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Jesse Wursten and Michael Reich

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UNIVERSITY OF CALIFORNIA

Small Businesses and the Minimum Wage*

Jesse Wursten† Michael Reich‡

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Abstract

We provide the first causal analysis of the role of firm size on minimum wage effects in the U.S. Using a stacked event study estimator, we find that minimum wages increase pay in low wage industries, particularly so in small businesses. We do not detect any corresponding disemployment effects. For teens, wage increases are stronger in larger businesses and come with modest disemployment effects in smaller ones. These results point to strong monopsony power for large firms and backward bending teen labor supply curves.

JEL codes: J7, J15, J31, J38
Keywords: minimum wages, small businesses, medium businesses, QWI, CBP

1 Introduction

In this paper we examine whether the effects of minimum wages on small businesses differ from those on larger ones. Small businesses tend to have lower pay and are thus more likely to be affected by wage floors.[1] They are more labor intensive (Autor et al., 2020), which increases their vulnerability to pay increases (Card and Krueger, 1995); and have less product market pricing power, reducing their ability to pass on costs to consumers, a prominent adaptation mechanism (Cooper, Luengo-prado and Parker, 2020).

On the other hand, the rise of large restaurant chains (such as McDonald's) and superstores (such as Walmart) has reduced the share of low wage workers active in small businesses. Figure 1 shows that this share has dropped almost ten percentage points between 1990 and 2018 (red line). Over the same horizon, the *overall* share of employment in small firms has remained stable (blue line). Large firms also tend to have more bargaining power in the *low wage* labor market, suppressing

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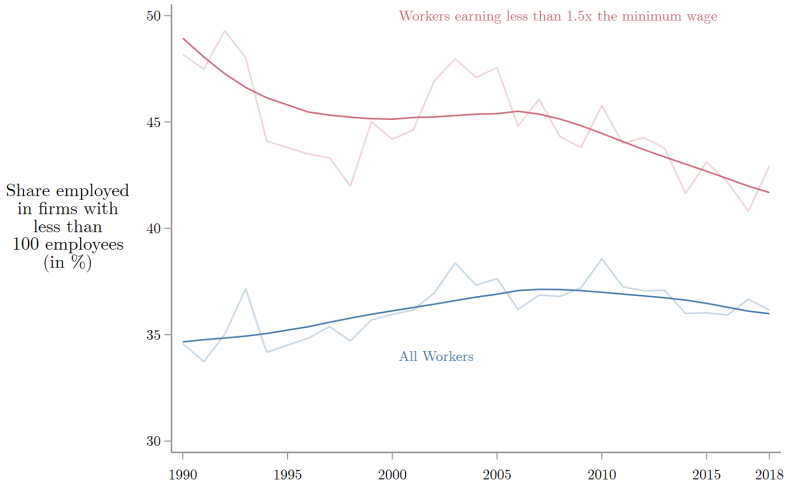
†KU Leuven, Naamsestraat 69, 3000 Leuven, Belgium (jesse.wursten@kuleuven.be). Wursten gratefully acknowledges financial support of the Research Foundation Flanders (FWO) under grant number 1125818N.

‡Center on Wage and Employment Dynamics, University of California, Berkeley (mreich@econ.berkeley.edu)

[1] See Oi and Idson (1999) for a review on the large-firm wage premium and Bloom et al. (2018) for recent evidence on the shrinking but still considerable pay gap between small and large firms.

Figure 1. Distribution of employees by firm size class, 1993-2020



Notes: Weighted by the outgoing rotations group person weights. Solid line is a lowess smoothing of the underlying yearly means. *Replication tag*: #sizeEmployeeDistributionOverTime-cps. The replication tag is mirrored in the codebase and makes it easy to link exhibits in the paper to the exact code used to generate it (and is more stable and generalizable than table and figure numbers which are subject to change between versions). *Source*: Current Population Survey, own calculations.

wages and employment for vulnerable workers (Wiltshire, 2023). As such, pay for these workers may be lower in large firms even if average pay in those firms is high.

Small businesses also profit from limited exceptions and delayed phase-ins in state and substate minimum wage policies.[2] Moreover, federal minimum wage increases have contained substantial tax credits for small businesses, as for example in the Fair Minimum Wage Act of 2007. They are also subject to lower federal and state tax rates, are eligible for low-cost assistance from the U.S. Small Business Administration, receive priority points in government contracting, are less likely to provide health, pension and other benefits, are less likely to be the focus of minimum wage enforcement activity, and are much more likely to under-report their net income to the tax authorities (Almeida and Carneiro, 2009).[3] Finally, minimum wage increases reduce employee turnover (Dube, Lester and Reich, 2016; Wursten and Reich, 2021); these reductions may be greater among small firms with low-wage employees than among large firms (Willingham, 2021). As a result, it remains an open question whether small businesses are particularly affected by minimum wage policy.

We address this gap by providing the first systematic empirical examination of the causal effects

[2]In three states, small businesses (less than 26 employees in California, less than 15 employees in Maryland and less than 6 employees in New Jersey) are permitted longer phase-in periods to minimum wage increases. Nearly fifty cities, mostly in California, have allowed longer phase-ins for employers with less than 26 employees; and five cities in California have implemented higher sectoral minimum wages for larger hotels (UC Berkeley Labor Center, 2023).

[3]The IRS reports that non-farm proprietors do not report 56 percent of their net income (IRS, 2022).

of minimum wages on pay and employment throughout the firm size distribution.[4] Our analysis encompasses effects in multiple business size bins, from businesses with fewer than 20 workers up to businesses with 500 or more workers. We draw upon federal and state minimum wage variation between 1990 and 2019 and use earnings and employment data by size of business assembled in the Quarterly Workforce Indicators (QWI) dataset for our main analysis. Using County Business Patterns data, we also examine minimum wage effects on the number and size distribution of business establishments.

We first study the industries with the highest proportions of minimum wage workers (see Appendix Table A1), focusing first on three detailed (3-digit) industries: restaurants (NAICS 722), grocery stores (NAICS 445), and general merchandise stores (NAICS 452). Then we broaden this analysis to all other sizeable three and four digit industries with average wages less than twice the applicable minimum wage. Finally, we analogously examine effects by employer size bin on teens ages 14-18 and young workers ages 19-21.[5]

We generally find that wage increases in low-wage industries are modestly greater in smaller firms, consistent with previous studies of the size-wage relationship among all firms (Bloom et al., 2018). Among low-wage industries, we do not detect significant disemployment effects in any employer size bin. These results are not affected by pre-trends, and they hold in our robustness tests. We find modest employment declines among teens working in smaller businesses. As a group, teens are still better off as wages increase more than employment declines. Moreover, these reductions in employment may reflect supply-side responses shifting teens' time from work to schooling, rather than reduced employer demand.

Methodology Our analysis is based on the stacked event study described by Cengiz et al. (2019), which we adapt to a setting with a continuous treatment variable.[6] As the name suggests, we *stack* multiple *event studies*. Each event study concerns a minimum wage in a particular state and quarter, fully account for the dynamics of any treatment effect and is adjusted for the potentially confounding effects of any events happening in its set of control states. We stack these event studies into a single regression to optimize power and to minimize the idiosyncratic impact of any particular event.

Theory Economic theory no longer predicts that minimum wage increases will necessarily have adverse employment effects. Modern labor economics recognizes the pervasiveness of labor market frictions, even when workers can choose from many potential employers (Card, 2022). In frictional labor markets, and in the absence of a binding minimum wage, employers will pay employees less than the value of their marginal product and hire fewer workers than they would in a competitive labor market. Wage standards can then increase both pay and employment. Moreover, a number of studies have found that minimum wage cost increases in low-wage industries, such as restaurants and grocery stores, are fully absorbed by price increases (Cooper, Luengo-prado and Parker, 2020). Thus, even in competitive labor markets minimum wages may not have disemployment effects.

However, employment effects could still vary by size of business. Small firms have less bargaining

[4] We use the term small business to refer only to small employers; non-employee enterprises and businesses whose workers are all family members are not subject to minimum wage laws.

[5] We also examined effects on workers with a high school education or less. Unfortunately, the QWI excludes workers younger than 25 from its education-specific datasets, resulting in an inadequate bite of the minimum wage for this subgroup. The QWI does not provide datasets split by education *and* age.

[6] The original setting involves wage bins which are either affected or not, whereas our setting evaluates continuous changes in average wages and employment counts.

power in both the product and the labor market, reducing their adjustment options. Moreover, if firm size is correlated with worker productivity, then a minimum wage could reduce the number of low-productivity jobs and replace them with higher productivity jobs. In this scenario, minimum wage increases could reduce employment in small firms and increase employment in larger ones. Dustmann et al. (2022) find such a reallocation effect after the introduction of the national German minimum wage in 2015.

Definition of *small* business The official definition of a small business varies with the policy and institutional context. The U.S. Small Business Administration (SBA) generally uses a threshold of fewer than 500 employees to delineate eligibility for SBA low-interest loans and for preferences in government contracting.[7] However, SBA's thresholds vary by detailed industry and often include firms with as many as 1,000 employees (CRS, 2022). Other federal, state and local programs use smaller thresholds. For example, federal employer mandates for compliance with age discrimination laws apply to firms with 20 or more employees, while provision of family and medical leave and health insurance apply to firms with 50 or more employees, and mandated advance notice of plant closures applies to firms with 100 or more employees (Zywave, 2017). Moreover, franchising and multi-establishment chains are pervasive in restaurants, grocery stores and accommodations. We do not adopt a single definition. Instead, we take a data-oriented approach, examining outcomes that use all the size bins provided in each of our datasets.

Low-wage small firms Wage levels among small businesses vary substantially by industry (Appendix Table A7). In many small professional practices, such as accounting, law and medicine, pay averages well above median wage levels. Table 1 documents the low weekly and hourly wages in the three industries of our initial focus, and among teens. The QWI reports comparatively high wages for workers with a high school education or less because it excludes workers younger than 25.

Table 1. Wages and total employment by group, 2019q1

	All	722	445	452	HSOL	Teens
Average weekly wage (QWI, $)	1139	365	489	482	870	152
Average hourly wage (CPS, $)	18.17	10.46	12.86	13.18	15.29	9.95
Employment count (QWI)	121.42M	11.27M	2.95M	3.02M	44.66M	2.97M

Authors' calculations based on QWI and CPS. QWI data is averaged over states using population weights, CPS hourly wages are weighted by the outgoing rotation group person weights. QWI weekly wages are based on quarterly payroll and employment counts. As a reference point, the federal minimum wage at the time was $7.25 per hour (population weighted average of the effective minimum wage: $9); corresponding to a weekly wage of $290 for a full time employee ($364 at the average effective minimum wage). The CPS does not report NAICS industries, instead groups were selected based on the 1990 Census Bureau Industry Classification (abbreviated CI, variable IND1990 in IPUMS, see Flood et al., 2020). Column headers refer to All: all employment; 722: restaurants (NAICS 722, CI 641); 445: grocery stores (NAICS 445, CI 601); 452: general merchandise stores (NAICS 452, CI 591, 600); HSOL: workers with a high school diploma or less; Teens: workers aged 14-18. *Replication tag*: sa-wagesByGroup-to2019.

[7] The SBA uses 31 industry-based size standards, 16 of which are receipts-based thresholds. Of those 16 thresholds, only one is set at $1 million; all others are set at $6 million or above and range up to $41.5 million (FDIC, 2020).

Roadmap We describe our QWI dataset in Section 2. In Section 3 we introduce our methods and in Section 4 we present our main results: for workers in three low-wage industries, for workers in all low-wage sectors more generally and for young workers, as well as effects on establishment counts using the County Business Patterns data. Section 5 concludes.

2 Data

Our preferred results are based on the publicly-available Quarterly Workforce Indicators (QWI) from 1990 through 2019.[8] The QWI combines a large sample of administrative data with the most granular information on firm size. Over our sample period, QWI reports firm size in five size bins: 0-19, 20-49, 50-249, 250-499 and 500 plus. Our robustness tests draw on the County Business Patterns (CBP) dataset. We link these datasets to the regularly updated state minimum wage level data assembled by Vaghul and Zipperer (2016).[9]

QWI The QWI is based on the Census's administrative Longitudinal Employer-Household Dynamics dataset; it contains employment stocks and average weekly earnings for about 97 percent of workers. The QWI dataset provides data split by firm and worker dimensions, our analyses are based on data split by firm size and either the age and gender, or the education and gender of the worker. We focus first on effects in restaurants (NAICS 722), grocery stores (NAICS 445) and general merchandise stores (NAICS 452), then low-wage industries in general, and finally on teens (ages 14-18) and young workers (19-21).

Table 2 shows QWI state-level private-sector summary statistics for 1990-2019. State employment averages about 2.6 million workers, 9 percent of whom work in food services, 2.4 percent are 18 or under and 36 percent have at most a high school diploma.. Earnings in these groups are lower than in the overall economy and increase almost monotonically with firm size, consistent with the firm size wage premium literature (Pedace, 2010; Bayard and Troske, 1999). There are almost no general merchandise stores (NAICS 452) with fewer than 500 employees, therefore we merge these with grocery stores (NAICS 445) in our analyses.

CBP The CBP, which consists of data collected from different statistical sources, provides data for six employer size bins: 1-4, 5-9, 10-19, 20-49, 50-99 and 100-249. The sample sizes are two orders of magnitude smaller than in the QWI data, limiting the precision of some of our results. For these reasons, we mainly use the CBP to analyse the impact of the minimum wage on establishment counts (not available in the QWI) and consider the wage and employment results as robustness tests.

Minimum wages Since 1990 state minimum wages have increasingly diverged from the federal minimum wage. An increasing number of states have raised their state minimum wages above the federal level, with increasing variation among the state levels as well. Figure 2 shows the evolution of minimum wages at the state level, with the bottom line representing the federal floor. The

[8] We end our sample period in 2019 to avoid the confounding effects of the Covid pandemic. Changes in NAICS classifications in 2016 removed access in the publicly-available QWI to separate data on fast food (limited service) and full service restaurants. We therefore use an earlier vintage of the QWI with data through 2015 to test for heterogeneity between these two restaurant sectors in one of our robustness checks.

[9] The Current Population Survey collects annual data from workers on firm size. However, the population of individual CPS size bins is very noisy. We therefore do not use the CPS for our main results or robustness tests. Nonetheless, our estimates with the CPS, available on request, are consistent with our main results.

Table 2. QWI descriptive statistics by firm size

	All Workers	Industry 722	Industry 445	Industry 452	Teens	HSOL
Employment	2.58M (2.86M)	242K (276K)	62K (68K)	61K (62K)	64K (56K)	0.94M (1.06M)
0-19	18 %	21 %	15 %	1 %	20 %	19 %
20-49	10 %	20 %	7 %	0 %	16 %	10 %
50-249	15 %	19 %	9 %	1 %	18 %	16 %
250-499	7 %	5 %	3 %	0 %	5 %	6 %
500+	51 %	35 %	67 %	97 %	41 %	50 %
Earnings ($)	1 013 (181)	357 (59)	474 (78)	490 (65)	154 (27)	860 (98)
0-19	732 (112)	303 (51)	363 (54)	407 (73)	140 (28)	667 (76)
20-49	831 (128)	347 (58)	415 (68)	505 (128)	147 (30)	770 (88)
50-249	954 (151)	377 (70)	441 (75)	618 (199)	160 (33)	847 (95)
250-499	1 039 (188)	353 (71)	481 (131)	592 (340)	162 (31)	876 (96)
500+	1 178 (232)	392 (66)	510 (96)	491 (67)	163 (25)	963 (123)

Averages over the QWI samples (state-quarters, 119 quarters between 1990q2 and 2019q4), standard deviations in parentheses. Employment is a headcount, earnings refer to weekly earnings. See Table 1 for descriptions of the different samples.

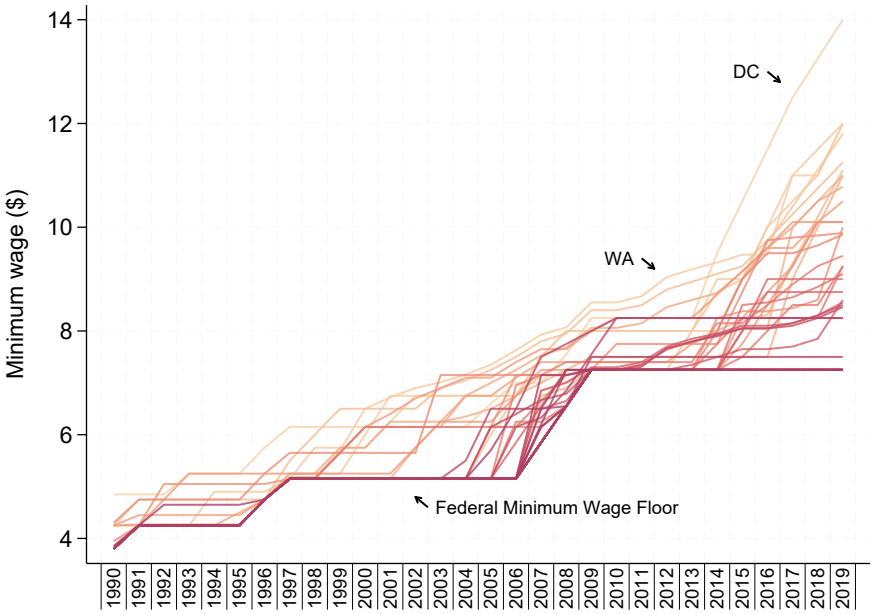


Figure 2. Evolution of effective state minimum wages between 1990 and 2019. Data source: Vaghul and Zipperer (2016). Replication tag: #figure-mw-overtime

District of Columbia had the highest minimum wage in 2019, at $14 per hour.

We observe 550 changes in state and federal minimum wages between 1990-2019, with an average size of $0.50 (8.4 percent). This count includes small cost-of-living changes, but excludes local (sub-state) minimum wage changes.

3 Stacked event study method

The minimum wage setting poses an econometric challenge because minimum wage changes are both repeated and staggered over time. As a result, both standard fixed effects models and standard staggered treatment effects models (Callaway and Sant'Anna, 2021; de Chaisemartin and d'Haultfoeuille, 2020) are imperfect options to produce reliable estimates. Instead, we base our preferred method on the stacked event study approach described in Cengiz et al. (2019, Online Appendix D), which produces reliable estimates in the minimum wage environment. We adapt their method to a setting with a frequently changed and continuous treatment variable.[10]

As the name suggests, we *stack* multiple event studies in one joint regression. In each event study, time is defined relative to the event studied; the minimum wage changing state is considered treated, all other states are controls. These other states might experience one or multiple minimum wage changes during the event window. Therefore, we add control variables that cumulate any confounding minimum wage changes over the event window. This gives rise to following regression equation,

$$y_{sqe} = \sum_{\tau=-2}^{4} \alpha_\tau I^\tau_{sqe} \Delta mw_{sqe} + \mu_{se} + \mu_{qe} + \omega_{sqe} + \epsilon_{sqe} \tag{1}$$

where y_{sqe} is the average hourly wage (2019$) in state s, quarter q, duplicated for each event e (if quarter q is in the window of event e). I^τ_{sqe} indicates whether the event e happened in state s and if quarter $q \in [q_e + 4(\tau - 1), q_e + 4\tau)$, where q_e is the event quarter. For example, if $\tau = 1$, then the indicator variable will be one during the event and the subsequent three quarters. This leads to three pre-treatment and four post-treatment years, with separate treatment effects α_τ each. We omit the indicator for the first pre-treatment year α_{-1}. Combined with the event-specific state and time fixed effects $\mu_{se} + \mu_{qe}$ this step ensures that all estimates are relative to that pre-treatment year.

We scale the treatment indicators with the size of the minimum wage change Δmw_{sqe} (log difference), as larger changes may have stronger effects.[11] Finally, ω_{sqe} controls for confounding events, which we split into regular and small events.[12] The small event control is the running sum of all small minimum wage changes (defined as less than five percent) over the event window per state. The regular event control is the running sum of all other minimum wage changes, excluding the studied event e.

[10] We also apply this method in Wursten and Reich (2021).

[11] This scaling is not present in Cengiz et al. (2019) because their observations are wage cells, for example [$7.25, $7.50); whether a cell is affected by minimum wage policy depends on the level of the new minimum wage, not the size of the change.

[12] We maintain the small-large distinction to remain consistent with Cengiz et al. (2019), even though it is not strictly required in our setup– which explicitly takes the size of confounding minimum wage changes into account.

We consider all minimum wage changes larger than five percent (in nominal terms) between 1974-2019 as events and control separately for all smaller changes. We do not differentiate between state and federal events, but our setup omits federal events whenever there is no state variation in the effective change in the minimum wage.[13] Appendix Figure A1 shows all events by state, quarter and type.

4 Results

We present here results for the restaurant, grocery and general merchandise industries –our three low-wage industries, followed by results for the set of other low-wage industries, then for teens and young adults, and finally robustness tests using the CBP data. For each group, we show wage and employment effects for all the size bins available in the QWI.

4.1 Low-wage industries: significant wage effects, no disemployment effects

In line with other minimum wage studies (Dube, Lester and Reich, 2016), we find significant wage effects in the restaurant industry. Table 3 shows average elasticities over the post period. The overall wage elasticity is 0.16, implying that a 10 percent minimum wage change increases average wages in this sector by 1.6 percent. As these wages are based on quarterly payroll data, this positive effect precludes sizeable reductions in hours worked. The effect is stable across firm sizes, dropping slightly for very large firms (500+ employees). The outsized effect for semi-large firms (250-499 employees) is likely a statistical anomaly: as the last row shows, very few workers in this sector are employed in firms in this size bin.[14]

These robust wage effects do not lead to significant disemployment effects. Point estimates are close to zero for all size classes (excluding the anomalous 250-499 group, see above) and the standard errors are small. For example, for small firms between 0 and 19 employees, the 95 percent confidence interval excludes employment elasticities larger than -0.06. The own wage employment elasticity, which relates changes in the average wage to employment changes is -0.07. As such, it is far from the threshold value of -1 where employment losses outweigh wage gains: the policy is thus a net positive for workers in this segment.[15] As Figure 3 highlights for small firms, these results are free of meaningful pre-trends, suggesting they are not driven by pre-existing differential trends in wages and employment.[16]

We show results for grocery and general merchandise stores in Table 4. Wage elasticities are positive and significant for smaller firms (+0.12, s.e. 0.02 for 0-19 employees, +0.10, s.e. 0.03 for 20-49 employees). The minimum wage does not have any bite in very large firms (-0.00, s.e. 0.02) where

[13] Cengiz et al. (2019) omit federal events because their binned setup requires variation in minimum wage levels between states. However, as our analysis is based on the *change* in the minimum wage, we can still extract information from federal minimum wage changes even if only some states had different minimum wage levels *before* the change.

[14] Indeed, for this size group, we omit more than half of all states because they had fewer than ten such-sized firms in some quarters.

[15] Appendix Tables A5 and A6 show that these conclusions also hold for limited and full service restaurants separately. These tables also show that wage increases are higher in limited service restaurants.

[16] Figures A2 and A3 show that these trends are absent for all firm sizes.

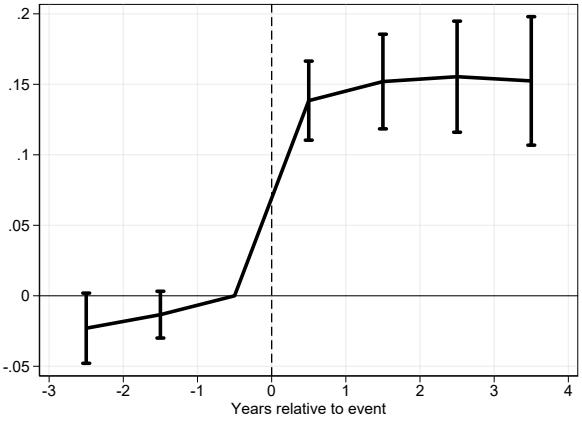
Table 3. Stacked event study, multiple firm size groups
Restaurants (NAICS 722) 1990-2019

	Firm size →	All	0-19	20-49	50-249	250-499	500+
Weekly earnings	Log Minimum Wage	0.16	0.15	0.17	0.18	0.28	0.12
		(0.02)	(0.02)	(0.02)	(0.02)	(0.04)	(0.02)
	N (event-quarter-state)	347658	347658	347658	342067	166976	293546
Employment	Log Minimum Wage	-0.02	-0.01	-0.05	-0.03	-0.07	0.03
		(0.02)	(0.03)	(0.02)	(0.04)	(0.09)	(0.03)
	N (event-quarter-state)	347658	347658	347658	342067	166976	293546
	Group size in 2019Q4	11.7 M	22 %	19 %	19 %	5 %	35 %

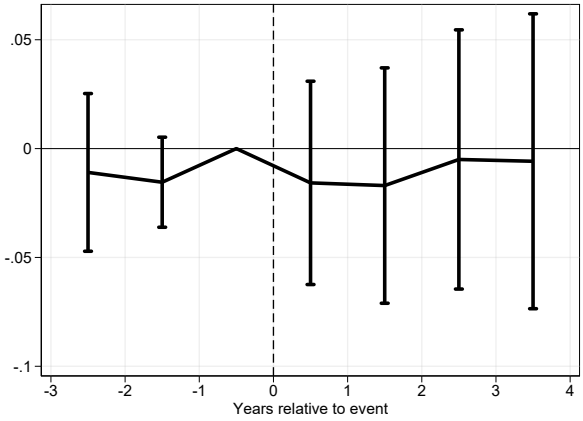
Notes: All dependent variables are in logs. Analysis at the event-quarter-state level, data based on QWI data. We exclude state and firm size combinations that potentially include fewer than ten firms. We find positive earnings effects for all firm size groups. Employment effects are muted and insignificant. Among firms with 250-499 employees, the employment effect is insignificant but with a modestly negative point estimate. There are almost no firms in this size class. Weighted by state level population. Standard errors are clustered at the state level and shown in parentheses. Replication tag: #ses-qwi722-to2019-baseline.

Figure 3. Stacked event study, food services sector (NAICS 722), firms with 0-19 employees, 1990-2019. Wage and employment effects over time.

(a) Wage elasticity



(b) Employment elasticity



Notes: Wage and employment elasticities over time for firms with 0-19 employees, related to Table 3. Elasticities are small and insignificant in the pretreatment period, indicating an absence of differential pre-existing trends in both wage and employment evolutions. Whiskers show 95 percent confidence intervals. Replication tag: #ses-qwi722-to2019-baseline.

wages often exceed minimum wage levels. The wage gains in the smaller stores do not lead to significant disemployment effects although confidence intervals are wider than in the restaurant industry. In particular, the 95 percent confidence interval for stores with 20-49 employees spans $[-0.12, 0.20]$.

Table 4. Stacked event study, multiple firm size groups
General merchandise and grocery stores (NAICS 445+452), 1990-2019

	Firm size →	All	0-19	20-49	50-249	250-499	500+
Weekly earnings	Log Minimum Wage	0.01	0.12	0.10	0.04	0.26	-0.00
		(0.02)	(0.02)	(0.03)	(0.05)	(0.00)	(0.02)
	N (event-quarter-state)	347658	347658	331712	185207	13858	343165
Employment	Log Minimum Wage	-0.00	-0.03	0.04	0.09	0.39	-0.02
		(0.02)	(0.04)	(0.08)	(0.09)	(0.00)	(0.02)
	N (event-quarter-state)	347658	347658	331712	185207	13858	343165
	Group size in 2019Q4	5.9 M	8 %	4 %	5 %	1 %	82 %

Notes: All dependent variables are in logs. Analysis at the event-quarter-state level, data based on QWI data. We exclude state and firm size combinations which potentially include fewer than ten firms. There are relatively few firms in the 50-499 employees size classes. Weighted by state level population. Standard errors are clustered at the state level and shown in parentheses. Replication tag: #ses-qwi452p445-to2019-baseline.

The restaurant, grocery store and general merchandise store industries account for about 36 percent of all minimum wage workers (see Appendix Table A1). We turn next to the effects in a broader group of low-wage industries.

Figures 4 and 5 show that the results above hold more generally for all low wage sectors. We define a low-wage industry as any three and four digit naics industry in which the average weekly wage in 1990 was less than two times the prevailing federal minimum wage, \$268[17], and that employed at least 100,000 workers nationwide.[18] We list the included industries in Appendix Table A7.

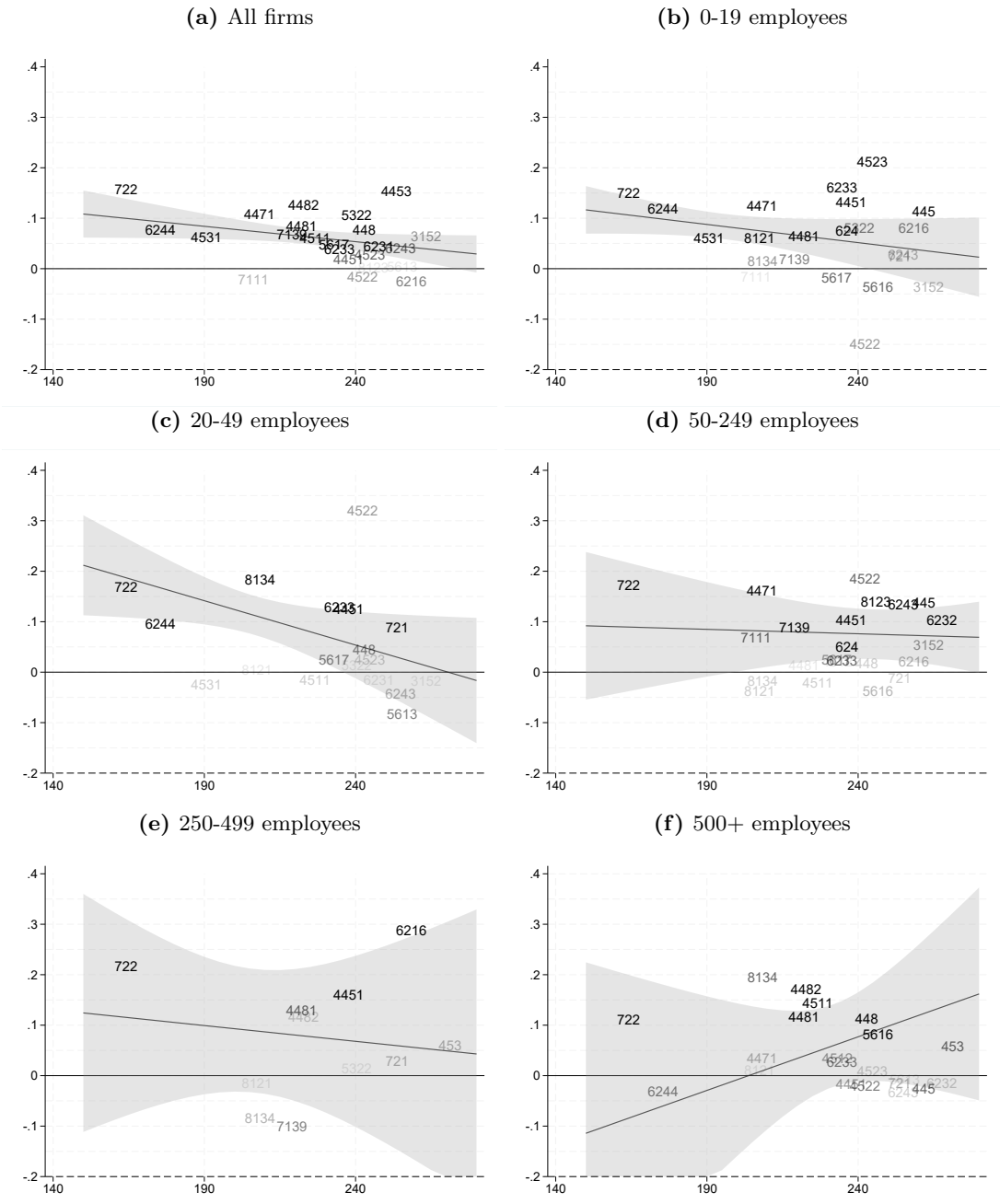
Next, we apply Equation (1) to QWI data for those industries. The industry labels in Figure 4 show the industry-specific earnings elasticities for all firm size groups. The solid black line is a weighted OLS prediction of the relation between initial 1990 wages and the earnings elasticity.[19] This line is downward sloping and close to zero at the right end of the initial wage distribution, suggesting earnings elasticities are larger in lower wage sectors and likely to be close to zero for sectors above the \$268 threshold. Consistent with the previous results, earnings effects are smaller to non-existent in firms with more than 500 employees.

[17] $2 \times 3.35 \frac{\$}{hour} \times 40 \frac{hours}{week}$

[18] Additionally, we require that the industry employs more than 25,000 workers in at least three size groups and are not part of the agriculture super-sector. A list of excluded industries can be found in Appendix Table A8. We allow both 3 and 4 digit NAICS industries because of the considerable size variation among industries of the same aggregation level. We retain the 4-digit sector if it is sufficiently large or covers the entire 3-digit sector. We switch to the 3-digit sector if the 4-digit sector is too small.

[19] We do not use inverse variance weighting because this leads to excessively large weights for very precise estimates. Instead, we use $(1 - pvalue) * 5$ weights. As a result, an observation with a p-value of zero gets five times more weight than an observation with a p-value of one.

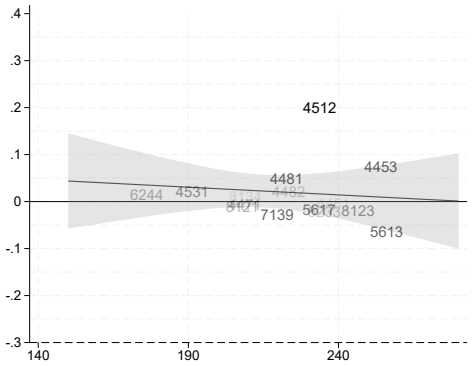
Figure 4. Earnings elasticities with respect to the minimum wage, all low wage industries QWI, Stacked Event Study, 1990-2019.



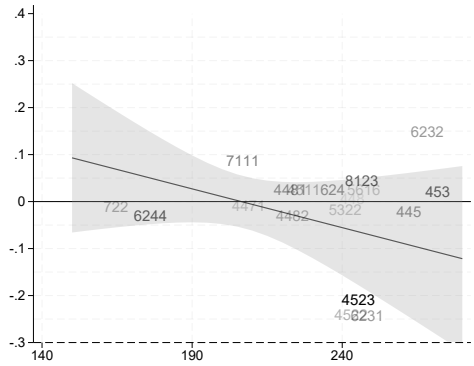
Notes: X-axis shows 1990 weekly wages per sector. Line shows precision-weighted OLS predictions of the relation between initial wages and earnings elasticities. We weight observations with a factor $(1-pvalue)*5$ such that coefficients with a p-value of zero have a five times larger weight than coefficients with a p-value of one. We do not use inverse variance weighting because this lead to excessively large weights for very precise estimates. We omit industries where the average pre-treatment coefficient is a) more than half the size of the post-treatment effect *and* b) larger than 0.05. Shaded area is the 95% confidence interval. Each number represents an observation, either a 3 digit or 4 digit NAICS industry. Lighter numbers are less significant estimates. *Replication tag*: #ses-allSectors.

Figure 5. Employment elasticities with respect to the minimum wage, all low wage sectors. QWI, Stacked Event Study, 1990-2019.

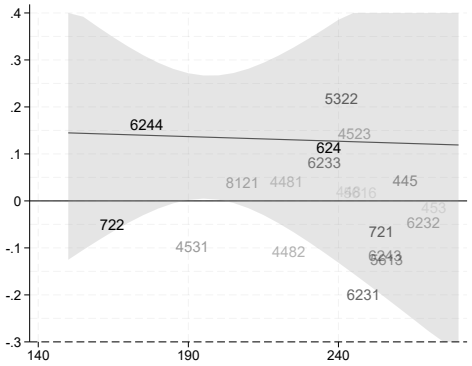
(a) All firms



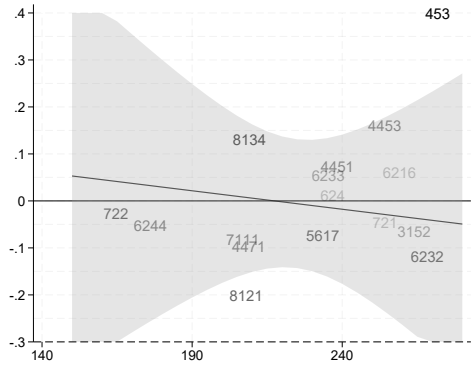
(b) 0-19 employees



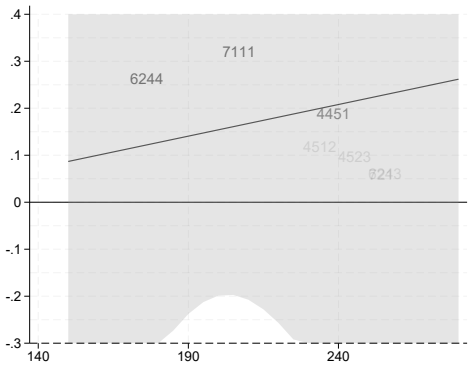
(c) 20-49 employees



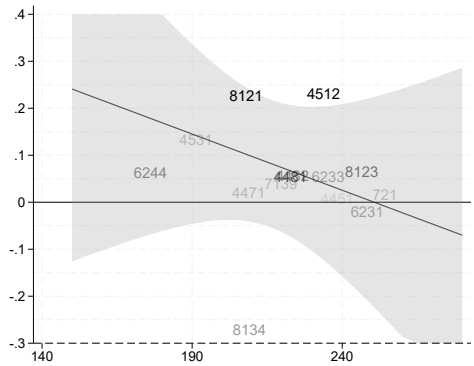
(d) 50-249 employees



(e) 250-499 employees



(f) 500+ employees



Notes: See Table 4. *Replication tag*: #ses-allSectors.

We do not find a similarly clear-cut link for employment effects in Figure 5. The *aggregate* relation is flat and indistinguishable from zero, with narrow confidence bands (Panel a). By firm size, the relation between initial wages and employment elasticities remains insignificant throughout the wage distribution. These overall low wage sector results are consistent with the food services and grocery and general merchandise store specific results: robust wage gains in firms with less than 500 employees and the absence of significant disemployment effects in any size bin.

4.2 Teens and young workers: large wage effects, some disemployment effects

4.2.1 Teens 14 to 18

Wage elasticities of teens 14 to 18 are positive and significant in all size bins and modestly higher in the larger size bins (Table 5). These results indicate that wages for teens 14 to 18 were lower in large chains than in small businesses. We find significant declines in teen employment for small and medium sized firms (up to 249 employees), whereas employment stays stable in larger sized employers.

These teens as a group are better off after a minimum wage increase, as wage gains outweigh the disemployment effect in all size groups. Across all firms, wage elasticities for 14 to 18 year olds are 0.21 (similar to findings in other studies) and much larger than the estimated disemployment effect (-0.09). In very large firms, which account for 41 percent of all teen employment, wage gains are similar while employment is not changed (-0.03, s.e. 0.09).

The overall gains for teens may be even greater, as the observed employment losses might reflect reductions in high school dropout rates and increased time spent studying, rather than reduced employer demand. Smith (2021) finds that a 10 percent increase in the minimum wage reduces the high school dropout rate by about ten percent among low socioeconomic status (SES) students, but not among high SES students. In other words, minimum wages increase schooling levels among more at-risk students.

Additional evidence of teens' supply-side response to higher minimum wages comes from the spread of state college scholarship programs. Since 1988 25 states have added merit aid college scholarship programs for their graduating seniors. Frisvold and Pitts (2018) find that the labor force participation of teens fell more in the states with more selective GPA and test score criteria than in the states with less selective criteria. In the more selective states, higher minimum wages induced teens to work less and study more.

The findings in these two studies suggest that many teens are on a backward-bending section of their labor supply schedule, where minimum wage increases induce reductions in labor supply. Given the many benefits of educational attainment, the long term impact on teens substituting time studying for time working in the labor market should be considered a benefit, not a cost, of minimum wage policies.

This tension between employment and wages appears absent in large firms (500+). This is consistent with a monopsony labor market model, where the bargaining power of the employer allows it to set wages closer to the outside option of the worker than to their marginal product of labor (MPL). Higher minimum wages shift this balance toward the worker without necessarily leading to wages

that exceed their MPL. Thus, low-wage workers receive higher wages while the employer has no incentive to let go off the worker.

Table 5. Stacked event study, multiple firm size groups
Teens 14-18, 1990-2019

	Firm size →	All	0-19	20-49	50-249	250-499	500+
Weekly earnings	Log Minimum Wage	0.21	0.15	0.28	0.24	0.44	0.21
		(0.03)	(0.03)	(0.03)	(0.04)	(0.09)	(0.03)
	N (event-quarter-state)	347658	347658	343165	241627	33643	253075
Employment	Log Minimum Wage	-0.09	-0.10	-0.10	-0.18	-0.16	-0.03
		(0.05)	(0.04)	(0.06)	(0.06)	(0.24)	(0.09)
	N (event-quarter-state)	347658	347658	343165	241627	33643	253075
	Group size in 2019Q4	3.1 M	21 %	16 %	17 %	5 %	41 %

Notes: All dependent variables are in logs. Analysis at the event-quarter-state level, data based on QWI data. We exclude state and firm size combinations which potentially include fewer than ten firms. Weighted by state level population. Standard errors are clustered at the state level and shown in parentheses. Replication tag: #ses-qwi1418-to2019-baseline.

4.2.2 Young workers 19 to 21

As Table 6 shows, the effects on workers 19 to 21 accord more with the industry-specific results. Wage gains are about +0.10 in all firm size groups and no significant disemployment effects appear in any firm size group. This age group does not include high school students, supporting the labor supply interpretation above of the effects on teens 14 to 18.

4.3 High school or less: neither wage nor employment effects

Appendix Tables A2 and A3 show that we find only small positive wage effects and no employment effects for workers with, respectively, no high school diploma or only a high school diploma. This result holds among all firm size groups and is likely a consequence of the low share of minimum wage workers in this group, especially as the QWI education data excludes workers younger than 25. Unfortunately the QWI data does not allow us to impose a wage restriction to increase this share. The CPS allows a wage restriction, but its sample of observations with firm size information and low educational attainment is too small for meaningful analysis.

4.4 Robustness checks

We use annual County Business Pattern (CBP) data to perform robustness checks. The CBP also allows us to examine the effects of minimum wages on the overall number and size distribution of establishments.

Table 6. Stacked event study, multiple firm size groups
Young adults 19-21, 1990-2019

Firm size →		All	0-19	20-49	50-249	250-499	500+
Weekly earnings	Log Minimum Wage	0.10	0.10	0.09	0.11	0.15	0.11
		(0.03)	(0.03)	(0.03)	(0.03)	(0.05)	(0.03)
	N (event-quarter-state)	347658	347658	347658	321387	123772	323368
Employment	Log Minimum Wage	-0.04	-0.05	-0.03	-0.06	-0.06	-0.02
		(0.02)	(0.02)	(0.02)	(0.02)	(0.05)	(0.03)
	N (event-quarter-state)	347658	347658	347658	321387	123772	323368
	Group size in 2019Q4	5.9 M	17 %	11 %	15 %	5 %	52 %

Notes: All dependent variables are in logs. Analysis at the event-quarter-state level, data based on QWI data. We exclude state and firm size combinations which potentially include fewer than ten firms. Weighted by state level population. Standard errors are clustered at the state level and shown in parentheses. Replication tag: #ses-qwi1921-to2019-baseline.

We apply the same methods to the CBP data as we used for the QWI. The results in Appendix Tables A9 and A10 paint a picture that is similar to our main industry results. Effects on pay are significant in the restaurant sector and more difficult to detect among grocery stores, which pay workers more than do restaurants. We do not detect evidence of disemployment effects in any size bin. We also do not detect a reduction in the number of establishments or any reallocation in the size distribution of establishments.

5 Discussion and conclusions

Discussions of minimum wage policies often assume that wage and employment effects will be larger in small businesses than in larger ones. This assumption has not heretoforce been tested empirically. We therefore conduct the first systematic causal investigation of minimum wage effects by firm size.

We use minimum wage variation since 1990 to conduct a stacked event study and deploy two datasets– the quarterly administrative data on pay and employment in the Quarterly Workforce Indicators (QWI) and the annual administrative data on pay and employment in County Business Patterns (CBP). The QWI provides the most granular data by firm size, allowing us to examine effects in employer bin sizes that range from less than 20 employees to 500 employees or more.

We first examine effects in the three three-digit industries with the largest proportions of minimum wage workers in their workforce. These industries– restaurants, grocery stores and general merchandise stores– also account for the largest proportions of all minimum wage workers. We then examine effects in other low-wage industries and among teens 14-18 and young workers 19-21. Our results across all samples find significant wage effects in all size bins, with somewhat greater wage effects among smaller businesses. We do not detect employment effects in any of our employer size bins in any low-wage industry. We do find modest employment declines among teens in smaller firms; these may reflect effects on teen labor supply rather than on labor demand. The combination

of positive wage effects without employment declines for teens in large firms supports a monopsony model of the low-wage labor market.

Our event studies find parallel trends in pre-periods. Our robustness tests, which draw from the CBP, support our main pay and employment findings. The CBP results also do not exhibit evidence of any declines in the number of establishments overall, nor in specific employer size bins.

We conclude that minimum wages cause modestly higher wage increases in smaller low-wage firms than in larger low-wage firms. This result is consistent with the continuing size wage premia in low-wage industries. We also conclude that minimum wages do not cause disemployment effects among low-wage industries in any size bin. We find some modest disemployment effects among teens, which may reflect labor supply rather than labor demand responses to minimum wages.

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Appendix A Additional tables and figures

Table A1. Distribution of affected workers by industry, 2019

Code	Industry Title	Share of affected workers (share of all workers)	Share of affected workers within industry	Affected workers
722	Food Services and Drinking Places	20 (8)	56	6,749,959
44-45	Retail Trade	16 (11)	35	5,551,425
62	Health Care and Social Assistance	13 (14)	21	4,501,840
56	Administrative and Support and Waste Management and Remediation Services	7 (6)	27	2,494,844
61	Educational Services	7 (9)	17	2,310,938
31-33	Manufacturing	6 (9)	16	2,052,810
81	Other Services (except Public)	3 (3)	28	1,173,831
54	Professional, Scientific, and Technical Services	3 (6)	12	1,087,371
48-49	Transportation and Warehousing	3 (4)	17	1,069,060
99	Federal, State, and Local Government (excl. schools, hospitals, post)	3 (7)	11	1,063,781
42	Wholesale Trade	3 (4)	18	1,027,992
23	Construction	3 (5)	11	854,452
721	Accommodation	2 (1)	38	814,050
71	Arts, Entertainment, and Recreation	2 (2)	32	800,533
52	Finance and Insurance	2 (4)	13	716,377
53	Real Estate and Rental and Leasing	1 (2)	22	496,555
51	Information	1 (2)	14	410,330
11	Agriculture Supersector	1 (0)	67	288,757
55	Management of Companies	1 (2)	10	248,927
21	Mining Supersector	0 (0)	7	49,577
22	Utilities	0 (0)	2	9,113

Shares are in percentages. Workers are classified as affected if they earn less than 1.5 times the state minimum wage. Wages at the 10th, 25th, 50th and 90th percentile per state and industry obtained from the Occupational Employment Statistics (OES) Research Estimates. We fit a linear regression through those four points and invert it to derive an approximate share of affected workers. *Replication tag*: sa-mwWorkers.

Table A2. Stacked event study, multiple firm size groups.
Persons without a high school diploma, 1990-2019.

	Firm size →	All	0-19	20-49	50-249	250-499	500+
Weekly earnings	Log Minimum Wage	0.03	0.03	0.04	0.03	0.03	0.00
		(0.02)	(0.01)	(0.01)	(0.02)	(0.03)	(0.01)
	N (event-quarter-state)	347658	347658	347658	342474	221315	321610
Employment	Log Minimum Wage	0.01	0.01	-0.00	0.02	-0.03	0.02
		(0.01)	(0.01)	(0.02)	(0.02)	(0.04)	(0.01)
	N (event-quarter-state)	347658	347658	347658	342474	221315	321610
	Group size in 2019Q4	16.4 M	20 %	10 %	16 %	6 %	48 %

Notes: All dependent variables are in logs. Analysis at the event-quarter-state level, data based on QWI data. We exclude state and firm size combinations which potentially include fewer than ten firms. Weighted by state level population. Standard errors are clustered at the state level and shown in parentheses. Replication tag: #ses-qwiLTH-to2019-baseline.

Table A3. Stacked event study, multiple firm size groups.
Persons with (only) a high school diploma, 1990-2019.

	Firm size →	All	0-19	20-49	50-249	250-499	500+
Weekly earnings	Log Minimum Wage	0.02	0.02	0.03	0.02	0.04	0.01
		(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)
	N (event-quarter-state)	347658	347658	347658	347658	286759	347658
Employment	Log Minimum Wage	0.01	0.01	0.00	0.02	-0.00	0.02
		(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)
	N (event-quarter-state)	347658	347658	347658	347658	286759	347658
	Group size in 2019Q4	29.2 M	19 %	10 %	15 %	6 %	50 %

Notes: All dependent variables are in logs. Analysis at the event-quarter-state level, data based on QWI data. We exclude state and firm size combinations which potentially include fewer than ten firms. Weighted by state level population. Standard errors are clustered at the state level and shown in parentheses. Replication tag: #ses-qwiHS-to2019-baseline.

Table A4. Firm sizes, establishments and employee counts in 2017. Restaurant sector only (NAICS 722).

Firm size	Number of firms		Establishments		Employees	
< 5	178,582	37%	178,988	27%	293,982	2%
5-9	95,618	20%	95,911	15%	642,658	5%
10-19	95,924	20%	97,046	15%	1,313,503	11%
20-99	103,397	21%	121,405	18%	3,854,629	32%
100-499	8,695	2%	42,544	6%	1,559,353	13%
500+	1,885	0%	121,898	19%	4,312,653	36%
Total	484,101	100%	657,792	100%	11,976,778	100%

Source: https://www.census.gov/data/tables/2017/econ/susb/2017-susb-annual.html, *Replication tag*: ptd-ss-estabs-722.

Table A5. Stacked event study, multiple firm size groups
Full service restaurants (NAICS 7221) 1990-2015

	Firm size $\rightarrow$	All	0-19	20-49	50-249	250-499	500+
Weekly earnings	Log Minimum Wage	0.14	0.16	0.18	0.16	0.26	0.06
		(0.02)	(0.03)	(0.03)	(0.02)	(0.20)	(0.04)
	N (event-quarter-state)	272409	272409	272409	235791	18517	199576
Employment	Log Minimum Wage	-0.06	-0.06	-0.08	-0.05	0.39	0.07
		(0.02)	(0.06)	(0.05)	(0.07)	(0.48)	(0.06)
	N (event-quarter-state)	272409	272409	272409	235791	18517	199576
	Group size in 2014Q1	4.5 M	20 %	24 %	20 %	3 %	33 %

Notes: All dependent variables are in logs. Analysis at the event-quarter-state level, data based on QWI data. We exclude state and firm size combinations that potentially include fewer than ten firms. We find positive earnings effects for all firm size groups. Employment effects are muted and insignificant. There are relatively few firms with 250-499 employees class. Weighted by state level population. Standard errors are clustered at the state level and shown in parentheses. Replication tag: #ses-qwi7221-to2015-baseline.

Table A6. Stacked event study, multiple firm size groups
Limited service restaurants (NAICS 7222) 1990-2015

	Firm size →	All	0-19	20-49	50-249	250-499	500+
Weekly earnings	Log Minimum Wage	0.15	0.18	0.18	0.13	0.20	0.10
		(0.03)	(0.03)	(0.03)	(0.03)	(0.08)	(0.04)
	N (event-quarter-state)	272409	272409	268024	218220	85916	191606
Employment	Log Minimum Wage	-0.04	-0.01	-0.01	-0.09	-0.09	0.00
		(0.03)	(0.05)	(0.08)	(0.07)	(0.15)	(0.07)
	N (event-quarter-state)	272409	272409	268024	218220	85916	191606
	Group size in 2014Q1	4.2 M	20 %	14 %	20 %	9 %	37 %

Notes: All dependent variables are in logs. Analysis at the event-quarter-state level, data based on QWI data. We exclude state and firm size combinations that potentially include fewer than ten firms. We find positive earnings effects for all firm size groups. Employment effects are relatively muted and insignificant. There are relatively few firms with 250-499 employees class. Weighted by state level population. Standard errors are clustered at the state level and shown in parentheses. Replication tag: #ses-qwi7222-to2015-baseline.

Table A7. Included low wage sectors, average earnings and employment in 1990.

Code	NAICS 2002 Title	Wage (in $)	Emp (mio)
722	Food services and drinking places	159	6.1
6244	Child day care services	169	0.4
4531	Florists	184	0.1
7111	Performing arts companies	199	0.3
8121	Personal care services	201	0.4
4471	Gasoline stations	201	0.9
8134	Civic and social organizations	202	0.3
7139	Other amusement and recreation industries	212	0.6
4481	Clothing stores	215	0.9
4482	Shoe stores	216	0.2
4511	Sporting goods and musical instrument stores	220	0.3
5617	Services to buildings and dwellings	226	1.1
4512	Book, periodical, and music stores	226	0.2
6233	Community care facilities for the elderly	228	0.3
624	Social assistance	231	1.1
4451	Grocery stores	231	1.6
5322	Consumer goods rental	234	0.2
4521	Department stores	236	1.6
448	Clothing and clothing accessories stores	237	1.3
4529	Other general merchandise stores	238	0.9
8123	Drycleaning and laundry services	239	0.4
5616	Investigation and security services	240	0.5
6231	Nursing care facilities	241	1.2
4453	Beer, wine, and liquor stores	247	0.1
6243	Vocational rehabilitation services	248	0.2
721	Accommodation	248	1.5
5613	Employment services	249	1.4
6216	Home health care services	252	0.3
445	Food and beverage stores	256	2.6
3152	Cut and sew apparel manufacturing	257	0.8
6232	Residential mental health facilities	261	0.3
453	Miscellaneous store retailers	266	0.7

Wage refers to nation-wide average weekly wages in 1990 (1990 dollars). *Emp* is total employment in 1990 (in millions). This table uses the NAICS 2002 sector classification as we use the 1990 wage to detect low wage sectors. The regressions of Figures 4 and 5 are based on the equivalent NAICS 2017 sectors. *Replication tag*: satabulateLowWageIndustries-included.

Table A8. *Excluded* low wage sectors, average earnings and employment in 1990.

Code	NAICS 2002 Title	Wage (in $)	Emp (mio)
	Too small		
7213	Rooming and boarding houses	167	0.01
814	Private households	176	0.26
8141	Private households	176	0.26
4854	School and employee bus transportation	202	0.12
1113	Fruit and tree nut farming	207	0.11
1124	Sheep and goat farming	211	0.00
1142	Hunting and trapping	214	0.00
1112	Vegetable and melon farming	214	0.07
4533	Used merchandise stores	223	0.05
6116	Other schools and instruction	228	0.09
7212	Rv parks and recreational camps	236	0.02
8131	Religious organizations	238	0.09
7132	Gambling industries	245	0.03
1132	Forest nursery and gathering forest products	247	0.00
4853	Taxi and limousine service	254	0.06
4872	Scenic and sightseeing transportation, water	255	0.01
4859	Other ground passenger transportation	264	0.02
1119	Other crop farming	265	0.06
4855	Charter bus industry	267	0.02
	Inferior Duplicate		
7224	Drinking places, alcoholic beverages	143	0.38
7221	Full-service restaurants	161	2.37
7223	Special food services	170	0.40
72	Accommodation and food services	177	7.60
447	Gasoline stations	201	0.86
451	Sporting goods, hobby, book and music stores	222	0.50
713	Amusements, gambling, and recreation	226	0.73
452	General merchandise stores	236	2.56
7211	Traveler accommodation	239	1.09
812	Personal and laundry services	245	1.08
623	Nursing and residential care facilities	245	1.86
315	Apparel manufacturing	260	0.89
	Agriculture		
1151	Support activities for crop production	224	0.16
115	Agriculture and forestry support activities	231	0.20
111	Crop production	246	0.42
11	Agriculture, forestry, fishing and hunting	266	0.90

See also notes to Appendix Table A7. *Inferior duplicate* refers to sectors excluded because they are almost entirely covered by its subsectors (e.g. 4471 fully covers 447) or the super sector has better coverage across firm sizes than its subsectors. *Replication tag*: satabulateLowWageIndustries-excluded.

Table A9. Stacked event study, multiple firm size groups.
Food services sector (NAICS 722), 1990-2018. *CBP dataset.*

	Firm size →	All	1-19	20-49	50-99	100-249
Weekly earnings	Log Minimum Wage	0.14	0.14	0.17	0.16	0.06
		(0.02)	(0.03)	(0.03)	(0.03)	(0.04)
	N	125516	124768	121694	118419	82217
Employment	Log Minimum Wage	-0.02	-0.02	-0.00	-0.11	0.08
		(0.02)	(0.10)	(0.02)	(0.06)	(0.08)
	N	125516	124768	122080	118419	82217
Establishment	Log Minimum Wage	-0.00	0.02	0.00	-0.08	-0.01
		(0.02)	(0.02)	(0.02)	(0.06)	(0.08)
	N	125562	125562	125562	125562	103404

Notes: All dependent variables are in logs. Analysis at the event-year-state level, based on CBP data. We exclude state and firm size combinations which include fewer than ten firms. Weighted by state level population. Standard errors are clustered at the state level and shown in parentheses. Replication tag: #ses-cbp722-baseline.

Table A10. Stacked event study, multiple firm size groups.
Grocery stores (NAICS 445), 1990-2018. *CBP dataset.*

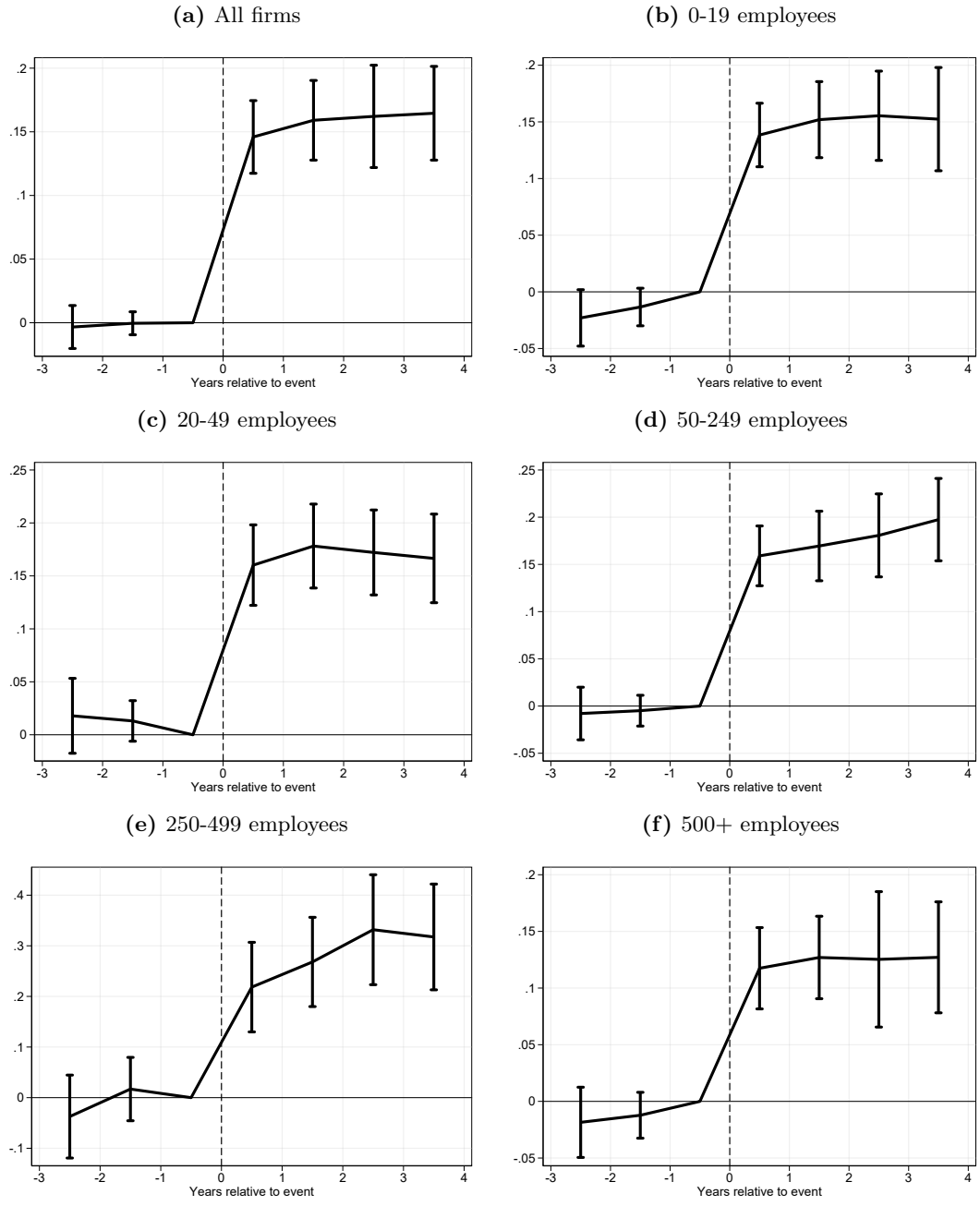
	Firm size →	All	1-19	20-49	50-99	100-249
Weekly earnings	Log Minimum Wage	0.05	0.04	0.11	-0.05	0.14
		(0.03)	(0.02)	(0.05)	(0.05)	(0.06)
	N	125516	125449	117608	104715	75478
Employment	Log Minimum Wage	-0.01	-0.07	0.03	-0.09	0.16
		(0.04)	(0.04)	(0.07)	(0.11)	(0.13)
	N	125516	125449	117608	104715	75689
Establishment	Log Minimum Wage	-0.01	0.01	0.04	-0.07	0.17
		(0.03)	(0.04)	(0.07)	(0.08)	(0.11)
	N	125562	125562	125562	123100	113252

Notes: All dependent variables are in logs. Analysis at the event-year-state level, based on CBP data. We exclude state and firm size combinations which include fewer than ten firms. Weighted by state level population. Standard errors are clustered at the state level and shown in parentheses. Replication tag: #ses-cbp445-baseline.

Figure A1. All minimum wage events. 1977-2019

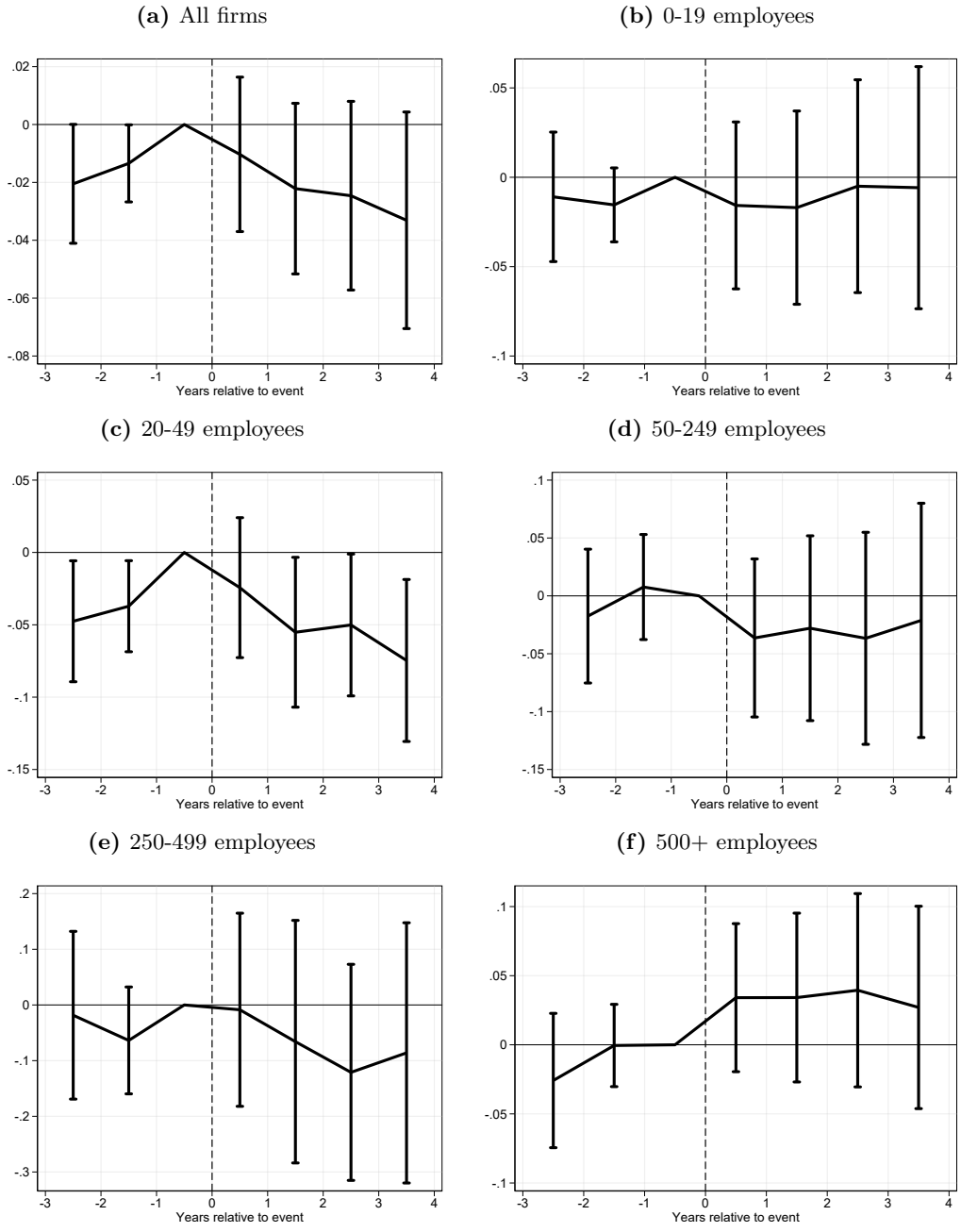
Notes: Figure shows all events between 1977-2019. The data only starts in 1982, so the federal changes in the years before only have a minor impact on the regressions. Markers are scaled by the size of the event. We define federal events as events happening during federal minimum wage change quarters, which explains why they are larger in particular states. Notice how especially the effective impact of the federal changes of 2007-2009 differ substantially by state. Source: Wursten and Reich (2021).

Figure A2. Stacked event study, food services sector (NAICS 722), 1990-2019. Wage elasticities over time by firm size.



Notes: Wage elasticities over time by firm size, related to Table 3. Whiskers show 95 percent confidence intervals *Replication tag*: #ses-qwi722-to2019-base.

Figure A3. Stacked event study, food services sector (NAICS 722), 1990-2019. Employment elasticities over time by firm size.



Notes: Employment elasticities over time by firm size, related to Table 3. Whiskers show 95 percent confidence intervals *Replication tag*: #ses-qwi722-to2019-base.