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ABSTRACT

A large theoretical literature on job search predicts that a higher minimum wage will increase the number of job seekers for affected jobs, which can lead to more job creation and higher employment. This paper uses novel data on job search in all U.S. states to examine the effect of minimum wage increases on the number of job seekers for low-skilled positions. We find no evidence that higher minimum wages increase job search for low-skilled jobs. Instead, the evidence suggests that higher minimum wages decrease the number of workers seeking employment.

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1 Introduction

Analyses of the effects of minimum wages in job search models have focused on job search by the unemployed, which is predicted to increase in response to a higher minimum wage. The job search response among the unemployed could lead to higher employment, because it could lead firms to open up more job vacancies and fill more jobs (e.g., Flinn, 2006; Manning, 2021). However, Faberman et al. (2022) show that job search while on the job is widespread and constitutes a large majority of search activity for low-skilled occupations. When on-the-job search is considered, the effect of minimum wage increases on overall job search may differ, possibly declining – in which case a higher minimum wage would not be expected to increase employment. Thus, understanding how minimum wages impact job search is informative about the potential for higher minimum wages to generate positive employment effects, or for job search models to rationalize the absence of evidence of non-negative employment effects of the minimum wage.

We use novel data from one of the three largest job search platforms in the United States covering January 2021 to September 2023 to estimate the effect of unscheduled minimum wage increases on the number of job seekers for low-skilled occupations.[1] While the existing empirical literature on search behavior predominantly relies on self-reported survey data (the Current Population Survey (CPS) or the American Time Use Survey (ATUS)), our data is unique in that we directly observe job seekers' behavior on the platform via tracking user interactions. By directly observing search behavior, we hope to provide a more accurate view of search responses than previously available data. In particular, we study two unscheduled minimum wage increases – in Nebraska and Hawaii – using a difference-in-differences strategy that compares changes in job search in the treated states to changes in other states whose minimum wages did not change. Across all specifications and empirical scenarios we find no evidence that higher minimum wages increase job search. Instead, our results suggest that minimum wage increases are associated with substantial decreases in the number of job seekers for low-skilled occupations.

[1] By "unscheduled," we mean the increase was not a subsequent step legislated earlier, or an indexed increase.

The neoclassical theory of labor demand predicts that a higher minimum wage will reduce employment of the least-skilled workers. There is a great deal of evidence consistent with this prediction, but there are also some estimates in the research literature that point to negligible or even positive effects on low-skill employment (Neumark and Shirley, 2022). Some researchers interpret the overall body of evidence, then, as inconsistent with the neoclassical model. They argue, instead, that frictions in labor markets give rise to a monopsony-type result where a higher minimum wage can increase low-skilled employment (e.g., Manning 2005, 2020; Schmitt 2015; Wiltshire et al. 2024). Studies that cite monopsony-like explanations of positive or non-negative minimum wage effects include, for example, Card and Krueger (1994), Derenoncourt and Montialoux (2021), Dube (2019), and Giuliano (2013).

In the presence of labor market search frictions, "not all workers who want a job manage to get one, and not all employers who want to hire a worker manage to find one" (Manning, 2021, p. 21). Under such conditions, both unemployment and job vacancies can exist in equilibrium. A higher minimum wage reduces labor demand, ceteris paribus, but it can also increase labor supply – i.e., the number of job seekers. Under certain conditions, the increased number of workers searching for jobs might induce firms to post more job vacancies if they believe there is an increased probability of filling them with productive workers, and the net effect may be to increase low-skilled employment, in contrast with the neoclassical model.[2] Search models in this framework are often referred to as models of "dynamic monopsony."

There are also other models that can create upward-sloping labor supply curves to the firm, and hence generate monopsony-like responses that can lead to a higher minimum wage increasing employment. Rebitzer and Taylor (1995) generate this response in an efficiency wage model. In their model, firms have two ways to create incentives for workers: they can monitor carefully and fire a worker if they "shirk," or they can monitor less, lowering the probability of detection of shirking, but pay an above-market wage so that the value of the job, relative to another job or being unemployed, creates incentives not to shirk. Suppose there is only one manager monitoring workers. If the firm expands employment, the manager's ability to monitor each individual worker declines, and the firm may thus raise the wage to deter shirking. This

[2] A more formal treatment is provided in, e.g., Flinn (2006). For an accessible discussion of search-and-matching models, see Daly et al. (2012).

creates the same phenomenon as in the classical monopsony model – that the marginal cost of labor curve is steeper than the labor supply curve – in which case an aptly chosen minimum wage can increase employment (Stigler, 1946).

Another explanation of monopsony-type effects is unique to the "table-service" part of the restaurant industry, where part of workers' compensation comes as tips (Wessels, 1997). If a restaurant adds a waiter, then on the margin (i.e., with no other changes) the tips earned per waiter decrease. In order to maintain the elevated level of employment the restaurant would need to pay a higher wage to all tipped workers, again implying that a higher minimum wage can increase employment. A third explanation is static, explaining employer labor market power as resulting from workers' idiosyncratic tastes for different combinations of job amenities that are offered by small numbers of firms, and which are not fully priced into wages (Manning 2020).

Each of these alternative models may apply in some contexts. However, we believe it is fair to say that a model of search and matching is the canonical model that economists rely on to generate the behavioral prediction that a higher minimum wage may increase employment and to rationalize findings of non-negative employment effects. For example, in recent work Hurst et al. (2022) use a search and matching model to analyze the distributional and long- and short-run effects of the minimum wage. Wiltshire et al. (2024) similarly emphasize search and matching frictions in their recent study of the fast-food industry. And there are scores of other papers that use search and matching models to analyze minimum wage effects. The core implication of these models is that higher minimum wages, under certain conditions, can induce more search, leading to more vacancies posted and/or filled, and therefore potentially higher employment.

However, despite the many papers using search and matching models, there is very little direct evidence that higher minimum wages increase search for low-skilled jobs. Some research provides indirect evidence, such as whether individual labor force participation responds positively to a higher minimum wage. Boffy-Ramirez (2019) finds that labor force participation decreases in response to a higher minimum wage, which could imply reduced search. Dube et al. (2016) report evidence that a higher minimum wage reduces both separations and ac-

cessions among affected workers. They argue that this is consistent with a model with search frictions – in particular a job ladder model where higher minimum wages reduce the arrival rate of better-paying jobs. Wursten and Reich (2023) present evidence that higher minimum wages increase commuting via automobile by Black workers, which they interpret as reflecting a wider job search radius. We do not regard any of this evidence as establishing decisively whether aggregate job search increases in response to higher minimum wages.

We have identified two papers that provide more direct evidence on time spent searching for jobs – on both the intensive and extensive margins. Piqueras (2023) uses combined data from the CPS and the ATUS and reports that higher minimum wages increase intensive search effort (time spent searching). However, he finds that individuals who increased search effort did not find jobs faster. Through the lens of a search model, he interprets this as reflecting a corresponding reduction in labor market tightness. Adams et al. (2022) also use ATUS data. They find no impact of higher minimum wages on the likelihood of searching and only short-term spikes in search effort by those already looking for work.

These last two papers provide perhaps a little support to the idea that increased job search because of a minimum wage increase could, in principle, lead to rising employment. However, Piqueras fails to find an employment effect, and Adams et al.'s results do not provide evidence of the sustained increase in search that would seem necessary to motivate firms to create additional jobs. Moreover, neither paper directly measures changes in job applications. Also, time-use data cannot distinguish whether more time spent searching reflects job seekers applying to more jobs in an expanded set of job postings, or additional search due to increased difficulty in obtaining a job offer (because the minimum wage reduces the number of jobs posted). In search models, the first effect could indicate that minimum wage increases lead to more job seekers that could induce firms to post more vacancies and hire more workers, whereas the latter effect could simply reflect neoclassical labor demand effects.

In this paper, we use new data to study directly whether higher minimum wages increase job applications for low-skilled jobs. Our job application data come from a large online job search platform for narrow categories of low-skilled jobs, at the state-by-month level. The responses

we can measure with these data correspond more closely changes in search behavior that could – depending on the actual responses – lead firms to post more vacancies and potentially increase employment.

In our core results, we find that the 18.8% increase in the minimum wage in Hawaii caused an estimated 11% decline in job search for retail/cleaning occupations and an estimated 13.2% decline for food-related occupations during the following 17 months.[3] Similarly, we find that the 16.7% increase in the minimum wage in Nebraska caused an estimated 9.4% decline in job search for retail/cleaning occupations and an estimated 8.7% decline for food-related occupations during the following 11 months. These qualitative conclusions are robust to numerous alternative analyses, including those response to recent critiques of standard two-way fixed effects specifications.

These findings challenge a core building block of the analysis of minimum wage employment effects in search-and-matching models – that higher minimum wages induce more job search. We suggest that the contradictory evidence may be attributable to much more search coming from on-the-job workers (consistent with Faberman et al. (2022)), who may be more likely to stay in their current jobs and reduce search when the minimum wage increases.

2 Conceptual Framework

The effects of minimum wages in search models depend on the endogenous search responses of job seekers (Acemoglu, 2001). Traditionally, search-and-matching models have focused on job search among jobless workers and suggested that a higher minimum wage would increase the number of unemployed workers looking for jobs. Leading examples of such models include Flinn (2006) and Manning (2005, Chapter 12). By increasing labor supply in a labor market equilibrium assumed to have unmatched job seekers and job vacancies, increases and improvements in job matches may mitigate or even offset the negative employment effects of the minimum wage. This theoretical argument is the basis for search-related explanations of

[3]Retail and cleaning occupations include cashier, retail salespersons, janitor, cleaner, and receptionist job listings. Food-related occupations include crew member, cook, dishwasher, and host job listings.

the empirical findings from the minimum wage employment literature that sometimes point to no effect or even positive effects of minimum wages on employment (the employment effects do not always have to be non-negative in the search-and-matching framework).

In our view, however, theoretical considerations as well as new evidence suggest that we need to think more broadly about the channels through which a minimum wage increase could elicit changes in the total number of job seekers, considering two groups of potential job seekers for jobs whose wages are affected by the minimum wage:

1. *Jobless individuals* - The dominant focus of models of the minimum wage and job search has been on job seekers who are currently jobless (e.g., Gavrel et al. (2010), Gorry (2013), Lavecchia (2020)). A higher minimum wage incentivizes jobless individuals to search for a job if the new wage floor surpasses their reservation wage. Even if a higher minimum wage reduces the arrival rate of job offers, the expected value of search may still increase the overall labor supply to minimum wage jobs (see the canonical treatment in Flinn (2006) and Mincer (1976)).
2. *Those employed in minimum wage jobs* - In contrast to the focus on unemployed search, Faberman et al. (2022) show that most job search comes from employed individuals, and that search effort from the employed is also more elastic. Thus, the net effect of minimum wage changes on the overall number of job seekers will likely depend on its effect on this largest and most responsive group of potential job seekers.

In particular, the model in Liu (2022) suggests that job search from low-wage workers will decline following a minimum wage increase. This result comes from two channels that are modeled as occupational mobility but carry over to search more generally (Liu, 2022). The first is a "wage compression" channel: minimum wage increases reduce wage dispersion, decreasing the benefit from switching jobs, thereby reducing the number of job transitions.[4] The second is via employment effects: Minimum wage increases reduce job postings and the reduction in the likelihood of job accession reduces the incentive for individuals to engage in job search. However, in many search models, as discussed above, postings can increase in response to a higher minimum wage.

[4] Although not relevant to our inquiry, this effect also leads to greater occupational mismatch.

Thus, there is an additional theoretical reason – via wage compression – that workers in minimum wage jobs will reduce job search in response to a minimum wage increase. Given the evidence from Faberman et al. (2022) that most low-skilled job search comes from already-employed individuals, the overall effect of a minimum wage increase may be more likely to decrease rather increase search. The overall effect depends on the sizes of the two groups of potential job seekers, and the magnitudes (and directions) of their responses to higher minimum wages.[5] These considerations imply that, ultimately, the impact of a higher minimum wage on job search is an empirical question – one that the novel data in this paper is uniquely situated to answer.

3 Data

3.1 Data from Online Job Search Platform

Our primary data source is one of the three largest job search platforms in the United States. We obtained monthly data at the state level on the number of job seekers accessing individual job postings from January 2021 through September 2023. On this platform, job postings are sorted into occupational groups based on the job search platform's algorithm. This should ensure similarity across states. We target occupations likely to be affected by the minimum wage, paralleling the existing literature on minimum wages and employment.

In particular, we focus on occupations with a low hourly wage to make it more likely that minimum wages would affect wages in those jobs. We identified the occupations with mean hourly wages below $18 per hour using the May, 2023, National Occupational Employment and Wage Estimates (U.S. Bureau of Labor Statistics, 2023a). Table A.1 in the Appendix shows the occupations with lowest mean hourly wage.

[5] In addition to jobless individuals and those employed in minimum wage jobs, a third group of labor market participants comprises those employed in non-minimum wage jobs. While our data cannot distinguish between these worker types, the literature acknowledges their relevance. For example, Phelan (2019) demonstrates that minimum wage increases can alter the composition of compensation by changing the mix of wages and amenities, potentially making certain lower-wage jobs more attractive to workers previously employed in jobs paying somewhat above the minimum wage.

We collected data on job seekers for job titles that match with low-wage occupations and that have at least 10,000 monthly job seekers nationwide in the platform. Based on the job categories listed separately on this platform, we obtained job search data for the following job titles: cashier, retail salespersons, janitor, cleaner, receptionist, crew member,[6] cook, dishwasher, and host. To avoid unnecessary specificity, our primary analysis aggregates these occupations into either retail/cleaning or food-related occupational categories, as follows:

- Retail and Cleaning Occupations: cashier, retail salespersons, janitor, cleaner, receptionist
- Food-related Occupations: crew member, cook, dishwasher, host

Table A.2 shows the comparison of the job titles and the occupations (and wages) associated with them.

For any given state-month observation, our data provide a measure of search activity on the extensive margin, indicated by the number of unique job seekers for job listings in the given occupational category. The number of job seekers is measured by counting the unique platform users – identified via tracking cookies – who clicked on a job posting's thumbnail. Clicking provides additional information about the job, which we use as evidence of individual-level job search activity for that particular job. The tracking cookies ensure that in the data we do not double-count a platform user who clicks on multiple job postings with the same title; within each job title, each unique job seeker is only counted once. However, our aggregation of job titles within occupational classes may lead to limited multiple-counting of the same unique user if, for example, that person clicked on job postings with the crew member, cook, and dishwasher job titles within the same month. We anticipate any such effect would be relatively constant across space and time and should not impact our estimated effects of minimum wages.

Our data cover January 2021 through September 2023. The start date chosen avoids using data from the first year of the Covid-19 pandemic, and coincides with the beginning of the labor market recovery from the pandemic. The seasonally-adjusted U.S. labor force participation rate of 61.3% in January 2021 was the lowest value of the pandemic, apart from the immediate

[6]Crew-members typically refer to individuals employed in entry-level positions within the food service industry. Their responsibilities often include customer service, basic operational tasks, and maintenance duties. 9 out of the 10 top employers in the United States hiring workers with this job title were fast-food restaurants.

crash and rebound experienced in April 2020. Starting from January 2021, the U.S. labor force participation rate increased at a generally steady rate until September 2023, when it peaked at 62.8% (U.S. Bureau of Labor Statistics, 2023b).

3.2 Minimum Wages, Background and Treatment Timing

During the analysis period, Hawaii and Nebraska were the two states with newly-legislated minimum wage increases that also had sufficient pre-treatment data for analysis. We regard these as "unscheduled" minimum wage increases. In contrast, we define "scheduled" minimum wage changes to include both increase that had been previously established by specific legislative or ballot initiative language, typically mandating a multi-year set of increases, as well as changes – typically much smaller – that result from indexing the minimum wage level.[7]

Hawaii's minimum wage increase was the result of state legislation, HB2510, which made the state the first to legislate a minimum wage of $18 per hour (slated to reach this level in 2028) (Pepper, 2022). The last previous minimum wage increase from $9.25 to $10.10 per hour had occurred on January 1, 2018 (that increase was the last of several steps that had been legislated in 2014).[8] HB2510 was introduced on January 26, 2022, passed the House on March 8, passed the Senate in substantially different form on April 12, passed out of conference committee on April 29, and passed full votes of each chamber in early May (Hawai'i State Legislature, 2022). Hawaii's governor had already indicated his support and signed the legislation into law on June 22. The new minimum wage of $12.00 per hour (an increase of 18.8%) became effective on October 1, 2022.

[7]For discussion of and evidence on indexed minimum wages, see Clemens and Strain (2018). Virginia passed legislation to increase their minimum wage in February 2020. We do not include Virginia in our analysis since we would not have pre-treatment data.

[8]At the time of HB2510's passage, Hawaii had already mostly eliminated the tipped credit. The minimum wage for workers receiving gratuities rose from $9.35 per hour to $11.00 per hour on October 1, 2022. HB2510 also scheduled subsequent increases for the non-tipped minimum wage of $14 per hour on January 1, 2024, $16 per hour on January 1, 2026, and $18 per hour on January 1, 2028. It scheduled increases for the tipped minimum wage of $12.75 per hour on January 1, 2024, $14.75 per hour on January 1, 2026, and $16.50 per hour on January 1, 2028 (Hawai'i State Legislature, 2014).

This timeline suggests that workers had several months' advance notice that minimum wages might rise. Relative to the previous legislative actions, the conference committee vote attracted the most media attention[9] and likely served as the clearest signal of the coming minimum wage increase. Because expectations of a change in minimum wages in the near future could affect job search in the present (Karabarbounis et al., 2022; Jha et al., 2024), we use May as the treatment month for Hawaii.

Nebraska's minimum wage increase was the result of a ballot initiative (Nebraska Initiative 433, 2022) that passed on November 8, 2022, with 386,756 votes (58.66% of the total) (Ballotpedia, 2022). Initiative 433 was filed on August 20, 2021, and initiative organizers claimed to submit 152,000 signatures on July 7, 2022 (Ballotpedia, 2022). On September 6, 2022, the Nebraska secretary of state reported the campaign had submitted 97,245 valid signatures (out of 86,776 needed) and was eligible for the November ballot (Ballotpedia, 2022). Since there was no way for workers to know for sure that the ballot initiative would pass before November, we use November 2022 as the treatment month for Nebraska.[10]

Initiative 433 raised Nebraska's minimum wage 16.7%, from $9.00 per hour to $10.50 per hour, on January 1, 2023.[11] The last previous minimum wage increase was from $8.00 per hour to $9.00 per hour on January 1, 2016, resulting from the November 4, 2014 passage of another ballot initiative – Initiative 425, which passed with 59.47% of the vote (Ballotpedia, 2014).

3.3 Selection of Control States

Our primary analysis involves a difference-in-differences strategy that compares the changes in low-wage job search in Hawaii and Nebraska to a group of control states that have not experienced a nominal minimum wage change since the last federal minimum wage increase

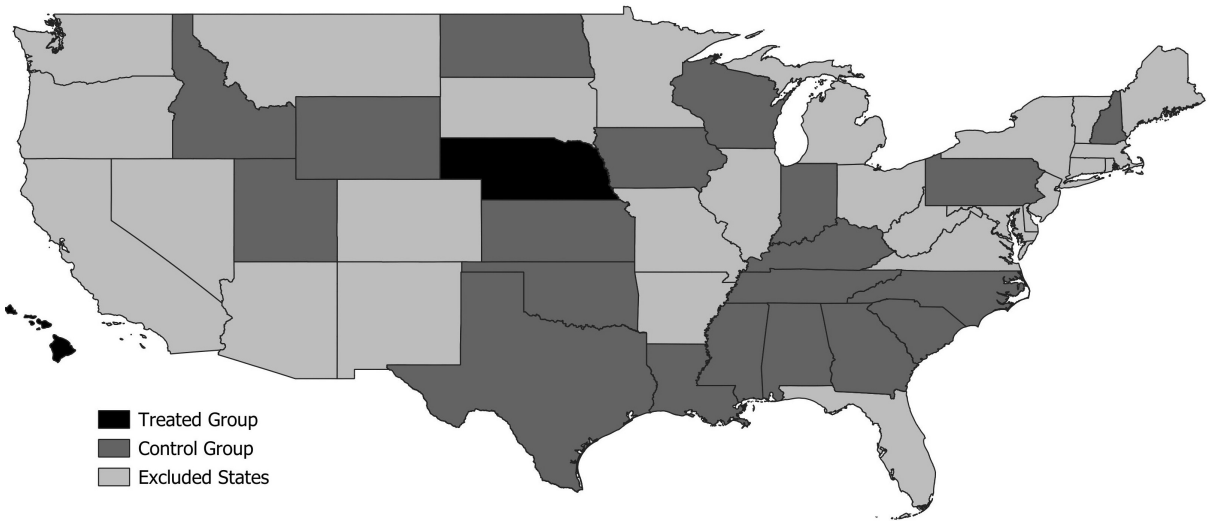
[9]Many news articles covered the approval of HB2510 in Early May 2022. Hawaii Public Radio, for example, stated that "The House and Senate approved the measure by wide margins. The bill now goes to Gov. David Ige, who has said he supports an $18 minimum wage." See more here: https://www.hawaiipublicradio.org/local-news/2022-05-03/lawmakers-vote-to-raise-minimum-wage-from-10-10-for-the-first-time-in-over-4-years.

[10]Economists or politically-knowledgeable readers might reply that the vast majority of ballot initiatives to increase the minimum wage are successful. However, we do not assume that the average minimum wage worker would know and act on this information.

[11]Initiative 433 did not change Nebraska's tipped wage credit. The minimum wage for workers receiving gratuities remains $2.13 per hour (equivalent to the federal minimum wage for such workers). It also scheduled additional minimum wage increases to $12.00 per hour on January 1, 2024, $13.50 per hour on January 1, 2025, and $15.00 per hour on January 1, 2026. It indexed further annual increases to the CPI-U of the Midwest Region.

in 2009. We focus on these control states with no recent history of minimum wage changes to avoid potential contamination of the controls by longer-term effects of the minimum wages, which have been highlighted in some recent research (Meer and West, 2016; Aaronson et al., 2018). Figure 1 shows a map of U.S. states, indicating the 20 states that are included in the control group for our primary analysis and the treated states. The remaining (excluded) states are included in some preliminary analyses discussed below, using a more standard panel data estimator. But we exclude them from our core analyses of the Hawaii and Nebraska minimum wages because they had previously scheduled minimum wage changes during the period of analysis, changed their minimum wage laws a few years before the time period of our analysis, or had an unscheduled minimum wage increase right before the period of analysis (this is only the case for Virginia). Table A.3 in the appendix shows the minimum wages for each state from 2018 to 2023 and indicates if a given state is in the treatment, control, or excluded group.

Figure 1: Treated and Control States



Notes: The map above shows the treated states for our primary analysis (Hawaii and Nebraska). It also shows the control states which include all states that did not have a previously scheduled minimum wage change in the period of analysis or immediately prior to the period of analysis. The excluded states were excluded from the primary analysis because they had previously scheduled minimum wage changes in the period of analysis or immediately prior to the period of analysis. Alaska, not shown, is also an excluded state.

Table 1: Descriptive Statistics

Variable	Mean	SD	Median
Panel A. **Hawaii**			
Log (Job Seekers) - Retails and Cleaning Occupations	10.56	0.16	10.53
Log (Job Seekers) - Food-related Occupations	10.275	0.21	10.25
Median Age (years)	44.37	.99	44
Female Share (%)	49.99	.68	50
White Share (%)	24.62	1.92	24.88
Urban Share (%)	23.65	2.72	23.48
Mean Number of Children per Household	.35	.03	.35
N		33	
Panel B. **Nebraska**			
Log (Job Seekers) - Retails and Cleaning Occupations	10.81	0.14	10.82
Log (Job Seekers) - Food-related Occupations	10.17	0.23	10.12
Median Age (years)	38.23	1.91	38
Female Share (%)	50.06	1.14	49.81
White Share (%)	89.67	1.58	89.71
Urban Share (%)	21.46	1.93	21.4
Mean Number of Children per Household	.31	.04	.31
N		33	
Panel C. **Control States**			
Log (Job Seekers) - Retails and Cleaning Occupations	11.77	1.01	11.87
Log (Job Seekers) - Food-related Occupations	11	0.99	11
Median Age (years)	40.84	3.58	41
Female Share (%)	51.18	1.29	51.22
White Share (%)	82.18	10.74	85.46
Urban Share (%)	16.49	8.80	16.8
Mean Number of Children per Household	.30	.05	.29
N		660	

Notes: This table reports the mean, standard deviation, and median of each of our outcome variables during the period of analysis, January 2021 through September 2023.

3.4 Descriptive Statistics

Table 1 provides the summary statistics for the primary outcome variable in our study – the state-level number of unique monthly job platform users actively seeking information in job postings for a given set of occupations likely to be affected by the minimum wage.

We also include in the table a set of demographic characteristics of the states (some of these serve as control variables in some estimations). These data come from the Current Population Survey (CPS). Our control variables are median age of respondents, share of female

respondents, share of white respondents, the share of households that reside in a metropolitan area, and the mean number of children residing within each household. The statistics show that the treated states are generally similar to the control group across the considered demographic characteristics, with Hawaii's racial/ethnic composition being an exception. While 82% of the population in control states, on average, is white, only 25% of the Hawaiian population is white.

4 Empirical Strategy

4.1 Baseline Analysis

We first consider an ordinary least squares regression with two-way fixed effects (state and month-year) where all states are included. We examine the effect of changes in the minimum wages on the number of job seekers for low-skilled jobs. We estimate the specification:

$$Log(\text{JobSeekers})_{it} = \beta_1 \times Log(\text{Minimum}_{Wage})_{it} + \gamma_i + \sigma_t + X_{it}\delta + e_{it}, \tag{1}$$

where i indexes the state and t indexes each unique month-year. $Log(\text{JobSeekers})_{it}$ represents the natural log of the number of unique job seekers in each of our two occupation categories in a given state in a given month-year.[12] $Log(\text{Minimum}_{Wage})_{it}$ is the natural log of the nominal minimum wage for each state in each month-year. γ_i represents a vector of state fixed effects, σ_t represents a vector of month-year fixed effects, and and X_{it} is a matrix of demographic variables. e_{it} represents the error term.

In this initial analysis, we include all 50 states regardless of when legislation was passed to change their minimum wages and regardless of whether the changes in minimum wages were scheduled or not. There are potential complications in this analysis. For example, the effects of scheduled minimum wage increases may differ because expectations of job seekers in these states could lead to changes in behavior well before the actual minimum wage increases occur. In addition, estimation of minimum wages effects using this approach could be prone to biases highlighted in the recent difference-in-differences econometrics literature (Callaway and

[12] We use a logged dependent variable because the scale of the number of job seekers varies greatly based on the population size of each state.

Sant'Anna, 2021; Goodman-Bacon, 2021), such as dynamic treatment effects contaminating later untreated observations that serve as controls. There are solutions to these issues applicable to the simpler analyses we do of the Hawaii and Nebraska minimum wage increases, which are not applicable to the more general setting with frequent and continuous minimum wage changes. Nonetheless, this evidence is useful as a point of comparison with our primary analyses, and because past studies of the effects of minimum wages on other outcomes (mainly employment) use this empirical strategy (Gopalan et al., 2021).

4.2 Primary Analyses

Our primary analyses consist of two-way fixed effects (TWFE) specifications for Hawaii and Nebraska. We examine each treatment separately to avoid any biases that may be caused by heterogeneous treatment effects. The minimum wage increases in these states were not scheduled prior to the analysis period and sufficient data exists to examine pre-treatment changes or trends for each state. We estimate ordinary least squares regressions with state and month-year fixed effects, using as untreated observations the 20 states without prior scheduled minimum wage changes during the analysis period.We use the specification:

$$Log(\text{JobSeekers})_{it} = \beta_1 \times \text{Treated}_{it} + \gamma_i + \sigma_t + X_{it}\delta + e_{it}. \tag{2}$$

Treated is an indicator variable that takes a value of 1 for the time periods after which a state is treated with a minimum wage increase. We determine the start of the treatment period as the point in time at which job search behavior is likely to have changed in response to the coming minimum wage change (this is prior to the new minimum wage's implementation date, see section 3.3). We analyze the treatments in Hawaii and Nebraska separately because the magnitude and duration of the minimum wage change (i.e., scheduled later increases) differs between the states. The estimator from this specification provides the average causal effect of the minimum change on job search behavior over the treatment period, meaning that combining differing treatment periods may impede accurate inference. Because we only consider one

treated state at time in our primary analysis, we do not face any issues associated with heterogeneity in treatment timing described by the recent difference-in-differences econometrics literature. Cluster-robust standard errors are shown in all specifications.[13]

4.3 Pooled Analysis

Finally, we include data from both states in our analysis, enhancing the efficiency of our estimates. We begin with a TWFE difference-in-differences estimation identical to specification 2, but with the inclusion of both Hawaii and Nebraska as treated states. However, various studies have demonstrated the potential limitations of TWFE in estimating the average treatment effect on the treated (ATT) in scenarios like ours where treatment adoption is staggered over time and treatment effects may vary across groups and over time (De Chaisemartin and d'Haultfoeuille, 2020; Borusyak et al., 2021; Callaway and Sant'Anna, 2021; Goodman-Bacon, 2021; Sun and Abraham, 2021). Our primary analyses are robust to these potential problems since we consider one treated state at a time. When including both treated states in the analysis, however, we need to consider possible biases highlighted in this recent work. Thus, we provide a robustness check by comparing our results with those produced by alternate estimators.

We use the doubly robust (augmented inverse probability weighting) method described in Callaway and Sant'Anna (2021) (C&S) and the two-way Mundlak (TWM) method described in Wooldridge (2021) as alternatives for the results produced from standard TWFE estimation. The Callaway and Sant'Anna estimator allows for estimation and inference of interpretable causal parameters even in the presence of arbitrary treatment effect heterogeneity and dynamic effects, circumventing the potential problems arising from interpreting the results of standard two-way fixed effects regressions as causal effects. The TWM estimator also allows unbiased estimation in the presence of heterogeneous effects across different treatment intensities and varying treatment timings. We implement these estimators in an extension of specification 2 that includes both treated states (Hawaii and Nebraska) and the control states. We also imple-

[13] All results shown in this paper are qualitatively identical and remain statistically significant with wild bootstrap with 10,000 repetitions. There are other potential ways of clustering given that our analyses have one or two treated areas (MacKinnon and Webb, 2019, 2020). But given that our most important conclusion is that there is not a *positive* effect of minimum wages on search, and the estimated effect is in fact negative, alternative clustering methods would not impact this conclusion.

ment these estimators in a extension of specification 2 that examines each occupation individually. We compare the results obtained from the Callaway and Sant'Anna estimator and the TVM estimator with those obtained using our standard TWFE specification (with fixed effects for month-year and state).

5 Results

5.1 Baseline Analysis: All States

Table 2 provides the results associated with specification 1 and include all U.S. states. We regard this specification as providing an imperfect national baseline that connects our study to prior research.

The baseline results suggest that minimum wage increases are correlated with decreased job search in low-wage occupations. The elasticity of job search for retail/cleaning jobs with respect to changes in the minimum wage is estimated to be -0.144 during our period of analysis. The elasticity of job search for food-related jobs is estimated to be -0.276. Both estimates are economically meaningful and display moderate precision, although only the estimate for retail/cleaning occupations is significant (at the 10% level).

Table 2: Outcome: Log(Job Seekers)

	Retail/Cleaning Occupations	Food-related Occupations
Log (Minimum Wage)	-.144*	-.276
	(.075)	(.173)
Observations	1,646	1,646
Number of States	50	50

Notes: Cluster-robust standard errors in parentheses. *** p<0.01, ** p<0.05, and * p<0.1.

5.2 Primary Analysis: Hawaii

This subsection examines the causal effect of the increase in the minimum wage in Hawaii from $10.10 to $12.00 per hour (an 18.8% increase). Table 3 provides the results from a simple 2x2 difference-in-differences approach where we compare the average logged number

of job seekers per month in each occupational class in Hawaii before and after the effective announcement of the coming change in minimum wage laws (May 2022) to the same metric averaged across the control group.[14] These initial results indicate that the number of job seekers for retail and cleaning jobs decreased by about 9.2% on average relative to the control group over the 17 months after the minimum wage increase was signaled. Job seekers for food-related jobs decreased by 13.0%. Both of these results suggest that the increase in minimum wages in Hawaii had a negative effect on job search.

Table 3: Difference in Means of Log(Job Seekers) for Hawaii

	Pre-treatment	Post-treatment	Difference	Difference-in-Differences
Retail and Cleaning Occupations				
Treatment Group	10.461	10.671	0.209	**-0.092**
Control Group	11.626	11.928	0.302	
Food-related Occupations				
Treatment Group	10.115	10.445	0.330	**-0.130**
Control Group	10.781	11.241	0.461	

In Figure 2 the logged total monthly job seekers in each occupational classification in Hawaii is compared against the same metric averaged across control states prior to and following the effective announcement of the change in Hawaii's minimum wage laws (May 2022). The dashed red line shows the estimated counterfactual implied in our difference-in-differences estimate. In other words, it shows the trend in logged job seekers that Hawaii would have followed if it had experienced the same monthly changes as the average of the control states.[15]

Figure 2 shows that prior to the treatment, the logged total monthly job seekers in Hawaii in each occupational classifications followed a trend similar to that of the control group. In the post-treatment period Hawaii continued to follow a similar overall trend as the control group, but with visual and measurable differences. This visual examination helps to illustrate how

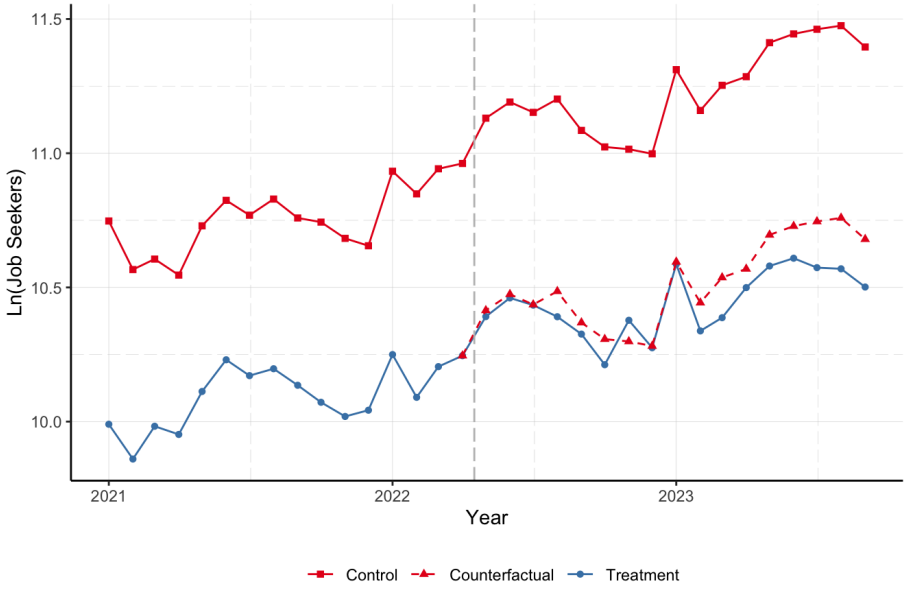
[14] May 2022 and all months thereafter are part of the treatment period. The months prior to May 2022 are included in the pre-treatment average.

[15] Since the outcome variable is the logged number of job seekers, the counterfactual line shows the percentage change in job seekers that would have taken place in Hawaii if Hawaii followed the same percentage change in job seekers as the control group.

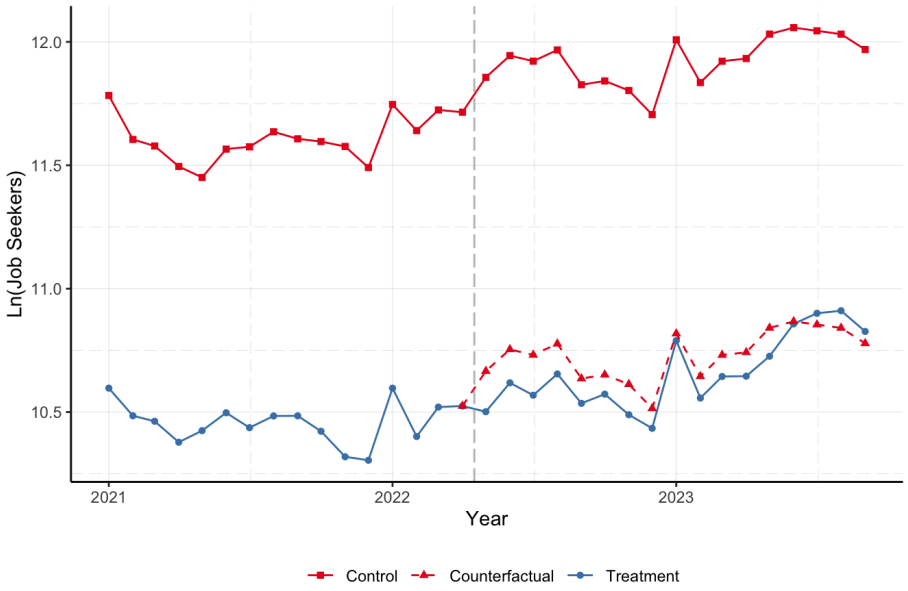
Hawaii's minimum wage increase led to a decrease in the number of job seekers for low-skilled jobs in both occupational classifications, although the decline in retail/cleaning occupations appears to occur more quickly.

Figure 2: Log(Job Seekers) for Treatment and Control Groups - Hawaii

(a) Food-related Occupations



(b) Retail and Cleaning Occupations



Notes: This figure plots the mean log of job seekers for the treatment and control groups. It also shows the counterfactual line which represents the path the treatment group would follow if the treatment group had followed the same trends as the control group.

Table 4 provides the results of the two-way fixed effects estimation associated with specification 2. This estimation does not suffer any biases that could be caused by heterogeneity in treatment timing or effect because we consider solely the effect of a single minimum wage increase in Hawaii relative to the control states, which experienced no nominal minimum wage changes since the last federal minimum wage increase in 2009.

The results suggest that the increase in minimum wages in Hawaii caused a decline of around 11% and 13% in the number of job seekers in retail/cleaning occupations and food-related occupations across the period from April 2022-September 2023. The addition of demographic controls to the regression has a negligible impact on the parameter estimates. All estimates are statistically significant at the 1% level. The computed elasticity of the change in the number of job seekers relative to the minimum wage change is -0.57 for retail and cleaning occupations and -0.69 for food-related occupations.[16]

Table 4: Effects of Minimum Wage Increase on Log(Job Seekers) in Hawaii

	Retail and Cleaning Occupations	Food-related Occupations
Baseline		
ATT	-.110***	-.132***
	(.013)	(.022)
With Controls		
ATT	-.110***	-.136***
	(.014)	(.020)
Observations	693	693
Number of States	21	21

Notes: The baseline results are based on specification 2 and include only fixed effects for states and time. The results with controls includes the demographic controls shown in Table 1. Cluster-robust standard errors are shown in parentheses. *** p<0.01, ** p<0.05, and * p<0.1.

5.3 Primary Analysis: Nebraska

This subsection examines the causal effects of the increase in minimum wage in Nebraska from $9.00 to $10.50 per hour (a 16.7% increase). The analysis is otherwise the same as the preceding one for Hawaii. Table 5 provides the results from a simple 2x2 difference-in-differences approach where we compare the logged total monthly job seekers in each occupational class in

[16]These values are calculated as the simple ratio of the estimated percentage decrease in the number of job seekers relative to the percentage increase in Hawaii's minimum wage, 18.8%.

Nebraska before and after the month of the effective announcement of the coming change in minimum wage laws (November 2022) to the same metric averaged across the control group. This initial analysis suggests that the average monthly number of job seekers in Nebraska decreased by about 8.4% for both occupational classifications over the 11 months after the minimum wage increase was signaled.

Table 5: Difference in Means of Log(Job Seekers) for Nebraska

	Pre-treatment	Post-treatment	Difference	Difference-in-Differences
Retail and Cleaning Occupations				
Treatment Group	10.759	10.936	0.177	**-0.084**
Control Group	11.693	11.954	0.260	
Food-related Occupations				
Treatment Group	10.054	10.423	0.369	**-0.084**
Control Group	10.867	11.320	0.453	

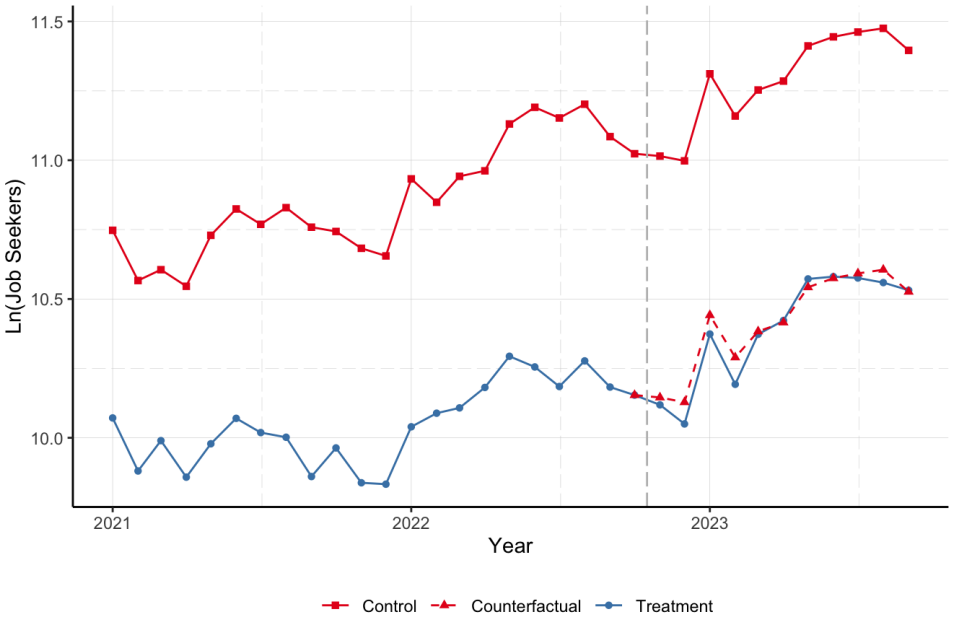
In Figure 3 the logged total monthly job seekers in each occupational class in Nebraska is compared to the same value averaged across control states. The dashed red line shows the trend that Nebraska would have followed if it had experienced the same average monthly changes as the control states. This graphic illustrates that prior to the treatment the number of low-wage job seekers in Nebraska followed a similar trend to the average trend of the control group. After treatment there is a small but noticeable deviation between the estimated counterfactual line and the actual number of job seekers for both food-related and retail and cleaning occupations.

Table 6 shows the results of the two-way fixed effects estimation associated with specification 2. The results suggest that the number of job seekers for retail and cleaning occupations declined by more than 9.0% over the 11 months (November 2022-September 2023) following the signal of the minimum wage increase. Job seekers for food-related occupations decreased by 8.7%. The addition of demographic controls to the regression has a negligible impact on the parameter estimate. All estimates are statistically significant at the 1% level. The computed elasticity of the change in the number of job seekers relative to the minimum wage change is -0.55 for retail and cleaning occupations and -0.51 for food-related occupations.[17]

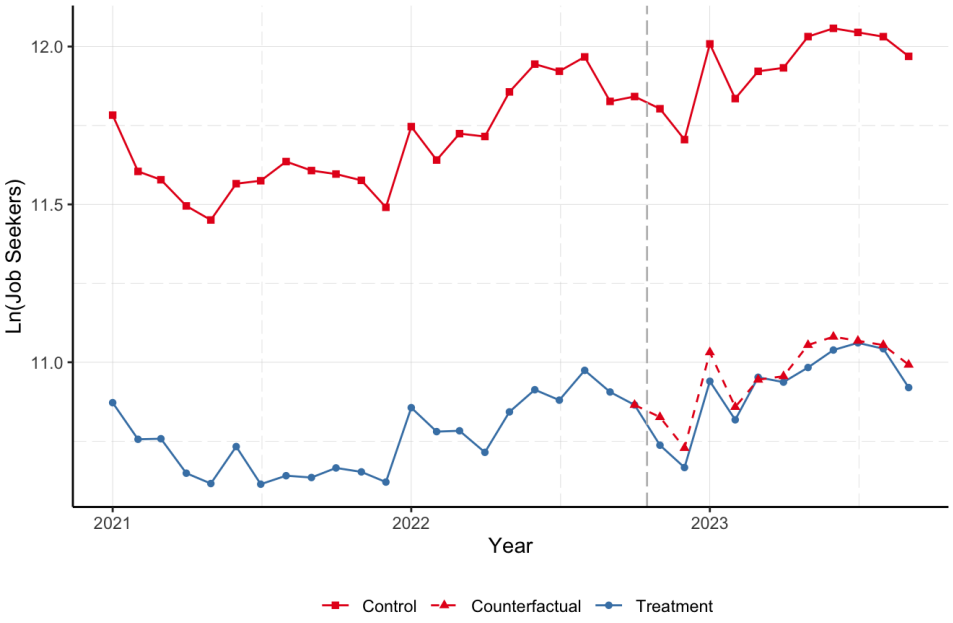
[17]These values are calculated as the simple ratio of the estimated percentage decrease in the number of seekers relative to the percentage increase in Nebraska's minimum wage, 16.7%.

Figure 3: Log(Job Seekers) for Treatment and Control Groups - Nebraska

(a) Food-related Occupations



(b) Retail and Cleaning Occupations



Notes: This figure plots the mean log of job seekers for the treatment and control groups. It also shows the counterfactual line which represents the path the treatment group would follow if the treatment group had followed the same trends as the control group.

Table 6: Effects of Minimum Wage Increase on Log(Job Seekers) in Nebraska

	Retail and Cleaning Occupations	Food-related Occupations
Baseline		
ATT	-.093***	-.087***
	(.011)	(.018)
With Controls		
ATT	-.091***	-.089***
	(.011)	(.020)
Observations	693	693
Number of States	21	21

Notes: The baseline results are based on specification 2 and include fixed effects for states and time. The results with controls also includes the demographic covariates shown in Table 1. Cluster-robust standard errors are shown in parentheses. *** p<0.01, ** p<0.05, and * p<0.1.

Notably, the state-specific (Hawaii and Nebraska) primary analyses find larger elasticities than the 50-state baseline analysis. This may be suggestive that large, discrete, unscheduled minimum wage changes produce larger effects than scheduled, discrete changes and marginal, index-driven changes. This could suggest nonlinear effects, since unscheduled minimum wage increases tend to be substantially larger than increases related to cost-of-living index changes. Alternatively, the difference may suggest that anticipatory effects mitigate the measured effect, since scheduled and index-driven changes are known in advance by both workers and employers.

5.4 Pooled Analysis

We now include both treated states in our analysis. We first consider a TWFE difference-in-differences estimation identical to specification 2, but with the inclusion of both Hawaii and Nebraska as treated states. As an alternative, we also utilize the difference-in-differences estimators described in Callaway and Sant'Anna (2021) and Wooldridge (2021). We compare these estimators against the results produced by a traditional two-way fixed effects (TWFE) specification (with fixed effects for year-month and state). In these each of these specifications, Hawaii and Nebraska are compared against the previously used group of control states.[18]

[18]Given that the demographic controls had no impact in the prior analyses, we drop them from here.

Table 7: Effects of Minimum Wage Increase on Log(Job Seekers) - Baseline

	Retail and Cleaning Occupations	Food-related Occupations
Panel A — TWFE		
ATT	-.102***	-.108***
	(.013)	(.026)
Panel B — Callaway and Sant'anna		
ATT	-.062***	-.057***
	(.012)	(.020)
Panel C — Wooldridge		
ATT	-.102***	-.112***
	(.013)	(.026)
Observations	726	726
Number of States	22	22

Notes: Cluster-robust standard errors are shown in parentheses. *** p<0.01, ** p<0.05, and * p<0.1.

Panel A of Table 7 shows the ATT estimated via a standard TWFE analysis, Panel B shows the ATT estimated via the Callaway and Sant'Anna (2021) method, Panel C shows the ATT estimated via the Wooldridge (2021) TVM method. The average minimum wage increase across the treated states was 17.75% (18.8% for Hawaii and 16.7% for Nebraska). It is also worth nothing that the treatment period in Hawaii was 17 months compared to 11 months in Nebraska.

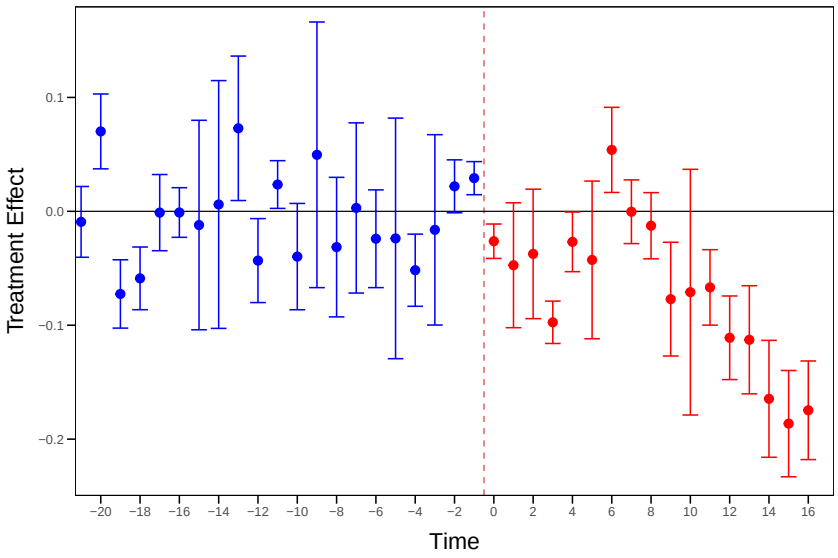
Each of the alternative specifications show an economically meaningful and precisely-estimated decrease in the number of job seekers associated with the minimum wage increases. The parameters estimated using the Callaway and Sant'Anna method are smaller than those estimated via the TVM method and standard TWFE. However, all estimates show a substantial decline (between 6% and 11%) in the number of job seekers in treated states. All estimates are statistically significant at the 1% level. The elasticity of the number of job seekers relative to changes in the minimum wage is -0.3 to -0.6.

Interestingly, the effects for retail and cleaning occupations are more precisely estimated than those for food-related occupations in almost every pair of regressions. This may reflect some food-related businesses facing relatively more inelastic demand from customers, being better able to pass along the increased labor cost and therefore relatively insensitive to minimum wage increases compared to the businesses hiring for retail and cleaning jobs. Regardless, our

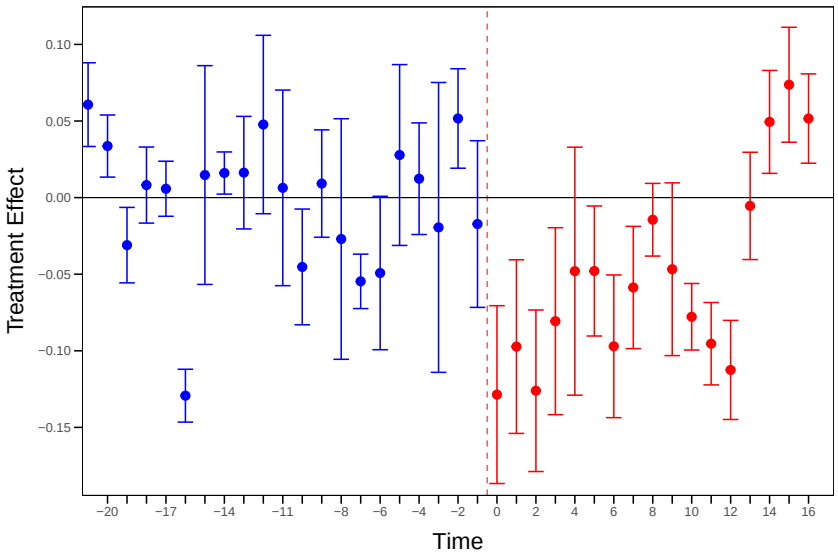
staggered adoption analysis suggests that the effect of similar, unscheduled minimum wage increases in two relatively dissimilar states was to meaningfully decrease the number of workers searching for low-wage jobs.

Figure 4: Event Study - Callaway and Sant'anna Method

(a) Food Occupations



(b) Retail and Cleaning Occupations



Notes: This figure shows the event study plots based on the Callaway and Sant'anna method shown in Panel B of Table 7.

We next examine event study plots associated with the staggered adoption analysis from the Callaway and Sant'Anna method (results shown in Panel B of Table 7). Figure 4 shows the event study plots for both food-related occupations and retail and cleaning occupations. The red points to the right of the vertical dashed line indicate the value of the estimated ATTs for each post-treatment month. In both occupation classifications we see evidence of a decline in the number of job seekers. There is no apparent trend in the pre-treatment period (shown to the left of the vertical line). This supports the parallel assumption necessary for our causal estimation. The estimation of the ATTs shows statistical noise in both the pre- and post-treatment periods. However, the lack of a consistent trend in the pre-treatment period, and the clear decline in the post-treatment period, help illustrate the results shown in Table 7.

5.5 Considering Individual Occupations

Last, we report results for narrower jobs within the food-related and retail and cleaning occupations. This is informative about whether the results are perhaps driven by a narrow set of jobs. This analysis also avoids the potential problem associated with counting the same job seeker more than once, since the data provides the unique number of job seekers for each job title (see discussion in section 3). Given that the alternative to the TWFE estimator made little difference in the analyses reported in Table 7, here we use the TWFE estimator (continuing to include both states). We also, as in Table 7, exclude the demographic control variables since they did not impact the findings.

For jobs in the food-related classification, we find a large decline in job seekers for crew member jobs.[19] The parameter estimate (-0.20) is statistically significant at all levels. This suggests that the elasticity of the number of job seekers for crew member jobs relative to changes in the minimum wage is about -1.1. The estimated effects for hosts and cooks are negative but smaller, while the estimate for dishwashers is positive but close to zero; the latter three estimates are insignificant. Importantly, there is no statistical evidence in this disaggregated analysis of food-related occupations indicating that higher minimum wages increase search.

[19] Likely the group with lowest wages and more likely to be affected by changes in minimum wages.

The results for jobs in the retail and cleaning classification are even more consistent. The estimate is negative in every case, and for four of the five jobs the estimate is of a similar magnitude to the aggreate estimate, and statististically significant.

We also report the average numbers of monthly job seekers for each job. This shows which occupations may play a bigger role in our main estimates. Retail salespersons is the largest category, followed by cashiers, receptionists, crew members, and hosts. For all of these larger categories, the estimates are negative. And the only positive estimate (albeit small), is for dishwashers, one of the smaller categories. Overall, then, our conclusion is robust. There is no evidence that higher minimum wages increase search, and a good deal of evidence of an adverse effect on search.

Table 8: Effects of Minimum Wage Increase on Log(Job Seekers) for Individual Occupations - Two-way Fixed Effects

	Food-related Occupations				Retail and Cleaning Occupations				
	Crew Member	Cook	Dishwasher	Host	Cashier	Retail Salespersons	Janitor	Cleaner	Receptionist
ATT	-.20***	-.04	.03	-.06	-.08**	-.13***	-.01	-.14**	-.11**
	(.06)	(.03)	(.06)	(.07)	(.04)	(.02)	(0.08)	(.06)	(.05)
Mean # of Seekers	32,543	13,864	23,842	34,455	41,572	82,128	21,482	19,494	37,281

Notes: Cluster-robust standard errors are shown in parenthesis. *** p<0.01, ** p<0.05, and * p<0.1.

6 Conclusion

Since the launch of the New Minimum Wage Research in the early 1990s, economists have used theoretical job-search models to attempt to explain positive estimates of the minimum wages' effect on employment. We present novel evidence on the effects of minimum wages on job search using data from a large online job platform, and studying the effects of two recent unexpected minimum wage increases on job search activity for low-wage jobs.

We find essentially no evidence that higher minimum wages increase job search for low-skilled jobs, as previously hypothesized in the labor search literature. Instead, we find consistent evidence of that minimum wage increases led to less job search. The results provide evidence consistent with the wage compression channel in the search model of Liu (2022),

wherein a reduction in wage dispersion due to the minimum wage dampens job search activity among the employed. Additionally, these findings align with the empirical results of Faberman et al. (2022), which highlights the prevalence and elasticity of on-the-job search, particularly among low-skilled workers.

Our data indicate substantial decreases in low-wage job search activity caused by minimum wage increases. Notably, our results suggest an average elasticity of low-wage job search activity with regard to minimum wage changes that is more negative than -0.3, and likely more negative than -0.5. Such estimates are at least two and perhaps greater than four times as large as the common range of estimates for the employment elasticity (-0.1 to -0.3 (Brown et al., 1982) and -0.148 (Neumark and Shirley, 2022)).

Our results are limited by the states that implemented unscheduled minimum wage increases during our data period (Hawaii and Nebraska), but the results for these two states are quite similar. Our results are also limited by the time period for which data was available and by the fact that some job search for low-wage jobs occurs in-person or through social networks, rather than via online job platforms. However, there is little reason to believe that job search activities would sharply diminish on online platforms while remaining constant or increasing via alternate channels. As a result, our work represents a challenge to the search-and-matching models predicting that higher minimum wages increase job search, as well as a challenge to appeals to these models to attempt to explain non-negative estimates in some studies of the effects of minimum wages on employment. Additional research and data will be useful to obtain more definitive evidence on the effects of minimum wages on job search.

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Appendix

Table A.1: Occupations with Lowest Mean Hourly Wages

Occupation Code Name	Occupation title	Mean Hourly Wage
772	Shampooers	14.07
687	Cooks, Fast Food	14.31
699	Fast Food and Counter Workers	14.48
753	Amusement and Recreation Attendants	14.54
751	Ushers, Lobby Attendants, and Ticket Takers	14.67
798	Cashiers	14.77
709	Hosts and Hostesses, Restaurant, Lounge, and Coffee Shop	14.78
752	Miscellaneous Entertainment Attendants and Related Workers	14.89
676	Lifeguards, Ski Patrol, and Other Recreational Protective Service Workers	15.07
708	Dishwashers	15.22
1219	Laundry and Dry-Cleaning Workers	15.33
704	Other Food Preparation and Serving Related Workers	15.37
746	Gambling and Sports Book Writers and Runners	15.4
783	Childcare Workers	15.42
743	Entertainment Attendants and Related Workers	15.5
1220	Pressers, Textile, Garment, and Related Materials	15.55
878	Hotel, Motel, and Resort Desk Clerks	15.66
1363	Parking Attendants	15.72
705	Dining Room and Cafeteria Attendants and Bartender Helpers	15.74
694	Food Preparation Workers	15.85
695	Food and Beverage Serving Workers	15.89
612	Home Health and Personal Care Aides	16.05
742	Animal Caretakers	16.12
702	Food Servers, Nonrestaurant	16.27
1228	Sewers, Hand	16.28
691	Cooks, Short Order	16.31
678	School Bus Monitors	16.33
685	Cooks and Food Preparation Workers	16.35
738	Animal Care and Service Workers	16.49
686	Cooks	16.52
1328	Ambulance Drivers and Attendants, Except Emergency Medical Technicians	16.55
680	Food Preparation and Serving Related Occupations	16.58
796	Retail Sales Workers	16.59
1366	Automotive and Watercraft Service Attendants	16.6
755	Locker Room, Coatroom, and Dressing Room Attendants	16.63

Table A.1: Bottom Occupations by Mean Hourly Wage (*Continued*)

Occupation Code Name	**Occupation title**	**Mean Hourly Wage**
721	Maids and Housekeeping Cleaners	16.66
756	Entertainment Attendants and Related Workers, All Other	16.67
624	Physical Therapist Aides	16.74
952	Graders and Sorters, Agricultural Products	16.77
1222	Sewing Machine Operators	16.83
1337	Taxi Drivers	16.88
611	Home Health and Personal Care Aides	
761	Funeral Attendants	16.92
1217	Textile, Apparel, and Furnishings Workers	16.93
1388	Cleaners of Vehicles and Equipment	16.95
711	Miscellaneous Food Preparation and Serving Related Workers	17.03
712	Food Preparation and Serving Related Workers, All Other	17.03
1391	Packers and Packagers, Hand	17.05
457	Floral Designers	17.07
1167	Bakers	17.09
747	Gambling Service Workers, All Other	17.14
719	Building Cleaning Workers	17.23
688	Cooks, Institution and Cafeteria	17.27
882	Library Assistants, Clerical	17.29
799	Gambling Change Persons and Booth Cashiers	17.32
690	Cooks, Restaurant	17.34
718	Building Cleaning and Pest Control Workers	17.36
776	Baggage Porters and Bellhops	17.36
1365	Transportation Service Attendants	17.37
956	Farmworkers and Laborers, Crop, Nursery, and Greenhouse	17.37
720	Janitors and Cleaners, Except Maids and Housekeeping Cleaners	17.43
786	Recreation Workers	17.44
771	Manicurists and Pedicurists	17.54
701	Waiters and Waitresses	17.56
1226	Shoe Machine Operators and Tenders	17.58
892	Receptionists and Information Clerks	17.59
830	Telemarketers	17.64
804	Retail Salespersons	17.64
853	Gambling Cage Workers	17.67
1372	Passenger Attendants	17.68
1170	Meat, Poultry, and Fish Cutters and Trimmers	17.71
1224	Shoe and Leather Workers	17.72
961	Forest and Conservation Workers	17.72

Table A.1: Bottom Occupations by Mean Hourly Wage (*Continued*)

Occupation Code Name	**Occupation title**	**Mean Hourly Wage**
1336	Shuttle Drivers and Chauffeurs	17.75
954	Miscellaneous Agricultural Workers	17.75
1225	Shoe and Leather Workers and Repairers	17.80
1232	Textile Cutting Machine Setters, Operators, and Tenders	17.81
957	Farmworkers, Farm, Ranch, and Aquacultural Animals	17.82
696	Bartenders	17.83
1234	Textile Winding, Twisting, and Drawing Out Machine Setters, Operators, and Tenders	17.84
790	Personal Care and Service Workers, All Other	17.88
789	Miscellaneous Personal Care and Service Workers	17.88
1109	Tire Repairers and Changers	17.92
634	Veterinary Assistants and Laboratory Animal Caretakers	17.94
1230	Textile Machine Setters, Operators, and Tenders	17.96
947	Agricultural Workers	17.97

Notes: This table shows all occupations with mean hourly wage below $18 in the United States.

Table A.2: Comparison of BLS categories and occupations used in this study

BLS occupational category	**Mean hourly wage**	**Our searched job titles**
Cooks and Food Preparation Workers	$16,35	cook, crew member
Food and Beverage Serving Workers	$15,89	crew member
Other Food Preparation and Serving Related Workers	$15,37	host, dishwasher
Retail Sales Workers	$16,59	retail salespersons
Cashiers	$14,78	cashiers
Janitors and Cleaners, Except Maids and Housekeeping Cleaners	$17,43	janitors, cleaners
Receptionists and Information Clerks	$17,59	receptionist

Notes: This table shows the mean hourly wage for each of the occupations associated with the job titles chosen for our study.

Table A.3: Minimum Wage for USA states

State Name	MW 2018	MW 2019	MW 2020	MW 2021	MW 2022	MW 2023	Group
Alabama	7.25	7.25	7.25	7.25	7.25	7.25	Control
Alaska	9.84	9.89	10.19	10.34	10.34	10.85	Excluded
Arizona	10.50	11	12	12.15	12.80	13.85	Excluded
Arkansas	8.50	9.25	10	11	11	11	Excluded
California	11	12	13	14	15	15.50	Excluded
Colorado	10.20	11.10	12	12.32	12.56	13.65	Excluded
Connecticut	10.10	10.10	11	12	13	14	Excluded
Delaware	8.25	8.75	9.25	9.25	10.50	11.75	Excluded
Florida	8.25	8.46	8.56	8.65	10	11	Excluded
Georgia	5.15	5.15	5.15	5.15	5.15	5.15	Control
Hawaii	10.10	10.10	10.10	10.10	10.10	12	Treatment
Idaho	7.25	7.25	7.25	7.25	7.25	7.25	Control
Illinois	8.25	8.25	9.25	11	12	13	Excluded
Indiana	7.25	7.25	7.25	7.25	7.25	7.25	Control
Iowa	7.25	7.25	7.25	7.25	7.25	7.25	Control
Kansas	7.25	7.25	7.25	7.25	7.25	7.25	Control
Kentucky	7.25	7.25	7.25	7.25	7.25	7.25	Control
Louisiana	7.25	7.25	7.25	7.25	7.25	7.25	Control
Maine	10	11	12	12.15	12.75	13.80	Excluded
Maryland	9.25	10.10	11	11.75	12.50	13.25	Excluded
Massachusetts	11	12	12.75	13.50	14.25	15	Excluded
Michigan	9.25	9.45	9.65	9.65	9.87	10.10	Excluded
Minnesota	9.65	9.86	10	10.08	10.33	10.59	Excluded
Mississippi	7.25	7.25	7.25	7.25	7.25	7.25	Control
Missouri	7.85	8.60	9.45	10.30	11.15	12	Excluded
Montana	8.30	8.50	8.65	8.75	9.20	9.95	Excluded
Nebraska	9	9	9	9	9	10.50	Treatment
Nevada	8.25	8.25	9	9	9.75	10.50	Excluded
New Hampshire	7.25	7.25	7.25	7.25	7.25	7.25	Control
New Jersey	8.60	8.85	11	12	13	14.13	Excluded
New Mexico	7.50	7.50	9	10.50	11.50	12	Excluded
New York	10.40	11.10	11.80	12.50	13.20	14.20	Excluded
North Carolina	7.25	7.25	7.25	7.25	7.25	7.25	Control
North Dakota	7.25	7.25	7.25	7.25	7.25	7.25	Control
Ohio	8.30	8.55	8.70	8.80	9.30	10.10	Excluded
Oklahoma	7.25	7.25	7.25	7.25	7.25	7.25	Control
Oregon	10.25	10.75	11.25	12	12.75	13.50	Excluded
Pennsylvania	7.25	7.25	7.25	7.25	7.25	7.25	Control
Rhode Island	10.10	10.50	10.50	11.50	12.25	13	Excluded
South Carolina	7.25	7.25	7.25	7.25	7.25	7.25	Control
South Dakota	8.85	9.10	9.30	9.45	9.95	10.80	Excluded
Tennessee	7.25	7.25	7.25	7.25	7.25	7.25	Control
Texas	7.25	7.25	7.25	7.25	7.25	7.25	Control
Utah	7.25	7.25	7.25	7.25	7.25	7.25	Control
Vermont	10.50	10.78	10.96	11.75	12.55	13.18	Excluded

Table A.3: Minimum Wage for USA states (*Continued*)

State Name	**MW 2018**	**MW 2019**	**MW 2020**	**MW 2021**	**MW 2022**	**MW 2023**	**Group**
Virginia	7.25	7.25	7.25	7.25	11	12	Excluded
Washington	11.50	12	13.50	13.96	14.49	15.74	Excluded
West Virginia*	8.75	8.75	8.75	8.75	8.75	8.75	Excluded
Wisconsin	7.25	7.25	7.25	7.25	7.25	7.25	Control
Wyoming	5.15	5.15	5.15	5.15	5.15	5.15	Control

Notes: All states with stable minimum wage requirements from 2018 to 2023 are included in the control group with the exception of West Virginia, which changed its minimum wage soon before 2018. All results shown in this paper are qualitatively identical when we include West Virginia in the control group. Nebraska and Hawaii had unscheduled changes in their minimum wages in 2022 or 2023 and thus are included in the treatment group. All other states are excluded from the main analysis.