City Size, Monopsony, and the Employment Effects of Minimum Wages

Appendix — For Online Publication

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A Supporting Figures and Tables

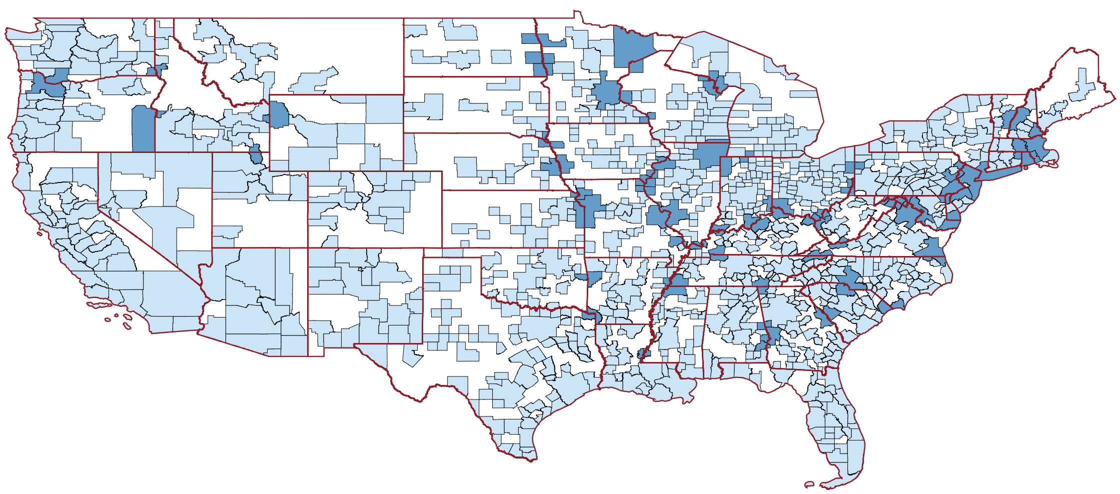


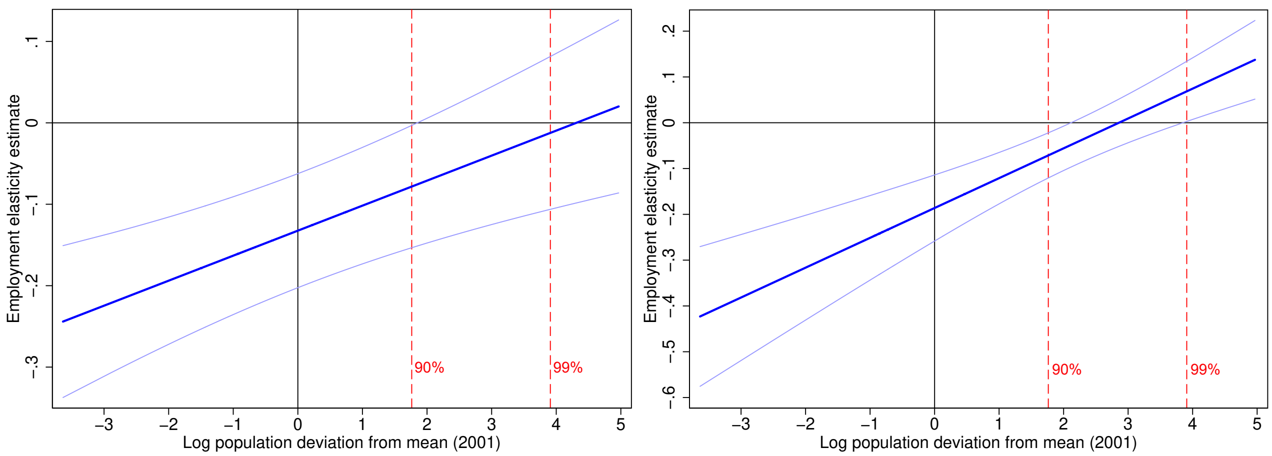
Figure A-1: The 919 Core-Based Statistical Areas (61 multi-state CBSAs in darker shade)

Notes: This map was created using Census TIGER files, which do not clip water bodies, as is particularly evident from the irregular shape of states with substantial coastlines or bodies of water, such as Michigan.

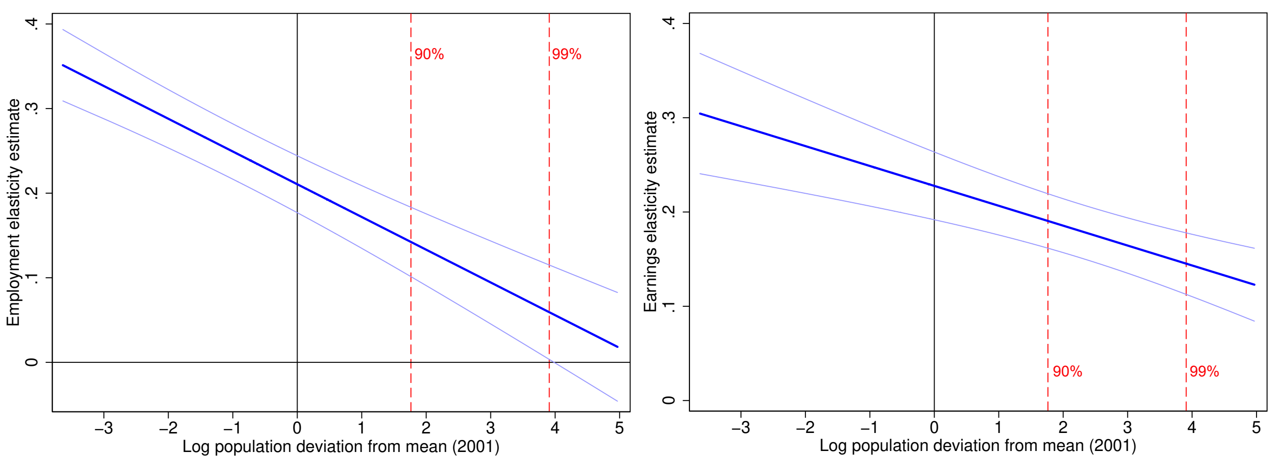
Table A-1: Correlations between monopsony power proxies

	θ_1^J	θ_2^J	θ_3^J	θ_4^J	θ_5^J	θ_6^J	θ_7^J	θ_8^J	θ_1^Q	θ_2^Q	θ_3^Q	θ_4^Q	θ_5^Q	θ_6^Q	θ_7^Q	θ_1^N	θ_2^N	θ_3^N	θ_4^N	$\ln P$
θ_1^J	1.00																			
θ_2^J	0.94	1.00																		
θ_3^J	0.83	0.85	1.00																	
θ_4^J	0.80	0.86	0.95	1.00																
θ_5^J	0.99	0.92	0.79	0.76	1.00															
θ_6^J	0.93	0.99	0.80	0.80	0.93	1.00														
θ_7^J	0.96	0.91	0.84	0.81	0.89	0.88	1.00													
θ_8^J	0.89	0.96	0.89	0.91	0.85	0.90	0.90	1.00												
θ_1^Q	0.63	0.63	0.77	0.74	0.61	0.58	0.62	0.69	1.00											
θ_2^Q	0.64	0.68	0.77	0.80	0.62	0.63	0.62	0.73	0.92	1.00										
θ_3^Q	0.65	0.70	0.64	0.66	0.61	0.67	0.67	0.71	0.80	0.78	1.00									
θ_4^Q	0.65	0.67	0.78	0.78	0.63	0.61	0.64	0.73	0.98	0.98	0.81	1.00								
θ_5^Q	0.61	0.61	0.72	0.68	0.59	0.56	0.62	0.66	0.90	0.84	0.75	0.89	1.00							
θ_6^Q	0.59	0.64	0.70	0.72	0.57	0.59	0.59	0.70	0.82	0.89	0.71	0.88	0.86	1.00						
θ_7^Q	0.62	0.65	0.74	0.73	0.60	0.60	0.63	0.70	0.89	0.90	0.75	0.91	0.96	0.97	1.00					
θ_1^N	-0.27	-0.21	-0.14	-0.14	-0.28	-0.21	-0.25	-0.18	-0.29	-0.24	-0.44	-0.27	-0.25	-0.16	-0.21	1.00				
θ_2^N	-0.28	-0.21	-0.14	-0.14	-0.28	-0.22	-0.25	-0.19	-0.29	-0.24	-0.47	-0.27	-0.24	-0.16	-0.20	0.98	1.00			
θ_3^N	-0.04	-0.11	-0.05	-0.07	-0.03	-0.11	-0.06	-0.09	0.06	0.00	0.10	0.03	0.02	-0.02	0.00	-0.14	-0.20	1.00		
θ_4^N	-0.05	-0.12	-0.07	-0.08	-0.04	-0.12	-0.08	-0.11	0.05	-0.01	0.07	0.02	0.01	-0.03	0.00	-0.09	-0.14	0.98	1.00	
$\ln P$	-0.22	-0.30	-0.28	-0.28	-0.20	-0.29	-0.24	-0.30	-0.13	-0.18	-0.02	-0.16	-0.13	-0.20	-0.17	-0.33	-0.43	0.47	0.46	1.00

Notes: See Table 1 for definitions.



(a) Elasticity estimates for employment – unweighted (left) and population weights (right)



(b) Elasticity estimates for earnings – unweighted (left) and population weights (right)

Figure A-2: Estimates of the minimum wage elasticity of employment and earnings by population size and weighting method (with 90 percent confidence bounds, and 90th and 99th percentiles for geography size)

Table A-2: TWFE estimation of minimum wage effects on restaurant employment for the remaining fluidity monopsony-power measures

	Restricted ($\gamma = 0$)		**Unrestricted**		
	$\hat{\beta}$	$\hat{\delta}$	$\hat{\beta}$	$\hat{\gamma}$	$\hat{\delta}$
A. Job-to-Job fluidity monopsony proxies (32,643 obs.)					
Overall hir. rate (θ_3^J)	-0.066**	-2.882***	-0.189***	0.047***	-1.781***
	(0.031)	(0.569)	(0.049)	(0.016)	(0.317)
Overal sep. rate (θ_4^J)	-0.067**	-2.960***	-0.195***	0.049***	-1.797***
	(0.031)	(0.616)	(0.052)	(0.016)	(0.342)
J2J cont. hir. rate (θ_5^J)	-0.082**	-9.140***	-0.174***	0.035***	-6.984***
	(0.033)	(1.755)	(0.043)	(0.009)	(1.349)
J2J cont. sep. rate (θ_6^J)	-0.108***	-8.855***	-0.167***	0.024***	-7.386***
	(0.035)	(1.489)	(0.045)	(0.009)	(1.153)
J2J b.n.e. hir. rate (θ_7^J)	-0.077**	-14.152***	-0.188***	0.043***	-9.706***
	(0.032)	(2.947)	(0.048)	(0.013)	(1.953)
J2J b.n.e. sep. rate (θ_8^J)	-0.089***	-15.655***	-0.181***	0.037***	-11.203***
	(0.031)	(2.968)	(0.047)	(0.013)	(1.868)
B. QWI fluidity monopsony proxies (74,139 obs.)					
Turnover rate (θ_4^Q)	-0.064*	-3.229***	-0.177***	0.049***	-1.646***
	(0.033)	(0.813)	(0.046)	(0.014)	(0.457)
Stable hir. rate (θ_5^Q)	-0.038	-4.518***	-0.172***	0.053***	-2.030***
	(0.036)	(1.059)	(0.046)	(0.016)	(0.558)
Stable sep. rate (θ_6^Q)	-0.036	-4.063***	-0.180***	0.057***	-1.314
	(0.036)	(1.106)	(0.046)	(0.017)	(0.804)
Stable turn. rate (θ_7^Q)	-0.040	-4.482***	-0.176***	0.054***	-1.786**
	(0.036)	(1.132)	(0.046)	(0.017)	(0.684)

Notes: This table reports $\hat{\beta}$ and $\hat{\delta}$ from the estimation of specification (2) under $\gamma = 0$ (restricted model), and $\hat{\beta}$, $\hat{\gamma}$, and $\hat{\delta}$ from the unrestricted estimation of specification (2) for the restaurant industry using 2001-2019 QWI data and different monopsony power proxies. Regressions are weighted by initial population. Standard errors (in parentheses) are clustered at the state level. The coefficients are statistically significant at the *10%, **5%, or ***1% level.

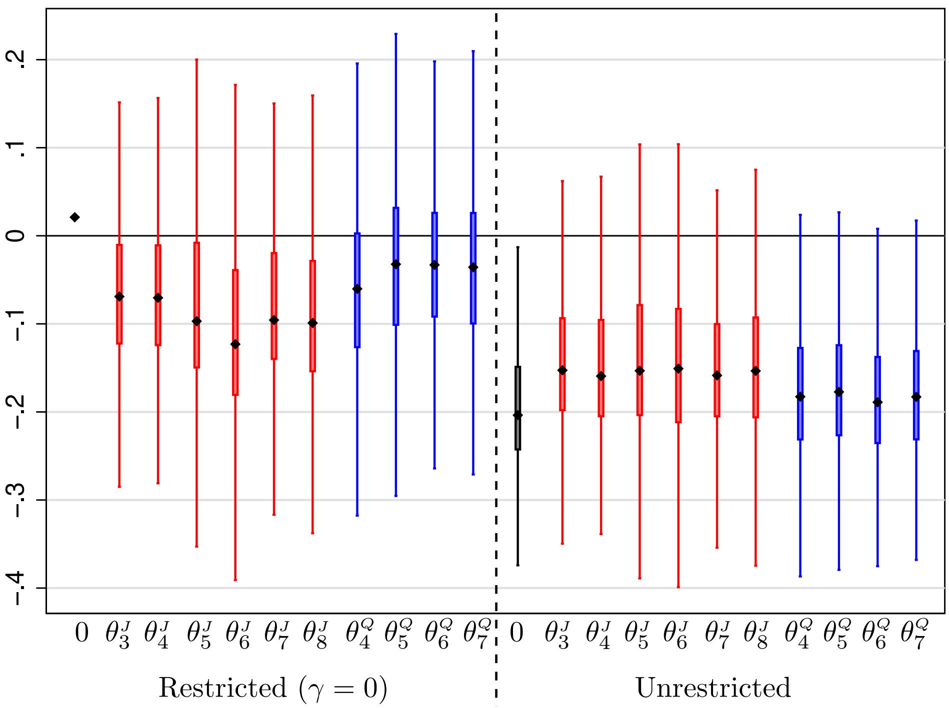


Figure A-3: Boxplots of predicted minimum wage elasticities of employment for CBSA-by-state entities by fluidity monopsony-power proxy

B Pair Approach Estimation

In an influential minimum wage paper, Dube, Lester, and Reich (2010)—DLR hereafter—argue that conventional TWFE regressions similar to specification (1), but with $\gamma = 0$, may yield biased results because they do not control for time-varying local economic shocks that are correlated with minimum wage changes. In a generalization of Card and Krueger (1994), they define local economic areas as pairs of U.S. counties straddling state borders. Using 316 such pairs with quarterly data from 1990 to 2006, and including pair-period fixed effects to control for time-varying spatial heterogeneity, they find null effects of minimum wages on restaurant employment.

In a recent replication of DLR, Jha, Neumark, and Rodriguez-Lopez (2024) show that how we define local economic areas matters—just because two counties are adjacent does not mean one is a good control for the other, as they may not be subject to the same local shocks. They show that when local areas are instead defined using multi-state commuting zones, a DLR-style specification again yields significant negative employment effects of minimum wages.[20] Importantly, each commuting zone—like each CBSA—is defined as a collection of counties linked by strong commuting ties, based on Journey-to-Work data.[21]

Following this idea, we verify the robustness of our results from Table 3 by estimating a DLR-style specification using the 61 multi-state CBSAs. Formed by 133 CBSA-by-state geographies (see Section 2.1), these MS-CBSAs generate 85 cross-state pairs: 52 from two-state CBSAs, 21 from three-state CBSAs, and 12 pairs from four-state CBSAs. Our pair-period specification is given by

$$\ln e_{ipt} = \alpha + \left[\beta + \gamma\left(\ln P_i - \overline{\ln P}\right) + \delta\left(\theta_i - \overline{\theta}\right)\right]\ln MW_{it} + \rho \ln E_{it}^{-} + \zeta \ln P_{it} + \eta_i + \tau_{pt} + \nu_{ipt}, \quad \text{(B-1)}$$

where subscript p denotes a pair—a geography i will belong to more than one pair in MS-CBSAs that span three or more states. The term τ_{pt} captures pair-period effects, which control for time-varying spatial heterogeneity, and ν_{ipt} is the error term.

With complete data for all 76 quarters, a pair-period specification can have at most 12,920 observations: two observations for each of the 85 pairs in each quarter ($2 \times 85 \times 76$). However, as mentioned in Section 2, some states enter the QWI only after 2001, and we have J2J monopsony proxy measures for only 436 (out of 991) CBSA-by-state entities. In the end, our pair-approach regressions include 9,882 observations from 68 pairs (drawn from 46 MS-CBSAs with 102 CBSA-

[20] Using more complete data from 1990 to 2016, Jha, Neumark, and Rodriguez-Lopez (2024) also find that restricting the county pair sample to pairs within multi-state commuting zones similarly yields negative and significant minimum wage effects on employment.

[21] Writing around the same time as DLR, Allegretto, Dube, and Reich (2009) were the first to propose using multi-state commuting zones as local areas instead of county pairs.

by-state entities) when using J2J fluidity proxies; 12,266 observations from 84 pairs (from 60 MS-CBSAs with 131 entities) when using QWI fluidity proxies; and 12,290 observations from 85 pairs (from 61 MS-CBSAs with 133 entities) when using NETS concentration proxies. Table B-1 presents the results from estimating (B-1), both with and without the restriction that $\gamma = 0$, using our 9 selected proxies for monopsony power.

As before, the specifications in Table B-1 show an upward bias in $\hat{\beta}$ in the restricted regressions, which even leads to positive and significant estimates when using NETS proxies. Comparing Table B-1 with Table 3, one of the main contrasts is that the estimated coefficients for the size interaction, $\hat{\gamma}$, are statistically insignificant in 6 out of the 9 unrestricted regressions in Table B-1. This is largely a consequence of sample selection when using MS-CBSAs. While the average working-age population in 2001 was 178,093 across the 991 CBSA-by-state entities, it was 464,639 across the 102 entities used in the J2J pair regressions, 366,859 across the 131 entities used in the QWI pair regressions, and 361,498 across the 133 entities in the NETS pair regressions. Because coefficients are identified from within MS-CBSA variation, and the sample consists mostly of large entities on both sides of the border, this explains that we do not obtain the significant size effect documented in Sections 3.2 and 4.

Although the estimates of β in the unrestricted specifications are less precise—also a consequence of the pair samples consisting mostly of large entities, where minimum wages are less likely to bind—the 9 estimated coefficients in Table B-1 are all negative, ranging from -0.186 to -0.049. Hence, the pair-approach regressions also point to negative effects of minimum wages on employment for an average-sized location with an average level of monopsony power.

Note that the estimates for δ from our J2J and QWI fluidity proxies are negative in both the restricted and unrestricted models, consistent with the results in Table 3. Including the additional fluidity measures from Table B-2, these estimates are generally less precise than those in Table 3, but the pair-approach regressions using fluidity measures still convey the same message: more fluid labor markets are associated with stronger negative employment effects of minimum wages, whereas less fluid (more monopsonistic) labor markets exhibit weaker effects. In addition, the estimates of δ are biased downward when the city size interaction is excluded.

Regarding our NETS concentration-based monopsony proxies, the four estimates for δ in Table B-1 using either establishments or firms per worker—θ_1^N and θ_2^N—remain positive, with one of them statistically significant. Thus, lower concentration (i.e., higher values of θ_1^N and θ_2^N) is not associated with more adverse employment effects of minimum wages. For the $1 - \text{HHI}$ measures, all estimates for δ are negative, but they have large standard errors.

Table B-1: Pair-approach estimation of minimum wage effects on restaurant employment for different monopsony power measures

	Restricted ($\gamma = 0$)		**Unrestricted**		
	$\hat{\beta}$	$\hat{\delta}$	$\hat{\beta}$	$\hat{\gamma}$	$\hat{\delta}$
A. Job-to-Job fluidity monopsony proxies (9,882 obs.)					
J2J Hiring rate (θ_1^J)	-0.091	-6.466***	-0.144*	0.032	-4.455
	(0.058)	(2.318)	(0.083)	(0.030)	(3.015)
J2J Sep. rate (θ_2^J)	-0.105*	-6.141***	-0.151*	0.031	-4.214
	(0.055)	(2.162)	(0.078)	(0.031)	(2.949)
B. QWI fluidity monopsony proxies (12,266 obs.)					
Hiring rate (θ_1^Q)	-0.026	-2.518**	-0.101	0.029	-2.103*
	(0.061)	(1.090)	(0.107)	(0.028)	(1.201)
Separation rate (θ_2^Q)	0.003	-1.640	-0.091	0.037	-1.113
	(0.067)	(1.574)	(0.091)	(0.030)	(1.945)
Replacement rate (θ_3^Q)	-0.103	-4.611***	-0.186	0.031	-4.222***
	(0.066)	(1.431)	(0.112)	(0.026)	(1.520)
C. NETS concentration monopsony proxies (12,290 obs.)					
Est. p/worker (θ_1^N)	0.074**	1.301	-0.075	0.053	3.557
	(0.030)	(1.645)	(0.124)	(0.032)	(2.173)
Firms p/worker (θ_2^N)	0.081**	1.846	-0.084	0.061*	4.615**
	(0.032)	(1.534)	(0.129)	(0.031)	(1.872)
$1 - $ *HHI (est.)* (θ_3^N)	0.076*	-0.518	-0.049	0.045*	-1.212
	(0.045)	(1.827)	(0.106)	(0.025)	(1.884)
$1 - $ *HHI (firm)* (θ_4^N)	0.069	-0.153	-0.051	0.043*	-0.786
	(0.048)	(1.889)	(0.108)	(0.025)	(1.889)

Notes: This table reports $\hat{\beta}$ and $\hat{\delta}$ from the estimation of specification (B-1) under $\gamma = 0$ (restricted model), and $\hat{\beta}$, $\hat{\gamma}$, and $\hat{\delta}$ from the unrestricted estimation of specification (B-1) for the restaurant industry using 2001-2019 QWI data and different monopsony power proxies. Regressions are weighted by initial population. Standard errors (in parentheses) are two-way clustered at the state and border segment levels. The coefficients are statistically significant at the *10%, **5%, or ***1% level.

Table B-2: Pair-approach estimation of minimum wage effects on restaurant employment for the remaining fluidity monopsony-power measures

	Restricted ($\gamma = 0$)		**Unrestricted**		
	$\hat{\beta}$	$\hat{\delta}$	$\hat{\beta}$	$\hat{\gamma}$	$\hat{\delta}$
A. Job-to-Job fluidity monopsony proxies (9,882 obs.)					
Overall hir. rate (θ_3^J)	-0.094	-3.748*	-0.146	0.035	-2.376
	(0.077)	(2.026)	(0.092)	(0.030)	(2.165)
Overal sep. rate (θ_4^J)	-0.073	-3.345	-0.135	0.035	-2.129
	(0.081)	(2.320)	(0.102)	(0.029)	(2.256)
J2J cont. hir. rate (θ_5^J)	-0.091*	-10.718***	-0.143*	0.030	-7.716
	(0.051)	(3.307)	(0.082)	(0.031)	(4.779)
J2J cont. sep. rate (θ_6^J)	-0.106**	-9.187***	-0.150*	0.030	-6.389
	(0.051)	(3.002)	(0.077)	(0.031)	(4.448)
J2J b.n.e. hir. rate (θ_7^J)	-0.063	-13.147*	-0.126	0.035	-8.124
	(0.072)	(7.740)	(0.093)	(0.029)	(8.185)
J2J b.n.e. sep. rate (θ_8^J)	-0.087	-16.434*	-0.140	0.033	-10.776
	(0.069)	(8.206)	(0.089)	(0.030)	(9.036)
B. QWI fluidity monopsony proxies (12,266 obs.)					
Turnover rate (θ_4^Q)	-0.022	-2.348*	-0.104	0.032	-1.851
	(0.060)	(1.251)	(0.101)	(0.029)	(1.513)
Stable hir. rate (θ_5^Q)	0.025	-1.729	-0.088	0.038	-1.455
	(0.058)	(2.039)	(0.087)	(0.029)	(2.320)
Stable sep. rate (θ_6^Q)	0.049	-0.734	-0.070	0.040	-0.513
	(0.075)	(3.061)	(0.083)	(0.028)	(3.228)
Stable turn. rate (θ_7^Q)	0.035	-1.347	-0.081	0.039	-1.069
	(0.067)	(2.608)	(0.083)	(0.029)	(2.862)

Notes: This table reports $\hat{\beta}$ and $\hat{\delta}$ from the estimation of specification (B-1) under $\gamma = 0$ (restricted model), and $\hat{\beta}$, $\hat{\gamma}$, and $\hat{\delta}$ from the unrestricted estimation of specification (B-1) for the restaurant industry using 2001-2019 QWI data and different monopsony power proxies. Regressions are weighted by initial population. Standard errors (in parentheses) are two-way clustered at the state and border segment levels. The coefficients are statistically significant at the *10%, **5%, or ***1% level.

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