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A MATCHED PAIR CROSS-BORDER ANALYSIS

Garrett C. Taylor
James E. West

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ABSTRACT

Using monthly data from major U.S. metropolitan areas that span state borders, we estimate the elasticity of employment with respect to the minimum wage using a difference-in-differences design with continuous treatment in two-digit industries of 71 (Arts, Entertainment and Recreation) and 72 (Accommodation and Food Services). In specifications that control for differences in state sales, personal and corporate income tax rates, we find negative average causal response on the treated (ACRT) in six-digit industries where we expect large numbers of young, entry-level employees, but positive correlations in other industries. Our results illustrate important heterogeneities in minimum wage effects in urban versus rural areas.

Garrett C. Taylor

Department of Economics

Baylor University

One Bear Place #98003

Waco, TX 76798

Garrett_Taylor1@baylor.edu

James E. West

Department of Economics

Baylor University

One Bear Place #98003

Waco, TX 76798

and NBER

j_west@baylor.edu

1 Introduction

In the three decades since Card and Krueger (1994) launched the new minimum wage literature, labor economists continue to study how minimum wage laws affect employment. Until the recent phenomena of city minimum wages, state level minimum wages and employment have been the primary source of variation used to investigate possible disemployment effects.¹ In 2020, 29 states plus the District of Columbia had in place a state minimum wage above the federal level. To increase the number of policy “experiments” from state level variation, Dube, Lester and Reich (2010) examined employment levels in adjacent border counties with shared county-pair fixed effects and linear trends to estimate the effects of state-level minimum wage laws. We extend this analytical framework with higher frequency monthly (as opposed to quarterly) data, state-level tax rate controls, and investigate heterogeneous treatment effects between urban and rural areas within an updated DiD with continuous treatment specification.

We examine the NAICS industries with the highest proportion of minimum wage workers employed as reported by the 2019 Current Population Survey, 71 (Arts, Entertainment and Recreation) and 72 (Accommodation and Food Services).² In the widely studied Limited-Service Restaurant sector (NAICS 722513), we find an elasticity of employment with respect to the binding minimum wage of -0.062 at a 1% level in urban county pairs when controlling for variation in state sales, personal and corporate tax rates. This estimate is comparable to elasticities found by Meer and West (2016), but less than elasticities found by Jardim, Long, Plotnick, Van Inwegen, Vigdor and Wething (2022) using administrative data from the state of Washington. Like Dube et al. (2010), we are unable to find disemployment effects in Limited-Service Restaurants with a sample containing all county border pairs.

¹See the survey of minimum wage literature by Neumark, Wascher et al. (2007).

²See Table 45: Wage and salary workers paid hourly rates with earnings at or below the prevailing Federal minimum wage by occupation and industry. Minimum wage workers as a proportion of employees in Leisure and Hospitality at 9.5% vastly exceed other sectors, the largest of which is Other Services at 1.8%.

2 Data

We use state-level binding minimum wage data by month obtained from Vaghul and Zipperer (2016) through 2017 which we update to 2020. County-level employment data by month are from the Quarterly Census of Employment and Wages. We report in Table 1 total employment in six-digit sub-categories of sectors 71 and 72 for which we are able to compute a minimum of 100 border pair differences. We obtain annual personal income and corporate tax rates from 2000 through 2020 from the Tax Foundation and 1990 through 1999 from The Council of State Governments (2022). Sales tax rates are from The Council of State Governments (2022).

We report summary statistics from January 1990 through February 2020 in Table 1. We omit March through December 2020 from our sample due to massive changes in employment in early months of the COVID pandemic. Statistics for all counties within the U.S. are in Column 1. Column 2 contains statistics for all border counties and additional counties within cross-border CBSAs with population centroids no more than 30 miles apart. Our designated border counties contained approximately 38

We illustrate the urban border counties of our primary sample in Figure 1. Although the 105 urban border counties represent less than 10 percent of all cross-border counties, they comprise 1/3 of the total U.S. population that live in state border counties.

3 Empirical Methods

A comparison of disemployment effects arising from different minimum wages across county pairs is an application of the nascent literature in difference-in-difference estimators with continuous treatment. Callaway, Goodman-Bacon and Sant’Anna (2021) decomposes such differences as a combination of the average causal response on the treated of dose d who receive dose d , $ACRT(d|d)$ and differences in the treatment effects between the two groups

at the base dosage. These differences can be interpreted as causal under a “strong ” parallel trends assumption, where the counterfactual outcome of the additionally treated unit at the base dosage is equivalent to the expected outcome of the base unit.³ In the context of our study, this is to assume that within a border pair such as Kanas City KS-MO, the disemployment effects of minimum wages in Kansas City, MO if it were to adopt the minimum wage of Kansas are equivalent to disemployment effects in Kansas City, KS at present minimum wage. Using the sample of all border counties, we construct pairs of all contiguous cross-border counties plus counties contained within a CBSA that are not contiguous but span a state border with population centroids no more than 30 miles apart and estimate

$$\Delta_p \ln \left(\frac{emp_{ym}}{emp_{(y-1)m}} \right) = \beta_{0p} + \beta_1 \Delta_p \ln(W_{ymp}) + \gamma \Delta_p TaxRate_{yp} + \theta_{ym} + \epsilon_{ymp} \quad (1)$$

where y denotes year, and m month. The dependent variable is the month-to-month annual employment growth rate in county B minus the growth rate in county A, or the difference in annual employment growth rates over a county pair, corrected for seasonality. We omit from our main sample observations in which less than 50 employees exist in either county to preclude observations where small absolute changes in employment levels represent large percentage changes. Δ_p denotes the difference between counties in pair p , β_{0p} is a county-pair fixed effect, \underline{W} is the binding minimum wage, $TaxRate$ is a vector containing state-level sales, personal and corporate income tax rates and a dummy variable to indicate the presence of a reciprocal income tax agreement interacted with the personal income tax rate.⁴ β_1 represents the effect of the percentage change in binding minimum wage from county B to county A on the change in the employment growth rate from county B to county A, or the elasticity of employment with respect to the minimum wage. Under a strong parallel trends assumption,

³See Callaway et al. (2021) and Cunningham (2022) for additional detail.

⁴With a reciprocal income tax agreement in place, a person who works in county B but lives in county A receives a credit for all income taxes paid in county B. See Rohlin, Rosenthal and Ross (2014).

β_1 is the causal ACRT. The county pair fixed effect controls for all time-invariant differences between counties within each pair. We control for differences in state personal income, sales, and corporate income tax rates. The tax difference variables in Equation (1) are not logged to enable the inclusion of county border pairs in which at least one tax rate is zero. Because of this, γ coefficients do not represent elasticities, but can be transformed into elasticities if multiplied by the respective Δ tax rate.⁵ θ is a month by year fixed effect, and ϵ is a stochastic disturbance.

4 Results

We estimate Equation (1) for urban border county pairs by OLS with a county-pair and month by year fixed effects, clustering standard errors at the county-pair level and report estimated coefficients in Table (2). In Panel A, we omit tax rate difference controls for better comparability to the existing literature. We find negative and significant elasticities of employment for Golf Courses and Country Clubs, -0.103, and Limited-Service Restaurants, -0.040. We find a positive and significant elasticity for Food Service Contractors, 0.171, and insignificant effects for the remaining five sectors. We include tax rate difference controls in Panel B. Elasticities for both Golf Courses and Country Clubs, and Limited-Service Restaurants become larger at -0.113 and -0.062 respectively. With tax rate controls, we find significant disemployment effects in Fitness and Recreational Sports Centers -0.102. For each specification, we test whether the values of additional tax rate control variables are jointly zero and report p -values in the final row of Table 2. We fail to reject the null hypothesis in 2 of 8 specifications, reject at marginal significance in two more, and reject at a significant level in the remaining four specifications.

We find contrasting estimates of Equation (1) for rural border pairs in Table 3. With tax

⁵Tax rates are not systematically larger in either county of the border pair. As such, average Δ tax rate ≈ 0 and the elasticity of employment w.r.t. tax rates is effectively zero when tax rates do not differ.

rate controls in Panel B, we do not find significant effects on employment in Golf Courses and Country Clubs, and Fitness and Sports Centers. In rural border pairs, we find a positive and significant effect of minimum wages on employment in Limited Service Restaurants. Also in contrast to urban border pairs, we find significant disemployment effects in Hotels and Motels, and in Food Service Contractors.

To better compare our estimates to the existing literature which does not distinguish between urban and rural border pairs nor enforce restrictions on minimum levels of employment, we combine the samples represented in Tables 2 and 3 and include observations with less than 50 employees. We report estimates using the maximum possible number of border pairs in Table 4. Of particular interest, the elasticity of employment in Limited-Service Restaurants is positive and lacks significance, as in Card and Krueger (1994) and Dube et al. (2010).

5 Discussion

We estimate elasticities of employment with respect to the binding minimum wage in six-digit sectors of Arts, Entertainment and Recreation (71) and Accommodation and Food Services (72). We suspect substantial variation in the proportion of minimum wage employees exists between these six-digit sectors, but are unable document these differences using data from the Bureau of Labor Statistics. With the exception of Full-Service Restaurants, we find negative and significant elasticities in classic urban/suburban unskilled entry-level jobs; Golf Course and Country Clubs, Fitness and Recreational Sports Centers, and Limited-Service Restaurants (including fast food). Within rural pairs, only one of these sectors (Fitness and Recreational Sports Centers) remains negative but is now marginally significant. However, we note the contrast between estimates for Hotels and Motels (except Casino Hotels) in Column 3 of both Tables 2 and 3. In urban border pairs, we do not find employment effects of minimum wages, but find large, -0.117, and highly significant negative effects in rural

border pairs, where we suspect the proportion of minimum wage employees is higher. We find a similar pattern in Full-Service Restaurants (Column 6). We note an even larger change in Food Service Contractors (Column 4), where a large and significant positive elasticity in urban areas becomes a large significant negative elasticity in rural border pairs.

Our criteria for selection of six-digit industries (100+ border pairs, no less than 50 employees) is unmet for rural border pairs in Food Service Contractors (89 pairs) and Caterers (55 pairs). All other six-digit sectors comfortably fulfill our inclusion criteria.

Estimates in Table 4, Panel A are most similar to the existing minimum wage literature by including all available border pairs regardless of population density, not controlling for urban/rural heterogeneities, and not including controls for differing tax rates. We find disemployment effects significant at a 5% level in three sectors; Fitness and Sports Centers, Hotels and Motels (Excluding Casino Hotels), and Full-Service Restaurants.

6 Conclusion

Using monthly data, we estimate the effects of differences in binding minimum wages on employment growth in a county border pair analysis. We find significant negative elasticities of employment with respect to minimum wages in urban border county pairs within six-digit industries expected to contain significant numbers of minimum wage employees. We find important heterogeneities in minimum wage treatment effects in urban versus rural border pairs. Our paper also finds mostly larger and more significant effects of minimum wages when controlling for differences in state sales, personal and corporate income tax rates. Given a strong parallel trends assumption, which we believe to be defensible in an urban border pair analysis, our estimates represent an average causal response on the treated, ACRT.

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Figure 1: County Border Pairs

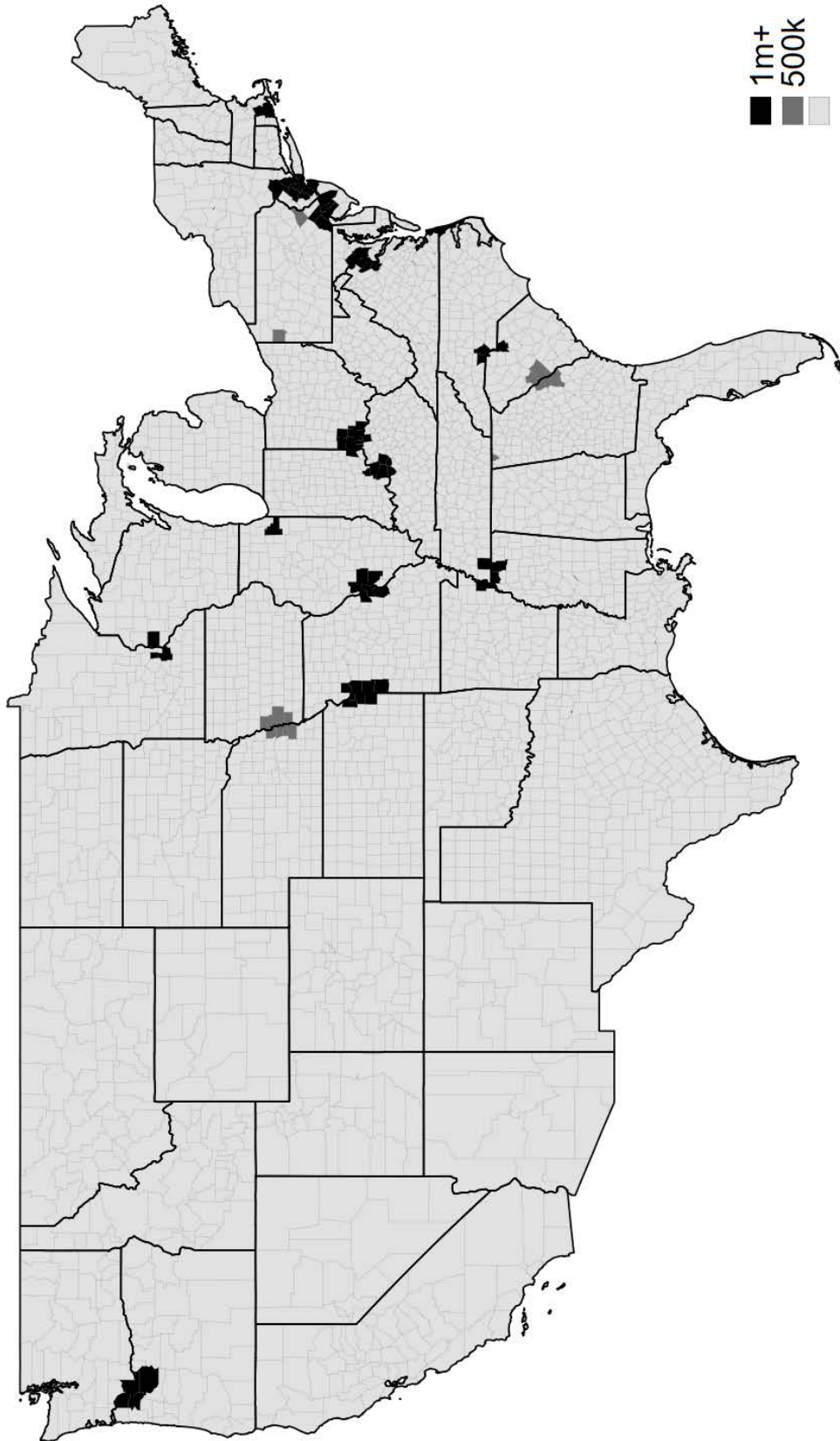


Table 1: Summary Statistics – Individual Counties

VARIABLES	(1)	(2)	(3)	(4)
	Full	Border Counties	CBSA Population 500k+	
	Sample	Plus CBSA	Y	N
	mean	mean	mean	mean
	(sd)	(sd)	(sd)	(sd)
	[N]	[N]	[N]	[N]
Binding Minimum Wage	6.075 (1.506) [1,046,942]	6.080 (1.520) [402,438]	6.064 (1.564) [37,470]	6.081 (1.515) [364,968]
Income Tax Rate	0.053 (0.029) [1,046,942]	0.055 (0.027) [402,438]	0.063 (0.021) [37,470]	0.055 (0.027) [364,968]
Sales Tax Rate	0.051 (0.015) [1,046,942]	0.051 (0.015) [402,438]	0.052 (0.014) [37,470]	0.051 (0.015) [364,968]
Corporate Tax Rate	0.061 (0.031) [1,046,942]	0.065 (0.028) [402,438]	0.074 (0.021) [37,470]	0.064 (0.029) [364,968]
Employment by NAICS 6-Digit Industry				
Golf Course & Country Clubs (713910)	358.460 (626.09) [252,279]	335.292 (545.43) [101,740]	468.206 (441.97) [22,015]	298.590 (565.23) [79,725]
Fitness & Sports Centers (713940)	470.297 (1,040.40) [333,542]	489.669 (1,090.68) [132,132]	993.115 (1,610.83) [28,196]	353.093 (849.10) [103,936]
Hotels & Motels Excluding Casinos (721110)	1,025.946 (3,214.98) [362,326]	814.530 (2,558.22) [146,475]	2,513.999 (5,778.28) [15,523]	613.076 (1,726.17) [130,952]
Food Service Contractors (722310)	790.139 (1,394.60) [131,110]	807.706 (1,430.84) [55,779]	1,154.606 (1,369.75) [19,337]	623.632 (1,428.42) [36,442]
Caterers (722320)	385.707 (745.66) [85,527]	401.674 (782.10) [33,100]	555.455 (730.68) [10,862]	326.561 (795.30) [22,238]
Full Service Restaurants (722511)	1,790.217 (5,617.40) [816,759]	1,712.594 (4,918.17) [319,481]	5,476.436 (9,336.70) [35,247]	1,245.852 (3,795.19) [284,234]
Limited Service Restaurants (722513)	1,668.277 (4,383.25) [682,527]	1,545.580 (3,224.31) [263,282]	3,974.047 (4,110.66) [33,020]	1,197.334 (2,914.95) [230,262]
Snack & Non-Alcoholic Beveridges (722515)	588.368 (1,333.14) [206,255]	577.683 (1,100.50) [83,889]	1,031.086 (1,266.95) [20,102]	434.797 (1,000.86) [63,787]
Number of Counties	3,127	1,197	105	1,092
Population	329,436,371	125,303,065	41,658,868	83,644,197

Table 2: Effect of Differential State Minimum Wages on Employment – Urban Border Pairs

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Golf Course Country Club	Fitness & Sports Centers	Hotels & Motels	Food Service Contractors	Caterers	Full Service Restaurants	Ltd. Service Restaurants	Snack & Non- Alcoholic Bars
VARIABLES	713910	713940	721110	722310	722320	722511	722513	722515
Panel A								
Binding Minimum Wage	-0.103** (0.046)	-0.050 (0.031)	0.051 (0.051)	0.171*** (0.045)	-0.032 (0.060)	-0.013 (0.015)	-0.040*** (0.013)	0.034 (0.028)
Panel B								
Binding Minimum Wage	-0.113** (0.047)	-0.102*** (0.034)	0.064 (0.060)	0.116** (0.051)	-0.025 (0.065)	-0.021 (0.015)	-0.062*** (0.014)	0.059* (0.032)
Δ_c Income Tax Rate	0.281 (0.355)	-0.182 (0.206)	0.138 (0.604)	0.019 (0.574)	2.660*** (0.675)	-0.352*** (0.112)	0.149 (0.131)	0.280 (0.390)
Δ_c Sales Tax Rate	1.275* (0.690)	-1.173** (0.461)	0.594 (1.031)	0.894 (1.375)	-0.378 (2.459)	-0.926** (0.357)	-1.598*** (0.338)	-0.070 (0.589)
Δ_c Corporate Tax Rate	-0.372* (0.209)	-0.695** (0.293)	-0.042 (0.580)	-1.413** (0.556)	-0.430 (0.622)	0.331*** (0.109)	-0.072 (0.109)	0.282 (0.362)
Reciprocal Income Tax	-0.726* (0.431)	-0.031 (0.379)	-0.557 (1.917)	1.241 (1.176)	-1.450 (1.483)	-0.047 (0.267)	-0.052 (0.161)	-0.445 (0.546)
Observations	23,480	45,132	11,960	25,947	7,121	66,127	61,457	25,149
R^2	0.023	0.010	0.021	0.019	0.082	0.007	0.010	0.020
Number of County Pairs	140	170	132	120	111	212	211	143
Tax Controls p -value	0.061	0.001	0.985	0.085	0.001	0.001	0.000	0.627

All specifications include county pair and month by year fixed effects. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 3: Effect of Differential State Minimum Wages on Employment – Rural Border Pairs

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	Golf Course Country Club 713910	Fitness & Sports Centers 713940	Hotels & Motels 721110	Food Service Contractors 722310	Caterers 722320	Full Service Restaurants 722511	Ltd. Service Restaurants 722513	Snack & Non- Alcoholic Bars 722515
Panel A								
Binding Minimum Wage	-0.003 (0.030)	-0.054 (0.033)	-0.108*** (0.035)	-0.144** (0.059)	-0.062 (0.135)	-0.032*** (0.013)	0.030** (0.015)	0.059 (0.072)
Panel B								
Binding Minimum Wage	0.003 (0.030)	-0.059* (0.035)	-0.117*** (0.036)	-0.155*** (0.057)	0.059 (0.183)	-0.033*** (0.013)	0.032** (0.015)	0.067 (0.070)
Δ_c Income Tax Rate	0.260** (0.112)	-0.030 (0.224)	-0.233 (0.147)	-0.213 (0.380)	-1.823*** (0.479)	-0.083 (0.065)	0.292*** (0.070)	0.290 (0.330)
Δ_c Sales Tax Rate	3.001*** (0.763)	-1.768** (0.803)	-0.571 (0.635)	1.170 (2.333)	9.125* (5.197)	-0.295 (0.233)	-0.296 (0.277)	-1.972 (1.774)
Δ_c Corporate Tax Rate	0.052 (0.139)	0.339 (0.248)	0.451* (0.240)	-0.288 (0.524)	1.848 (1.524)	-0.007 (0.069)	0.119 (0.116)	0.459 (0.587)
Reciprocal Income Tax	-0.136 (0.530)	0.389 (1.034)	-0.321 (0.779)	-2.910 (2.546)	-9.829 (13.360)	-0.027 (0.220)	-0.213 (0.192)	0.551 (1.328)
Observations	28,610	29,895	34,383	9,988	2,417	190,104	143,635	9,728
R^2	0.021	0.016	0.014	0.037	0.173	0.002	0.007	0.041
Number of county_pair_fe	196	172	405	89	55	935	847	170
Tax Controls p -value	0.00195	0.167	0.124	0.467	0.00277	0.498	0.000103	0.400

All specifications include county pair and month by year fixed effects. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 4: Effect of Differential State Minimum Wages on Employment – Urban Border Pairs, Cross Sectional Variation

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	Golf Course Country Club 713910	Fitness & Sports Centers 713940	Hotels & Motels 721110	Food Service Contractors 722310	Caterers 722320	Full Service Restaurants 722511	Ltd. Service Restaurants 722513	Snack & Non- Alcoholic Bars 722515
Panel A								
Binding Minimum Wage	-0.040 (0.026)	-0.049* (0.027)	-0.071** (0.031)	0.074* (0.042)	-0.044 (0.065)	-0.025** (0.010)	0.005 (0.011)	0.028 (0.032)
Panel B								
Binding Minimum Wage	-0.036 (0.027)	-0.063** (0.028)	-0.074** (0.031)	0.027 (0.043)	-0.047 (0.070)	-0.028*** (0.010)	0.004 (0.011)	0.028 (0.035)
Δ_c Income Tax Rate	0.108 (0.129)	-0.012 (0.148)	-0.210 (0.140)	-0.265 (0.293)	-0.278 (0.962)	-0.122** (0.058)	0.247*** (0.062)	0.204 (0.255)
Δ_c Sales Tax Rate	2.295*** (0.576)	-0.762 (0.475)	-0.342 (0.508)	0.407 (1.098)	1.170 (2.299)	-0.385* (0.199)	-0.701*** (0.221)	-0.736 (0.566)
Δ_c Corporate Tax Rate	0.038 (0.113)	-0.374* (0.199)	0.240 (0.206)	-1.110*** (0.389)	-0.072 (0.606)	0.023 (0.060)	0.054 (0.096)	0.090 (0.312)
Reciprocal Income Tax	-0.416 (0.354)	0.907** (0.449)	-0.290 (0.706)	1.017 (1.083)	-1.991 (2.546)	-0.080 (0.162)	-0.185 (0.140)	0.463 (0.755)
Observations	61,359	93,763	56,450	37,255	10,887	276,874	211,348	40,603
R^2	0.009	0.005	0.008	0.014	0.050	0.002	0.004	0.010
Number of county_pair_fe	387	494	688	238	192	1,283	1,136	395
Tax Controls p -value	0.00274	0.0720	0.390	0.0286	0.881	0.0565	1.28e-05	0.561

All specifications include month by year fixed effects. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.