single coverage and $11,000 for family coverage. These estimates are based on average annual premiums for retail workers ($5,716 for single coverage and $16,920 for family coverage, see figure 1.4) and average worker contribution rates (roughly 26 percent of the single premium and 36 percent of the family premium, see figure 6.26): https://www.kff.org/health-costs/report/2017-employer-health-benefits-survey/.

[36]Since wage estimates are necessarily restricted to employed workers, we focus on the analogous sample for insurance coverage effects.

[37]From above, the average employer contribution for this group was $3,800, which would fall by 2% on

minimum wage hikes were offset by declines in employer provided insurance coverage for individuals in Very Low wage occupations.

For Low wage occupations, we calculate that a $1 minimum wage increase would, on average, generate an annual earnings gain of $377 and a roughly $60 decline in the cost of insurance coverage. The coverage decline thus offsets roughly 16% of the wage gain. For Modest wage occupations, average annual earnings increase by a statistically insignificant $123, while the cost of employer coverage declines by $70.[38] The coverage decline thus offsets roughly 57% of the wage gain.

Substantial heterogeneity likely underlies these estimates of average impacts on wages and health insurance coverage. Most importantly, some individuals retain health insurance while others lose it. The distribution of changes in individual welfare thus depends crucially on two factors. First, it depends on the extent to which wage gains accrued to individuals who lost coverage.[39] On this point, we are unable to ascertain whether the same individuals experienced both coverage declines and large wage gains. A second key factor, as discussed in section 1, involves the extent to which individuals in Very Low and Low wage occupations value insurance. Risk aversion linked to subsistence constraints could make these valuations high, while the availability of substitutable forms of coverage, for example from the ACA, could make these valuations low (Mahoney, 2015; Finkelstein, Hendren, and Luttmer, 2015; Finkelstein, Hendren, and Shepard, 2017).

---

account of those who lose coverage.

[38]These estimates use annual earnings calculations from the ACS in 2011-2013: $13,000 for Low wage occupations and $20,500 for Modest wage occupations.

[39]Note that wage gains going to those who lost coverage is precisely what canonical benefit-incidence theory predicts, as it is the outcome that would most closely maintain the alignment of workers' productivity and compensation (Summers, 1989; Wessels, 1980; McKenzie, 1980).

5 Discussion and Conclusion

This paper explores the relationship between the minimum wage, the structure of employee compensation, and worker welfare. We advance a conceptual framework that highlights the relevance of non-wage job attributes for evaluating worker welfare and for understanding the spillover effects of minimum wage increases.

We find robust evidence that recent state minimum wage increases resulted in declines in employer-sponsored health insurance for minimum wage earners. Our estimates also suggest that insurance and wage effects spill over to those earning above, but not far from, the minimum wage. Previous work has considered the possibility of wage spillovers linked to firm-worker bargaining or resulting from compensation hierarchies (Akerlof and Yellen, 1990; Katz and Krueger, 1992). While these perspectives predict wage spillovers, they do not predict the changes we estimate in non-cash compensation. As noted in section 1, benefit packages set in common for high and low skilled workers can rationalize both the wage and insurance coverage spillovers we estimate.[40]

We conclude by observing that while employer insurance coverage is an important non-wage job attribute, it is but one of many non-wage job attributes. Our findings thus point to the need for an analysis of other job attributes and how they fluctuate with the minimum wage. Margins of interest, some of which have received attention in recent work, include the flexibility of work hours (Mas and Pallais, 2017), implicit effort contracts (Bils, Chang, and Kim, 2014), the pace of work (Obenauer and von der Nienburg, 1915; Hirsch, Kaufman, and Zelenska, 2015), and occupational safety. Standard theory suggests that such margins may have high relevance for worker welfare. Our estimates

[40]Interestingly, the spillover effects in wages go in the opposite direction of an endogeneity concern in which states increase minimum wages when general labor market conditions erode (and this drives any associated employment losses). In that case, we should see wage losses accompanying the insurance losses, when instead we see minimum wage hikes accompanied by wage gains spilling over onto non-minimum wage workers.

can be viewed as a lower bound on the extent to which adjustments of non-wage job attributes shape the welfare affects of minimum wage increases. Examining these other non-pecuniary margins, particularly those that are more difficult to observe in traditional data sources – like workplace amenities – is a fruitful direction for future research.

References

Aaronson, D., E. French, I. Sorkin, and T. To (2018): "Industry Dynamics and the Minimum Wage: A Putty-Clay Approach," *International Economic Review*, 59(1), 51–84.

Aaronson, D., and B. J. Phelan (2017): "Wage Shocks and the Technological Substitution of Low-Wage Jobs," *The Economic Journal*.

Abowd, J. M., F. Kramarz, and D. N. Margolis (1999): "High wage workers and high wage firms," *Econometrica*, 67(2), 251–333.

Acemoglu, D., and J.-S. Pischke (1999): "Minimum wages and on-the-job training," *NBER Working Paper 7184*.

Akerlof, G. A., and J. L. Yellen (1990): "The fair wage-effort hypothesis and unemployment," *The Quarterly Journal of Economics*, 105(2), 255–283.

Autor, D. H., A. Manning, and C. L. Smith (2016): "The contribution of the minimum wage to US wage inequality over three decades: a reassessment," *American Economic Journal: Applied Economics*, 8(1), 58–99.

Bils, M., Y. Chang, and S.-B. Kim (2014): "How Sticky Wages in Existing Jobs Can Affect Hiring," Working Paper 19821, National Bureau of Economic Research.

Bucila, L. (2008): "Employment-Based Health Insurance and the Minimum Wage," Discussion paper, College of the Holy Cross, Department of Economics.

Card, D. (1992a): "Do Minimum Wages Reduce Employment? A Case Study of California, 1987-89," *Industrial and Labor Relations Review*, 46(1), 38–54.

——— (1992b): "Using Regional Variation in Wages to Measure the Effects of the Federal Minimum Wage," *Industrial and Labor Relations Review*, 46(1), 22–37.

Card, D., A. R. Cardoso, J. Heining, and P. Kline (2018): "Firms and labor market inequality: Evidence and some theory," *Journal of Labor Economics*, 36(S1), S13–S70.

Chetty, R., J. N. Friedman, T. Olsen, and L. Pistaferri (2011): "Adjustment costs, firm responses, and micro vs. macro labor supply elasticities: Evidence from Danish tax records," *Quarterly Journal of Economics*, 126(2), 749–804.

Clemens, J., and D. M. Cutler (2014): "Who pays for public employee health costs?," *Journal of health economics*, 38, 65–76.

Clemens, J., L. B. Kahn, and J. Meer (2018): "Impacts of the Minimum Wage on Skill Requirements: Evidence from Vacancy Postings," Discussion paper, Yale University.

Clemens, J., and M. R. Strain (2017): "Estimating the Employment Effects of Recent Minimum Wage Changes: Early Evidence, an Interpretative Framework, and a Pre-Commitment to Future Analysis," *NBER Working Paper 23084*.

Clemens, J., and M. Wither (2014): "The Minimum Wage and the Great Recession: Evidence of Effects on the Employment and Income Trajectories of Low-Skilled Workers," *NBER Working Paper 20724*.

Duggan, M., G. S. Goda, and E. Jackson (2017): "The Effects of the Affordable Care Act on Health Insurance Coverage and Labor Market Outcomes," (23607).

Finkelstein, A., N. Hendren, and E. F. Luttmer (2015): "The Value of Medicaid: Interpreting Results from the Oregon Health Insurance Experiment," Working Paper 21308, National Bureau of Economic Research.

Finkelstein, A., N. Hendren, and M. Shepard (2017): "Subsidizing Health Insurance for Low-Income Adults: Evidence from Massachusetts," Working Paper 23668, National Bureau of Economic Research.

Frean, M., J. Gruber, and B. D. Sommers (2017): "Premium subsidies, the mandate, and Medicaid expansion: Coverage effects of the Affordable Care Act," *Journal of Health Economics*, 53, 72–86.

Gruber, J. (1994): "The incidence of mandated maternity benefits," *The American economic review*, pp. 622–641.

Hamermesh, D. S., and J. Grant (1979): "Econometric Studies of Labor-Labor Substitution and Their Implications for Policy," *Journal of Human Resources*, 14(4), 528–542.

Hashimoto, M. (1982): "Minimum wage effects on training on the job," *American Economic Review*, pp. 1070–1087.

Hirsch, B. T., B. E. Kaufman, and T. Zelenska (2015): "Minimum wage channels of adjustment," *Industrial Relations: A Journal of Economy and Society*, 54(2), 199–239.

Katz, L. F., and A. B. Krueger (1992): "The effect of the minimum wage on the fast-food industry," *ILR Review*, 46(1), 6–21.

Kolstad, J. T., and A. E. Kowalski (2016): "Mandate-based health reform and the labor market: Evidence from the Massachusetts reform," *Journal of health economics*, 47, 81–106.

Lee, D., and E. Saez (2012): "Optimal minimum wage policy in competitive labor markets," *Journal of Public Economics*, 96(9), 739–749.

Lee, D. S. (1999): "Wage inequality in the United States during the 1980s: Rising dispersion or falling minimum wage?," *Quarterly Journal of Economics*, pp. 977–1023.

Mahoney, N. (2015): "Bankruptcy as implicit health insurance," *The American Economic Review*, 105(2), 710–746.

Manning, A. (2011): "Imperfect competition in the labor market," *Handbook of labor economics*, 4, 973–1041.

Marks, M. S. (2011): "Minimum Wages, Employer-Provided Health Insurance, and the Non-discrimination Law," *Industrial Relations: A Journal of Economy and Society*, 50(2), 241–262.

Mas, A., and A. Pallais (2017): "Valuing alternative work arrangements," *American Economic Review*, 107(12), 3722–59.

McKenzie, R. B. (1980): "The Labor Market Effects of Minimum Wage Laws: A New Perspective.," *Journal of Labor Research*, 1(2).

Meer, J., and J. West (2016): "Effects of the Minimum Wage on Employment Dynamics.," *Journal of Human Resources*, 51(2).

Neumark, D., and W. Wascher (1992): "Employment effects of minimum and subminimum wages: panel data on state minimum wage laws," *ILR Review*, 46(1), 55–81.

Obenauer, M. L., and B. M. von der Nienburg (1915): "Effect of Minimum-wage Determinations in Oregon," *Bulletin of the US Bureau of Labor Statistics*, July(176).

Rosen, S. (1972): "Learning and experience in the labor market," *Journal of Human Resources*, pp. 326–342.

Royalty, A. (2001): "Do Minimum Wage Increases Lower the Probability that Low-Skilled Workers Will Receive Fringe Benefits?," Discussion paper, Northwestern University/University of Chicago Joint Center for Poverty Research.

Ruggles, S., K. Genadek, R. Goeken, J. Grover, and M. Sobek (2017): "Integrated Public Use Microdata Series: Version 7.0 [dataset]. Minneapolis: University of Minnesota, 2017," .

Simon, K. I., and R. Kaestner (2004): "Do minimum wages affect non-wage job attributes? Evidence on fringe benefits," *ILR Review*, 58(1), 52–70.

Song, J., D. J. Price, F. Guvenen, N. Bloom, and T. Von Wachter (2015): "Firming up inequality," Discussion paper, National Bureau of Economic Research.

Sorkin, I. (2015): "Are there long-run effects of the minimum wage?," *Review of Economic Dynamics*, 18(2), 306–333.

——— (2017): "Ranking firms using revealed preference," *The Quarterly Journal of Economics*.

Stigler, G. J. (1946): "The economics of minimum wage legislation," *American Economic Review*, pp. 358–365.

Summers, L. H. (1989): "Some simple economics of mandated benefits," *The American Economic Review*, 79(2), 177–183.

Vaghul, K., and B. Zipperer (2016): "Historical state and sub-state minimum wage data," *Washington Center for Equitable Growth. http://equitablegrowth.org/workingpapers/historical-state-and-sub-state-minimum-wage-data*.

Wessels, W. J. (1980): "The effect of minimum wages in the presence of fringe benefits: An expanded model," *Economic Inquiry*, 18(2), 293–313.

Figures and Tables

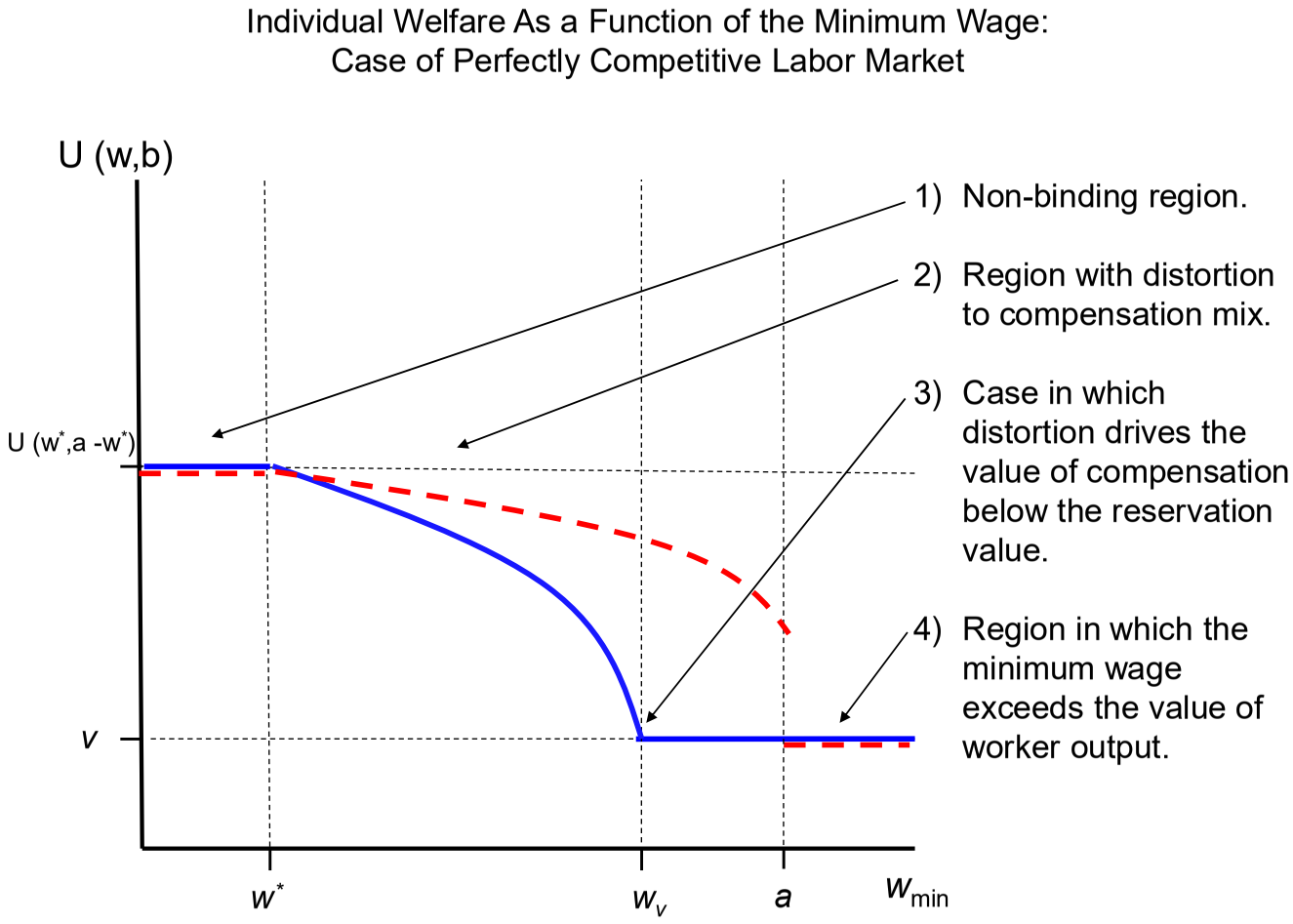

Figure 1: **Individual Utility: Perfect Competition**
The figure depicts an individual's utility as a function of the minimum wage in the case of a perfectly competitive labor market. The individual has productivity of a and receives compensation in the form of benefits b and cash wages a, over which he or she is assumed to have additively separable utility that is increasing and concave in both a and b, $U(w,b) = u(w) + g(b)$ The individual has a reservation utility of v, and thus works so long as $U(w,b) \geq v$. The assumption of a perfectly competitive labor market implies that $w + b = a$. The solid blue line depicts a case in which utility loss from distortion to the compensation package drives the utility from employment below the reservation utility before the minimum wage exceeds the value of the individual's output to the firm. The red dashed line depicts the opposite case.

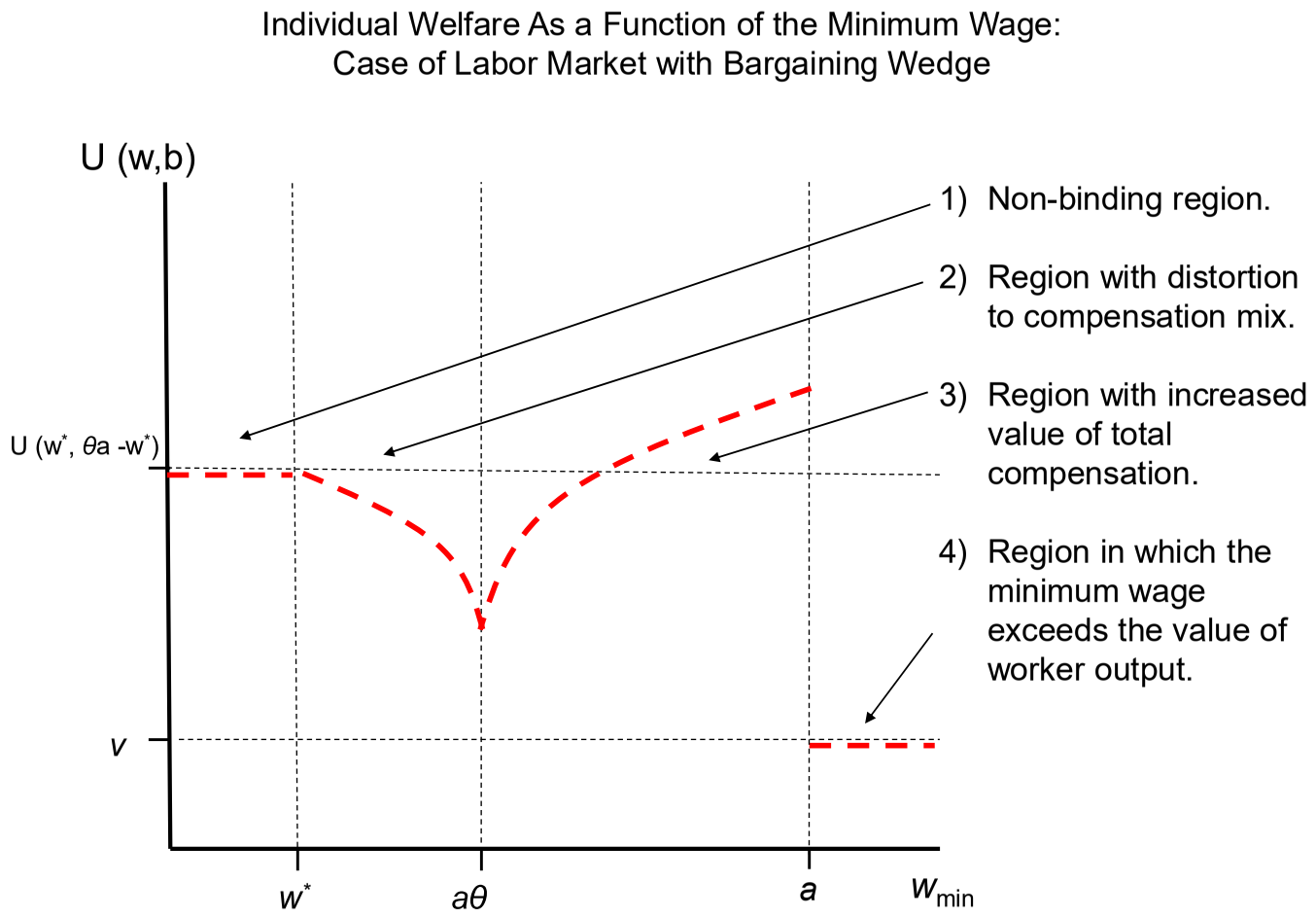

Figure 2: **Individual Utility: Bargaining Wedge**
The figure depicts an individual's utility as a function of the minimum wage in the case of an imperfectly competitive labor market in which a bargaining wedge introduces the possibility that the minimum wage can increase the value of total compensation. The individual has productivity of a and receives compensation in the form of benefits b and cash wages a, over which he or she is assumed to have additively separable utility that is increasing and concave in both a and b, $U(w,b) = u(w) + g(b)$ The individual has a reservation utility of v, and thus works so long as $U(w,b) \geq v$. The bargaining wedge is defined such that, unless the minimum wage is binding on the total cost of the worker's compensation, $w + b = \theta a$. The figure depicts the case in which $u(\theta a) \geq v$, so that distortion to the compensation package does not lead the individual to exit employment. Further, it depicts the case in which there are values of the minimum wage that are less than a and for which $u(w_{min} > u(w^*, \theta a - w^*)$, so that the minimum wage increases the individual's utility relative to the case in which it is fully non-binding.

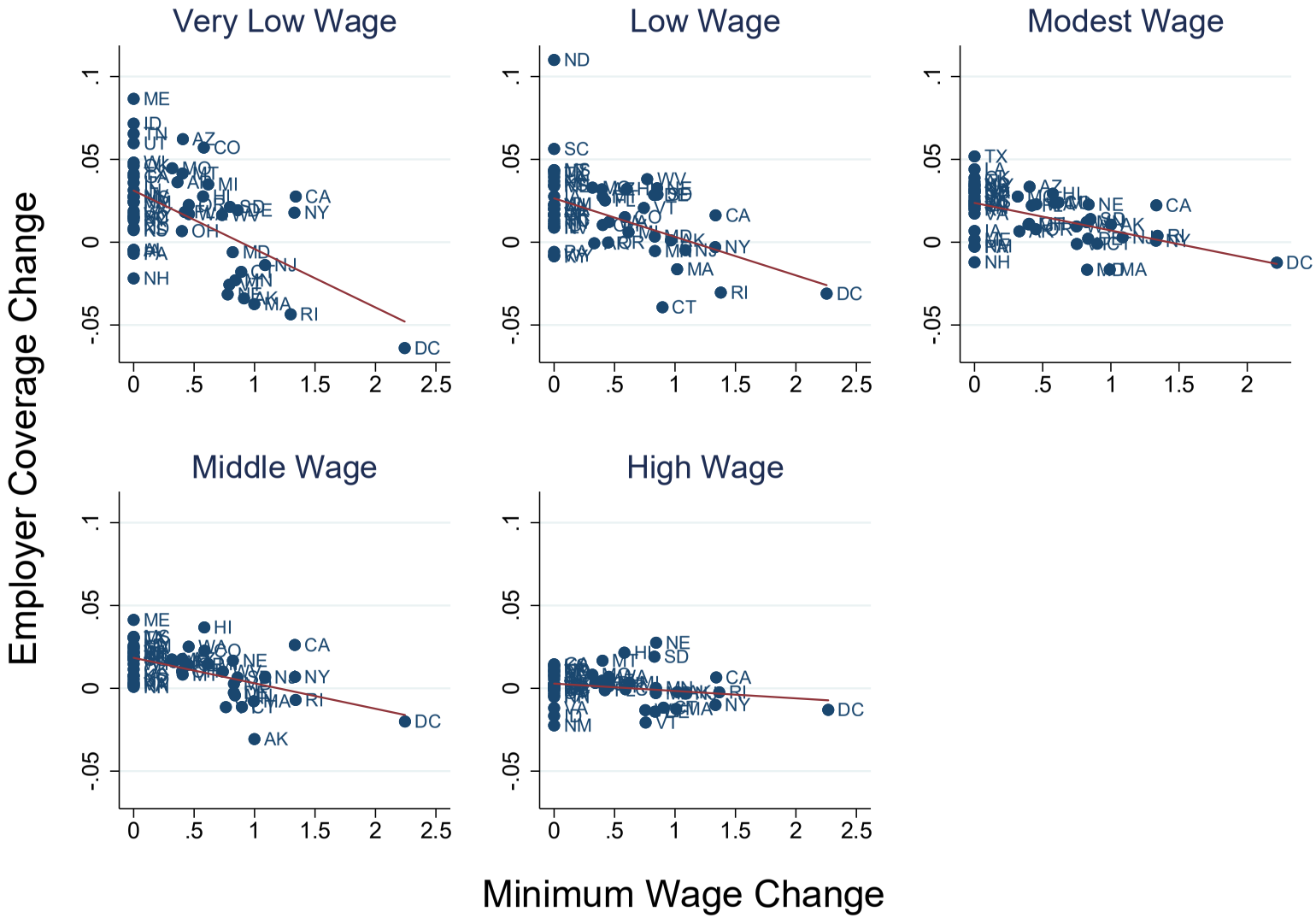

Figure 3: **Minimum Wage Changes and Employer Coverage Changes**

Note: The figure presents scatter plots of the state-level change in employer insurance coverage on the state-level change in the minimum wage, separately by occupation group. Changes refer to the 2014-2016 mean minus the 2011-2013 mean. We group occupations based on their decile of the 10th percentile wage distribution, as measured in the 2006 Occupational Employment Statistics. "Modest", "Medium", and "High" wage occupations correspond to the 2-4, 5-7, and 8-10 deciles, respectively. The bottom decile is split into "Very Low wage" occupations, which represent the bottom quarter of observations in the decile, and "Low wage" occupations, which cover the rest of the decile; see table 1.

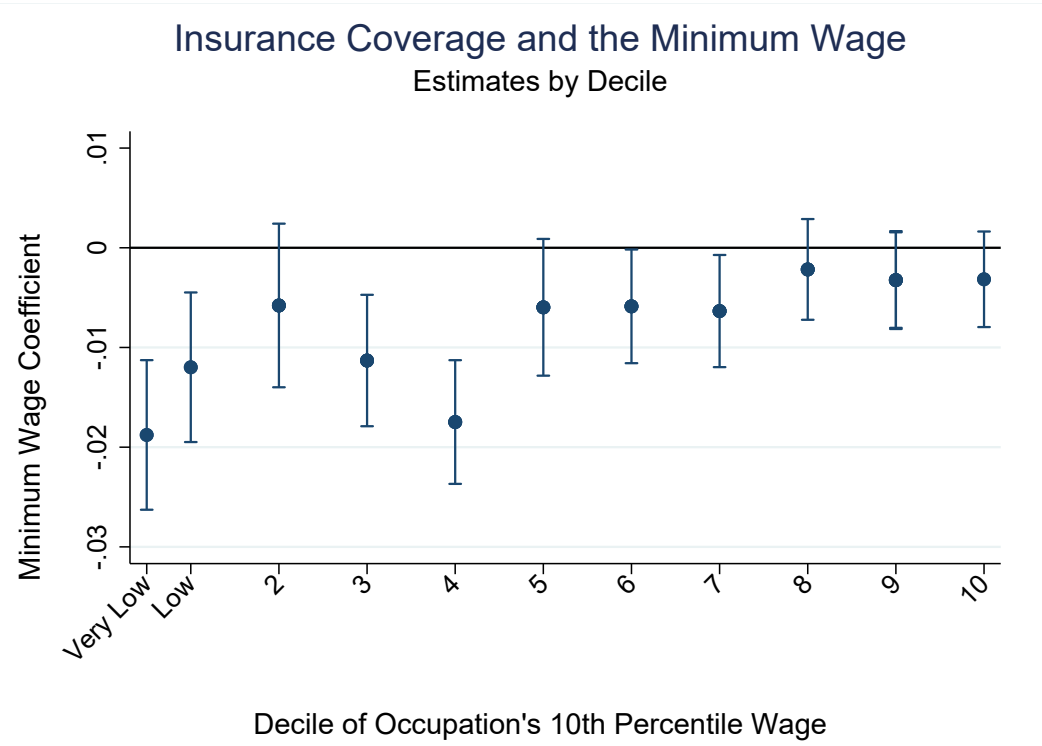

Figure 4: **Insurance Coverage Estimates across Deciles**
Note: The figure reports results of equation (1), estimated separately by decile of the occupation's 10th percentile wage (the bottom decile is split into "Very Low" wage occupations, which represent the bottom quarter of observations in the decile, and "Low" wage occupations, which make up the rest). The dependent variable is an indicator for whether an individual has employer provided insurance coverage, as measured in the American Community Survey from 2011-2016. We regress insurance coverage on the minimum wage in July of each calendar year, as well as full controls (see table 4). We plot the coefficient on the July minimum wage and 95 percent confidence bands.

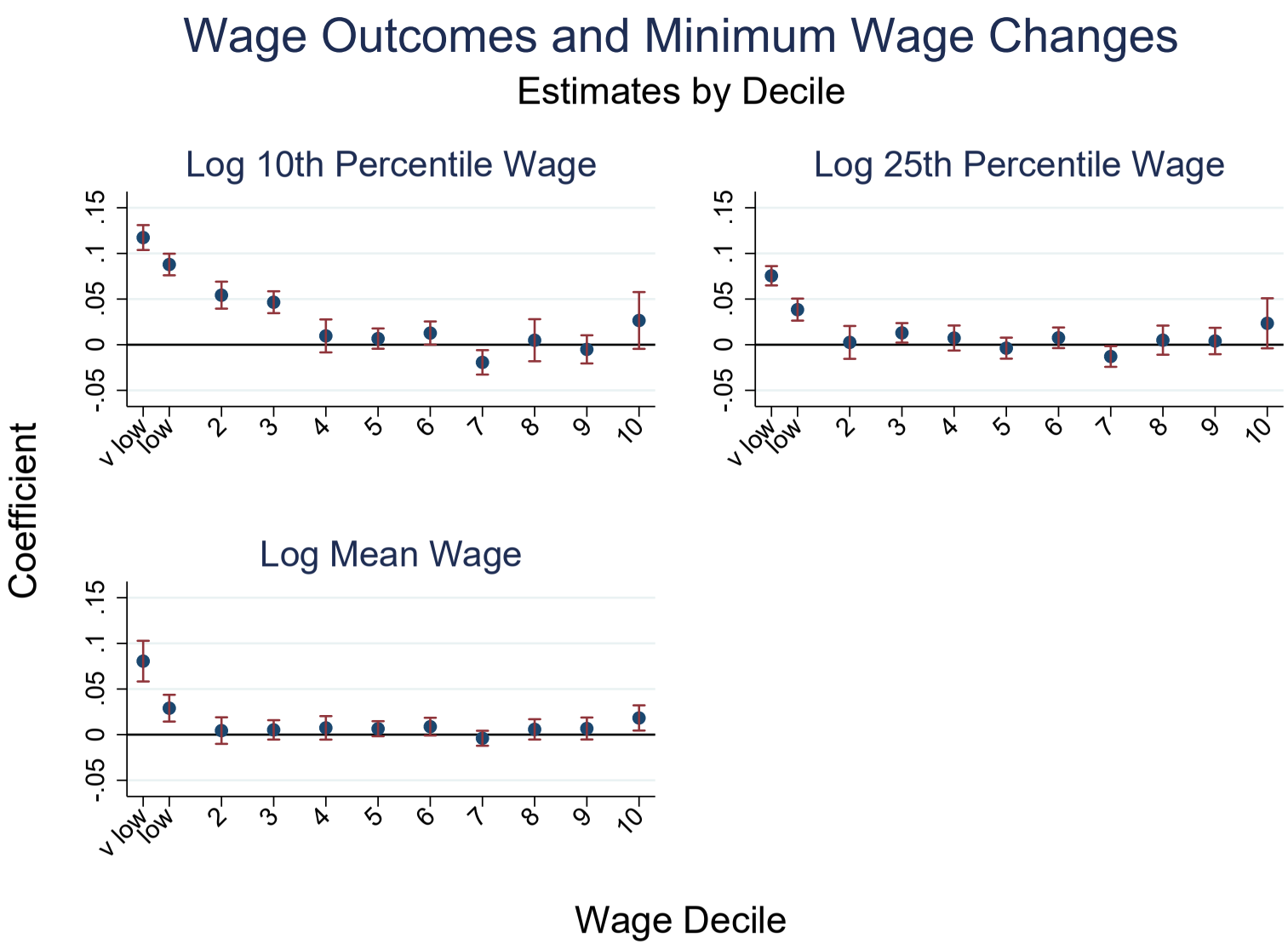

Figure 5: **Wage Outcomes across Deciles**

Note: The figure reports results of equation (1), estimated separately by decile of their 10th percentile wage (the bottom decile is split into "Very Low" wage occupations, which represent the bottom quarter of observations in the decile, and "Low" wage occupations, which make up the rest). The dependent variables are points in the occupation-state-year wage distribution, as measured in Occupational Employment Statistics (OES). Our sample consists of OES estimates in 2013 and 2016. Since the OES reports three-year rolling averages, these years reflect 2011-2013 and 2014-2016, respectively. We regress insurance coverage on the average July minimum wage in the each time period, as well as full controls (see table 7). We plot the coefficient on the minimum wage and 95 percent confidence bands.

Table 1: **Description of Low Wage Occupations**

SOC code	10th Ptile Wage	Occupation Description			
		Panel A: Very Low Wage Occupations			
3530	$5.85	Food and Beverage Serving Workers			
3590	$6.00	Other Food Preparation and Serving Related Workers			
3930	$6.04	Entertainment Attendants and Related Workers			
		Panel B: Low Wage Occupations			
3990	$6.40	Other Personal Care and Service Workers			
3520	$6.41	Cooks and Food Preparation Workers			
4120	$6.57	Retail Sales Workers			
		Panel C: Modest Wage Occupations			
3920	$6.65	Animal Care/Service	3940	$7.61	Funeral Service
3720	$6.66	Building Cleaning/Pest	4390	$7.64	Oth. Office Support
3950	$6.71	Personal Appearance	5191	$7.77	Misc. Production
3970	$6.74	Tour and Travel Guides	4320	$7.81	Comm. Equipment Op.
3960	$6.80	Porters, Bellhops, etc.	4391	$7.91	Oth. Admin. Support
4520	$6.95	Agricultural Workers	4730	$8.00	Helpers, Construction
5160	$7.13	Textile, Apparel, Furn.	5120	$8.00	Assemblers, Fabricators
3390	$7.23	Other Protective Serv.	4351	$8.03	Recordkeeping
5370	$7.35	Material Moving	2720	$8.11	Ent. and Perf., Sports and Rel.
4530	$7.35	Fishing and Hunting	5170	$8.14	Woodworkers
5360	$7.35	Oth. Transportation	4341	$8.38	Record Clerks
3730	$7.35	Grounds Maintenance	3510	$8.50	Supervisors of Food Prep/Serv.
5130	$7.44	Food Processing	2530	$8.52	Other Teach. and Instr.
3110	$7.53	Home Health Aides	4340	$8.69	Information Clerks
2590	$7.59	Other Ed, Train, Lib	5330	$8.71	Motor Vehicle Operators

Note: The table lists the 4-digit SOC occupation code, the 10th percentile wage, as measured in the 2006 Occupational Employment Statistics, and the occupation description. We group occupations based on their decile of the 10th percentile wage distribution, as measured in the 2006 Occupational Employment Statistics. The bottom decile is split into "Very Low wage" occupations, which represent the bottom quarter of observations in the decile, and "Low wage" occupations, which cover the rest of the decile "Modest" wage occupations correspond to the 2-4th deciles. "Medium" and 'High" wage occupations are not shown.

Table 2: **Summary Statistics**

Occupation Group	Very Low	Low	Modest	Middle	High
Panel A: ACS Variables					
Employer Insurance	0.456	0.473	0.550	0.653	0.807
	(0.498)	(0.499)	(0.497)	(0.476)	(0.395)
Any Insurance	0.731	0.750	0.770	0.826	0.933
	(0.443)	(0.433)	(0.421)	(0.379)	(0.250)
Employed	0.723	0.727	0.778	0.832	0.894
	(0.447)	(0.445)	(0.415)	(0.373)	(0.307)
Young adult	0.352	0.263	0.114	0.0546	0.0153
	(0.478)	(0.441)	(0.317)	(0.227)	(0.123)
HS or Less	0.601	0.593	0.610	0.467	0.161
	(0.490)	(0.491)	(0.488)	(0.499)	(0.367)
Minimum Wage	7.770	7.787	7.775	7.762	7.798
	(0.686)	(0.709)	(0.699)	(0.692)	(0.719)
Observations	333,948	967,696	2,516,357	2,966,480	3,014,456
Panel B: OES Variables					
10th Percentile Wage	8.259	8.468	9.640	12.73	22.46
	(0.716)	(0.701)	(1.109)	(2.379)	(6.117)
25th Percentile Wage	8.623	9.117	11.26	15.76	28.94
	(0.646)	(0.723)	(1.662)	(3.201)	(8.666)
Mean Wage	10.21	11.64	15.02	21.32	40.98
	(1.226)	(1.144)	(3.095)	(5.296)	(13.41)
Occ-State-Years	306	306	2937	3785	3332

Note: This table presents means and standard deviations (in parentheses) for our key dependent variables, by occupation group. We group occupations based on their decile of the 10th percentile wage distribution, as measured in the 2006 Occupational Employment Statistics. "Modest", "Medium", and "High" wage occupations correspond to the 2-4, 5-7, and 8-10 deciles, respectively. The bottom decile is split into "Very Low" wage occupations, which represent the bottom quarter of observations in the decile, and "Low wage" occupations, which cover the rest of the decile; see table 1. American Community Survey (ACS) variables are summarizes using sample weights. Minimum Wage refers to the minimum wage in the state as of July in a given year. Occupational Employment Statistics (OES) variables are at the 4-digit occupation-year-state level and summarized using employment weights. Because OES estimates reflect 3-year averages, we restrict OES data to 2013 and 2016 waves.

Table 3: **Effective Minimum Wage Changes, Conditional on Any Change**

Occupation Group	Very Low	Low	Modest	Middle	High
Minimum Wage Change	0.843	0.861	0.869	0.861	0.893
	(0.416)	(0.409)	(0.410)	(0.411)	(0.425)
			Effective Minimum Wage Change		
At 10th Percentile	0.443	0.264	0.0611	0.0000197	0
	(0.406)	(0.325)	(0.176)	(0.00326)	(0)
As Ratio	0.0544	0.0315	0.00706	0.00000231	0
	(0.0494)	(0.0385)	(0.0205)	(0.000385)	(0)
At 25th Percentile	0.204	0.0383	0.00785	0.00000940	0
	(0.287)	(0.0978)	(0.0708)	(0.00215)	(0)
As Ratio	0.0237	0.00419	0.000903	0.00000109	0
	(0.0331)	(0.0107)	(0.00817)	(0.000248)	(0)
At Median	0.0256	0.0000179	0.00194	0.00000288	0
	(0.0708)	(0.000399)	(0.0190)	(0.000657)	(0)
As Ratio	0.00274	0.00000171	0.000212	0.000000320	0
	(0.00744)	(0.0000380)	(0.00207)	(0.0000730)	(0)
Observations	78	78	746	956	845

Note: This table summarizes minimum wage changes from the 2011-13 pre-period to the 2014-16 period, among the 26 states with changes over this time period. Means and standard deviations (in parentheses) are weighted by average employment in the occupation-states that make up the occupation group cell. (See table 2 for detail on occupation groups.) The raw change from the midpoint of each period (July 2012 to July 2015) is summarized in the first row, and differs across occupation groups only because of weighting (i.e., variation in the distribution of high wage jobs across states). "Effective Minimum Wage Change" summarizes the gap between Occupational Employment Statistics (OES) wages in 2011-13 and the 2014-16 average minimum wage for occupation-state pairs. We take an average of this gap, imputing zeros for occupation-states whose wages are already above the eventual minimum. Because OES estimates reflect 3-year averages, we restrict OES data to 2013 and 2016 waves, corresponding to 2011-2013 and 2014-2016 estimates, respectively.

Table 4: **Employer-Sponsored Health Insurance and Minimum Wages**

Dependent Variable	Individual Has Employer Coverage			
	(1)	(2)	(3)	(4)
Panel A:	Very Low Wage Occupations			
Minimum Wage	-0.0145**	-0.0139**	-0.0225***	-0.0188***
	(0.00612)	(0.00620)	(0.00514)	(0.00603)
Observations	333,948	333,948	333,948	333,948
Panel A:	Low Wage Occupations			
Minimum Wage	-0.0129**	-0.0126**	-0.0186***	-0.0120***
	(0.00578)	(0.00596)	(0.00400)	(0.00383)
Observations	967,696	967,696	967,696	967,696
Panel B:	Modest Wage Occupations			
Minimum Wage	-0.0113**	-0.0102*	-0.0163***	-0.0122***
	(0.00557)	(0.00528)	(0.00340)	(0.00275)
Observations	2,516,357	2,516,351	2,516,351	2,516,351
Panel C:	Middle Wage Occupations			
Minimum Wage	-0.00369	-0.00325	-0.00916***	-0.00607**
	(0.00445)	(0.00407)	(0.00211)	(0.00237)
Observations	2,966,480	2,966,475	2,966,475	2,966,475
Panel D:	High Wage Occupations			
Minimum Wage	-0.00193	-0.00191	-0.00444**	-0.00286
	(0.00303)	(0.00290)	(0.00209)	(0.00186)
Observations	3,014,456	3,014,455	3,014,455	3,014,455
Occ, State, and Year FE	Yes	Yes	Yes	Yes
Occ-by-Yr, Occ-by-State FE	No	Yes	Yes	Yes
Macroeconomic Controls	No	No	Yes	Yes
ACA Expansion Controls	No	No	No	Yes

Note: *, **, and *** indicate statistical significance at the 0.10, 0.05, and 0.01 levels respectively. Each panel reports separate regressions (of equation 1) restricted to a given occupation group. The dependent variable is an indicator for whether an individual has employer provided insurance coverage, as measured in the American Community Survey from 2011-2016. We regress insurance coverage on the minimum wage in July of the calendar year, as well as the controls indicated, separately by occupation group (see table 2). Macroeconomic controls are the log of personal income, a housing price index, and the employment rate in the state-year. ACA expansion controls are indicators for whether a medicaid expansion is in effect in the state-year, the expansion indicator interacted with an after 2013 indicator, and the health insurance market concentration for providers to large and small firms. Standard errors are clustered at the state level.

Table 5: **Employer Coverage and Minimum Wages: Triple Difference Estimates**

Dependent Variable	Individual Has Employer Coverage		
	(1)	(2)	(3)
Very Low X Minimum Wage	-0.0120**	-0.0182***	-0.0158**
	(0.00494)	(0.00599)	(0.00642)
Low X Minimum Wage	-0.0111***	-0.0144***	-0.00930***
	(0.00370)	(0.00322)	(0.00337)
Modest X Minimum Wage	-0.00879***	-0.0122***	-0.00966***
	(0.00306)	(0.00273)	(0.00233)
Medium X Minimum Wage	-0.00140	-0.00474*	-0.00331
	(0.00203)	(0.00239)	(0.00282)
Observations	9,798,925	9,798,925	9,798,925
R-squared	0.116	0.116	0.116
Occ-by-Year FE	Yes	Yes	Yes
Occ-by-State FE	Yes	Yes	Yes
State-by-Year FE	Yes	Yes	Yes
Macroeconomic Controls by Occupation Group	No	Yes	Yes
ACA Expansion by Occupation Group	No	No	Yes

Note: *, **, and *** indicate statistical significance at the 0.10, 0.05, and 0.01 levels respectively. The table reports estimates of equation (2) on the full sample of workers with a non-missing occupation from 2011-2016. The dependent variable is an indicator for whether an individual has employer provided insurance coverage, as measured in the American Community Survey from 2011-2016. We regress insurance coverage on the minimum wage in July of each calendar year interacted with occupation group dummies (High wage occupations are the omitted category), as well as the controls indicated. Standard errors are clustered at the state level. See table 4 for a description of occupation groups and control variables.

Table 6: **Employer Coverage and Minimum Wages: Conditional on Employment**

Dependent Variable	Individual Has Employer Coverage	
	(1)	(2)
	All	Employed
Panel A:	Very Low Wage Occupations	
Minimum Wage	-0.0188***	-0.0205***
	(0.00603)	(0.00653)
Observations	333,948	228,891
Panel A:	Low Wage Occupations	
Minimum Wage	-0.0120***	-0.0128***
	(0.00383)	(0.00442)
Observations	967,696	676,224
Panel B:	Modest Wage Occupations	
Minimum Wage	-0.0122***	-0.0128***
	(0.00275)	(0.00327)
Observations	2,516,351	1,903,476
Panel C:	Middle Wage Occupations	
Minimum Wage	-0.00607**	-0.00694***
	(0.00237)	(0.00245)
Observations	2,966,475	2,425,639
Panel D:	High Wage Occupations	
Minimum Wage	-0.00286	-0.00293
	(0.00186)	(0.00185)
Observations	3,014,455	2,672,127
Full Controls from table 4	Yes	Yes

Note: *, **, and *** indicate statistical significance at the 0.10, 0.05, and 0.01 levels respectively. Column 1 replicates the full controls estimate from the estimates from table 4 (column 4). Column 2 restricts to individuals who were employed at the time of the survey.

Table 7: **Wage Outcomes and Minimum Wages Changes**

	(1)	(2)	(3)
Dependent Variable	log(10th pctile)	log(25th pctile)	log(mean)
Panel A:	Very Low Wage Occupations		
Minimum Wage	0.117***	0.0755***	0.0805***
	(0.00696)	(0.00539)	(0.0114)
Observations	306	306	306
Panel B:	Low Wage Occupations		
Minimum Wage	0.0879***	0.0384***	0.0290***
	(0.00604)	(0.00615)	(0.00748)
Observations	306	306	306
Panel C:	Modest Wage Occupations		
Minimum Wage	0.0339***	0.00870*	0.00601
	(0.00543)	(0.00502)	(0.00504)
Observations	2,866	2,866	2,866
Panel D:	Middle Wage Occupations		
Minimum Wage	0.000245	-0.00305	0.00384
	(0.00469)	(0.00397)	(0.00279)
Observations	3,742	3,742	3,742
Panel E:	High Wage Occupations		
Minimum Wage	0.00478	0.00786	0.00842*
	(0.00869)	(0.00723)	(0.00469)
Observations	3,312	3,312	3,312
Full controls from table 4	Yes	Yes	Yes

Note: *, **, and *** indicate statistical significance at the 0.10, 0.05, and 0.01 levels respectively. Each panel reports separate regressions (of equation 1) restricted to a given occupation group. See table 4 for a description of groups and control variables. The dependent variables are points in the occupation-state-year wage distribution as reported in Occupational Employment Statistics (OES) data. Our sample consists of OES estimates in 2013 and 2016. Since the OES reports three-year rolling averages, these years reflect 2011-2013 and 2014-2016, respectively. We regress insurance coverage on the average July minimum wage in each time period; macroeconomic and ACA expansion controls are also three-year averages. Observations are weighted by OES occupation-state-year employment and standard errors are clustered at the state level.

Appendix Material

A Data Appendix

This section briefly summarizes information related to the datasets we analyze.

The full American Community Survey (ACS) sample consists of all individuals ages 16 through 64 surveyed in years 2011-2016, extracted from IPUMS (Ruggles, Genadek, Goeken, Grover, and Sobek, 2017). This otherwise unrestricted sample contains 11,936,824 observations. Our primary estimation sample further restricts to the 9,798,937 individuals (the sum of sample sizes across columns in panel A of table 2) associated with a non-military occupation – individuals are asked to report the occupation on their primary job, or, if not working, their most recent occupation of the last 5 years. This sample thus excludes people with no recent work experience. When we instead explore effects across demographic groups (age and education), we can use the full sample of 11.9 million.

Regression samples typically fall a handful short of the full number of observations due to "singleton observations," meaning cases in which there is a single observation in a given occupation-by-state-by-year cell. In our triple-difference specification, for example, we lose 12 such observations; this yields the reported observation count of 9,798,925.

We merge in occupation wage data from Occupational Employment Statistics at either the four-digit occupation level, or the state-by-occupation level. OES data are extracted from the Bureau of Labor Statistics (https://www.bls.gov/oes/tables.htm). For wage data, we follow the convention of replacing topcoded observations with 1.5 times the top code value. When hourly pay data are not available we use annual earnings divided by 2000. For occupation codes, we need a crosswalk between the 2000 SOC codes used by OES until 2011 to the 2010 system used in recent OES years and in the ACS. We use a BLS crosswalk (https://www.bls.gov/soc/soc_2000_to_2010_crosswalk.xls) for

occupations that match one-to-one; we simply recode occupations that were combined; for occupations that split at the 6-digit level, we apply a stochastic crosswalk based on empirical shares observed in the IPUMS versions of the 2009 ACS (which contains the 2000 SOC) and the 2010-2012 ACS (which contains the 2010 SOC).[41]

At the national level, all 4-digit occupations observed in the ACS can be matched to an occupation in the 2006 OES except 4700 (miscellaneous construction). We impute the 10th percentile wage in this occupation by taking the average of all occupations from 4700 to 4799.

Our data on minimum wage rates is assembled from several sources. First, we extended the monthly minimum wage panel used for the analysis in Meer and West (2016). We then cross-checked the extended series against two additional databases that provide information on monthly minimum wage rates from July 2011 through July 2016, namely the minimum wage data compiled by Vaghul and Zipperer (2016) and the minimum wage data compiled by Clemens and Strain (2017). When discrepancies emerged, we further cross-checked against information provided by state labor departments or through legislative texts.

[41]Occupations that split were randomly assigned to one of the splits based on the empirical distribution of the splits in 2010-2012. Since these splits almost never cross the 4-digit SOC level, which we use in all analyses, measurement error from this stochastic assignment is trivial.

B Appendix Tables and Figures

Table A.1: **States with Minimum Wage Changes 2011-2016**

State	Total Change ($)	# Changes	Year of First Change
Alaska	2.00	2	2015
Arizona	0.70	4	2012
Arkansas	0.75	2	2015
California	2.00	2	2014
Colorado	0.95	5	2012
Connecticut	1.35	3	2014
Delaware	1.00	2	2014
District of Columbia	3.25	3	2014
Florida	0.74	4	2012
Hawaii	1.25	2	2015
Maryland	1.50	2	2015
Massachusetts	2.00	2	2015
Michigan	1.10	2	2015
Minnesota	1.75	2	2015
Missouri	0.40	3	2013
Montana	0.70	4	2012
Nebraska	1.75	2	2015
New Jersey	1.13	2	2014
New York	1.75	3	2014
Ohio	0.70	4	2012
Oregon	0.75	4	2012
Rhode Island	2.20	4	2013
South Dakota	1.30	2	2015
Vermont	1.45	5	2012
Washington	0.80	4	2012
West Virginia	1.50	2	2015

Note: The table summarizes minimum wage changes among states that had any change between 2011 and 2016. The first column lists the total change across the full time period. The second column lists whether the changes in the state are through statutory legislation or because their minimum wage is indexed to inflation. The third column lists the number of years within the time period where the July minimum wage of that year differed from the July minimum wage in the preceding year. The last column provides the year of the first minimum wage change within the time period.

Table A.2: **Employer Coverage and Minimum Wages: Robustness**

Occupation Group	Very Low	Low	Modest	Middle	High
Dependent Variable		Individual Has Employer Coverage			
	(1)	(2)	(3)	(4)	(5)
Panel A:		Level of the Min. Wage			
Minimum Wage	-0.0188***	-0.0120***	-0.0122***	-0.00607**	-0.00286
	(0.00603)	(0.00383)	(0.00275)	(0.00237)	(0.00186)
Observations	333,948	967,696	2,516,351	2,966,475	3,014,455
Panel B:		Log of the Minimum Wage			
Ln(Minimum Wage)	-0.149***	-0.0949***	-0.100***	-0.0473**	-0.0237
	(0.0512)	(0.0308)	(0.0215)	(0.0198)	(0.0151)
Observations	333,948	967,696	2,516,351	2,966,475	3,014,455
Panel C:		Policy Categories			
Statutory*After	-0.0157*	-0.0116**	-0.0115***	-0.00452	-0.00256
	(0.00820)	(0.00481)	(0.00322)	(0.00326)	(0.00211)
Indexer*After	-0.00901	-0.00503	-0.00401	0.00197	0.00138
	(0.00741)	(0.00472)	(0.00285)	(0.00386)	(0.00334)
Observations	333,948	967,696	2,516,351	2,966,475	3,014,455
Panel D:		States with No Sub-State Minimum Wage Changes			
Minimum Wage	-0.0162**	-0.0148***	-0.0136***	-0.00537*	-0.00461**
	(0.00672)	(0.00424)	(0.00313)	(0.00294)	(0.00184)
Observations	269,702	756,169	1,981,172	2,363,587	2,351,408
Panel E:		States That Adopted ACA Medicaid Expansion			
Minimum Wage	-0.0169***	-0.0112**	-0.00951***	-0.00413*	-0.00268
	(0.00588)	(0.00421)	(0.00298)	(0.00226)	(0.00175)
Observations	209,614	610,950	1,577,936	1,836,257	1,903,730
Full Controls	Yes	Yes	Yes	Yes	Yes

Note: *, **, and *** indicate statistical significance at the 0.10, 0.05, and 0.01 levels respectively. See table 4. Panels A replicates the specification from column 4. Panel B uses the log of the minimum wage (instead of the level) as the key explanatory variable. Panel C divides states with minimum wage changes into: (1) those with newly legislated increases and (2) inflation indexers. We report coefficients on the interaction of these groupings and an indicator for whether the first minimum wage increase in our time period is in effect. Panel D reports our preferred specification (the level minimum wage), excluding states with sub-state minimum wage changes during our time period: California, Illinois, Maine, Maryland, New Mexico, and Washington State (according to the University of California Berkeley Center for Labor Research and Education). Panel E excludes states that had not adopted the ACA Medicaid expansion as of 2016. In all panels except E, full controls are those listed in the fourth column of table 4. In Panel E, we omit Medicaid expansion controls (though still include market concentration variables) from the specification since, as noted in the text, they may bias our minimum wage estimate, and all states in this subsample have the expansion in place at some point.

Table A.3: **Effects on Extensive and Intensive Margins of Employment**

	(1)	(2)	(3)	(4)	(5)
Panel A:	Share of Population Employed in Occupation Group:				
	Very Low	Low	Modest	Middle	High
Minimum Wage	0.000155	-0.000143	-0.000373	0.000334	0.000477*
	(0.000131)	(0.000277)	(0.000426)	(0.000443)	(0.000282)
Observations	11,936,812	11,936,812	11,936,812	11,936,812	11,936,812
Panel B:	Usual Weekly Hours, Conditional on Employment in Occupation Group				
Minimum Wage (Jan)	0.00911	0.0419	-0.0916**	-0.0186	-0.0403
	(0.137)	(0.0918)	(0.0423)	(0.0275)	(0.0336)
Observations	228,891	676,224	1,903,476	2,425,639	2,672,127
Occupation	Very Low	Low	Modest	Middle	High
Panel C:	Weeks worked, Conditional on Employment in Occupation Group				
Minimum Wage (Jan)	0.153	0.0859	-0.0325	-0.0170	-0.0224
	(0.115)	(0.0756)	(0.0536)	(0.0306)	(0.0198)
Observations	228,891	676,224	1,903,476	2,425,639	2,672,127
Occupation	Very Low	Low	Modest	Middle	High
Full Controls	Yes	Yes	Yes	Yes	Yes

Note: *, **, and *** indicate statistical significance at the 0.10, 0.05, and 0.01 levels respectively. See table 4. The table reports estimates of equation (1). The dependent variable in panel A is an indicator equalling 1 if the individual is employed in the indicated occupation group and zero otherwise. It is estimated on the full American Community Survey sample (age 16-64). In panels B and C, the samples are restricted to employed individuals in the indicated occupation group. We use the prevailing minimum wage in January (rather than July) of the survey year because the dependent variables refer to work variables in the previous 12 months. Because the dependent variables in this table involve employment, we exclude the aggregate employment rate in the control set, but include all other controls from column 4 of table 4.

Table A.4: **Estimates across Age and Education Groups: Employer Coverage and Employment**

Dependent Variable	Employer Coverage		Employment	
	(1)	(2)	(3)	(4)
Panel A:	Young Adults			
Minimum Wage	-0.0127***	-0.0126***	-0.00844**	-0.0101**
	(0.00359)	(0.00372)	(0.00412)	(0.00415)
Observations	1,519,158	1,519,158	1,519,158	1,519,158
Panel B:	Low Experience, Low Education			
Minimum Wage	-0.0148***	-0.0144***	-0.00381	-0.00347
	(0.00341)	(0.00296)	(0.00312)	(0.00313)
Observations	1,692,654	1,692,654	1,692,654	1,692,654
Panel C:	High Experience, Low Education			
Minimum Wage	-0.00760***	-0.00764***	0.00189	0.00305
	(0.00248)	(0.00247)	(0.00189)	(0.00198)
Observations	2,911,108	2,911,108	2,911,108	2,911,108
Panel D:	Low Experience, High Education			
Minimum Wage	-0.00459*	-0.00421*	0.00126	0.00196
	(0.00250)	(0.00228)	(0.00166)	(0.00167)
Observations	2,463,832	2,463,832	2,463,832	2,463,832
Panel E:	High Experience, High Education			
Minimum Wage	-0.00395*	-0.00362*	0.00170	0.00243
	(0.00204)	(0.00209)	(0.00155)	(0.00153)
Observations	3,350,072	3,350,072	3,350,072	3,350,072
State and Year FE	Yes	Yes	Yes	Yes
Macroeconomic Controls	Yes	Yes	Yes	Yes
ACA Expansion Controls	Yes	Yes	Yes	Yes
Demographic by Yr Controls	No	Yes	No	Yes

Note: *, **, and *** indicate statistical significance at the 0.10, 0.05, and 0.01 levels respectively. Each panel reports separate regressions (of equation 1 restricted to a given demographic group. See table 4. We include all observations in a given demographic group, including those that cannot be linked to an occupation. Groups are exhaustive: Young Adults restrict to age 16-21, Low Experience is age 22-40, High Experience is age 41-64, Low Education is high school or less, High Education is some college or more. The dependent variable in columns 1 and 2 (3 and 4) is an indicator for whether an individual has employer provided insurance coverage (is employed), as measured in the American Community Survey from 2011-2016. Specifications include most of the full controls listed in column 4 of table 4, except fixed effects related to occupation. (We also omit controls for the aggregate employment rate in columns 3 and 4.) Where indicated, we add demographic controls for linear age and years of education, both interacted with year dummies.

Table A.5: **Employer Coverage and Minimum Wages: Estimates across Occupation and Age/Education Groups**

Demographic Group	All	Young Adult	Low Ed Adult	High Ed Adult
	(1)	(2)	(3)	(4)
Panel A:		Very Low Wage Occupations		
Minimum Wage	-0.0188***	-0.0184***	-0.00943	-0.0220**
	(0.00603)	(0.00668)	(0.00825)	(0.0104)
Observations	333,948	126,198	116,692	91,058
Panel B:		Low Wage Occupations		
Minimum Wage	-0.0120***	-0.0184***	-0.0146**	-0.000901
	(0.00383)	(0.00536)	(0.00565)	(0.00391)
Observations	967,696	265,525	398,176	303,995
Panel C:		Modest Wage Occupations		
Minimum Wage	-0.0122***	-0.0160***	-0.0153***	-0.00650*
	(0.00275)	(0.00417)	(0.00304)	(0.00339)
Observations	2,516,351	300,902	1,345,676	869,695
Panel D:		Middle Wage Occupations		
Minimum Wage	-0.00607**	-0.00650	-0.00851***	-0.00431*
	(0.00237)	(0.00668)	(0.00313)	(0.00245)
Observations	2,966,475	159,717	1,291,090	1,515,569
Panel E:		High Wage Occupations		
Minimum Wage	-0.00286	-0.0135	-0.00488	-0.00194
	(0.00186)	(0.00968)	(0.00395)	(0.00212)
Observations	3,014,455	45,711	472,487	2,496,043
Full Controls from Table 4	Yes	Yes	Yes	Yes

Note: *, **, and *** indicate statistical significance at the 0.10, 0.05, and 0.01 levels respectively. Each panel reports separate regressions (of equation 1) restricted to a given occupation (indicated at the panel heading) and age/education group (indicated at the top). Full controls are those included in column 4 of Table 4. Groups in columns 2-4 are mutually exclusive and exhaustive. Young Adults restrict to age 16-21, Low Education is high school or less, High Education is some college or more. See also table A.4.

Table A.6: **Other Sources of Health Insurance and Minimum Wages**

Type of Coverage	Employer	Any	Public	Private
	(1)	(2)	(3)	(4)
Panel A:	Very Low Wage Occupations			
Minimum Wage	-0.0188***	-0.0180**	0.000621	-0.00354
	(0.00603)	(0.00776)	(0.00865)	(0.00331)
Observations	333,948	333,948	333,948	333,948
Panel B:	Low Wage Occupations			
Minimum Wage	-0.0120***	-0.0172**	-0.00499	-0.00281
	(0.00383)	(0.00842)	(0.00757)	(0.00248)
Observations	967,696	967,696	967,696	967,696
Panel C:	Modest Wage Occupations			
Minimum Wage	-0.0122***	-0.0142**	-0.000610	-0.00537**
	(0.00275)	(0.00616)	(0.00527)	(0.00208)
Observations	2,516,351	2,516,351	2,516,351	2,516,351
Panel D:	Middle Wage Occupations			
Minimum Wage	-0.00607**	-0.00813*	-0.000144	-0.00398**
	(0.00237)	(0.00412)	(0.00353)	(0.00168)
Observations	2,966,475	2,966,475	2,966,475	2,966,475
Panel E:	High Wage Occupations			
Minimum Wage	-0.00286	-0.00444**	-0.000674	-0.00227*
	(0.00186)	(0.00215)	(0.00142)	(0.00132)
Observations	3,014,455	3,014,455	3,014,455	3,014,455
Full Controls from Table 4	Yes	Yes	Yes	Yes

Note: *, **, and *** indicate statistical significance at the 0.10, 0.05, and 0.01 levels respectively. See table 4. "Any" is an indicator equaling one if the individual had any health insurance coverage at the time of the interview. "Public" equals one if the individual had insurance coverage through the Medicare, Medicaid, or Veterans Affairs programs. "Private" equals one if the individual had coverage purchased directly from a private insurer by themselves or a family member.

Table A.7: **Employer Coverage and Minimum Wages: Family Relationships**

Dependent Variable	Individual Has Employer Coverage						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Group	All	Spouse Restriction			Other Adult Restriction		
		Any	Working	Higher Earning	Any	Working	Higher Earning
Panel A:	Very Low Wage Occupations						
Minimum Wage	-0.0171***	-0.0156**	-0.0165**	-0.0177***	-0.0213*	-0.0175	-0.0199*
	(0.00557)	(0.00652)	(0.00644)	(0.00658)	(0.0113)	(0.0113)	(0.0110)
Observations	333,948	244,544	262,447	275,681	104,210	142,271	162,961
Panel B:	Low Wage Occupations						
Minimum Wage	-0.0129***	-0.0148***	-0.0155***	-0.0152***	-0.0141***	-0.0134***	-0.0141***
	(0.00331)	(0.00382)	(0.00365)	(0.00376)	(0.00341)	(0.00352)	(0.00338)
Observations	967,696	616,700	690,501	726,382	270,024	403,444	458,204
Full Controls from table 4	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: *, **, and *** indicate statistical significance at the 0.10, 0.05, and 0.01 levels respectively. Column 1 replicates the full controls specification (column 4) from table 4. Columns 2-4 explore restrictions to individuals where there is no spouse present (Any), no working spouse present (Working), and no spouse working in an occupation that earns above the Low Wage occupation group (Higher Earning), respectively. Columns 5-7 explore the same restrictions but for any adult in the family, not just the spouse.

Table A.8: **Wage Outcomes and Minimum Wages: Triple Difference Estimates**

	(1)	(2)	(3)
Dependent Variable	log(10th pctile)	log(25th pctile)	log(mean)
Very Low X Minimum Wage	0.113***	0.0669***	0.0709***
	(0.0103)	(0.0100)	(0.0135)
Low X Minimum Wage	0.0839***	0.0308***	0.0204***
	(0.00984)	(0.00873)	(0.00692)
Modest X Minimum Wage	0.0299***	0.00122	-0.00243
	(0.0101)	(0.00800)	(0.00660)
Medium X Minimum Wage	-0.00418	-0.0109*	-0.00478
	(0.00700)	(0.00605)	(0.00473)
Observations	10,532	10,532	10,532
R-squared	0.997	0.998	0.999
Occ-by-Year FE	Yes	Yes	Yes
Occ-by-State FE	Yes	Yes	Yes
State-by-Year FE	Yes	Yes	Yes
Macroeconomic Controls by Occ Group	Yes	Yes	Yes
ACA Expansion by Occ Group	Yes	Yes	Yes

Note: *, **, and *** indicate statistical significance at the 0.10, 0.05, and 0.01 levels respectively. See tables 5 and 7. The table reports estimates of equation (2). We regress wage outcomes (as measured in the OES) on the minimum wage interacted with occupation group dummies (High wage occupations are the omitted category), as well as the controls indicated.

Table A.9: **Employer Coverage and Minimum Wages: March CPS**

Dependent Variable	Individual Has Employer Coverage			
	(1)	(2)	(3)	(4)
Panel A:	Very Low Wage Occupations			
Minimum Wage	-0.0270	-0.0259	-0.0486***	-0.0412**
	(0.0228)	(0.0227)	(0.0149)	(0.0171)
Observations	14,174	14,174	14,174	14,174
Panel B:	Low Wage Occupations			
Minimum Wage	-0.0213*	-0.0218*	-0.0347***	-0.0263**
	(0.0125)	(0.0130)	(0.0106)	(0.0125)
Observations	41,686	41,686	41,686	41,686
Panel C:	Modest Wage Occupations			
Minimum Wage	-0.00915	-0.00918	-0.0139**	-0.00529
	(0.00769)	(0.00740)	(0.00658)	(0.00605)
Observations	112,483	112,392	112,392	112,392
Panel D:	Middle Wage Occupations			
Minimum Wage	-0.000469	8.50e-05	-0.00965	-0.00865
	(0.0101)	(0.00978)	(0.00708)	(0.00777)
Observations	146,570	146,523	146,523	146,523
Panel E:	High Wage Occupations			
Minimum Wage	-0.00327	-0.00332	-0.00469	-0.00298
	(0.00596)	(0.00595)	(0.00710)	(0.00678)
Observations	164,866	164,861	164,861	164,861
Occ, State and Year FE	Yes	Yes	Yes	Yes
Occ-by-Year, Occ-by-State FE	No	Yes	Yes	Yes
Macroeconomic Controls	No	No	Yes	Yes
ACA Expansion Controls	No	No	No	Yes

Note: *, **, and *** indicate statistical significance at the 0.10, 0.05, and 0.01 levels respectively. Each panel reports separate regressions (of equation 1) restricted to a given occupation group estimated on the Current Population Survey (CPS) March supplement from survey years 2012-2017 (representing coverage in the previous calendar year). See notes to tables 1 and 4 for descriptions of occupation groups and control variables.