Bus Ridership and the Minimum Wage: Evidence from Bus Stops near Fast-Food Restaurants

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Abstract

This paper examines the impact of Minneapolis' local minimum wage ordinance on bus ridership. We use a difference-in-differences (DD) strategy to compare changes in ridership at bus stops in Minneapolis near fast-food restaurants to similarly situated stops around the metro area where the minimum wage was unchanged. We find that the minimum wage increase caused bus ridership to increase by 1,828 rides per day or 3.5% of post-treatment daily boardings in Minneapolis. We show that the treatment effect is highly concentrated at bus stops near fast-food restaurants. An increase in the intensive margin of labor, or weekly hours, is consistent with our results and available labor market indicators.

Keywords: Public Transit, Bus Ridership, Minimum Wage, Fast-Food
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1 Introduction

The federal minimum wage increased from \$6.55 to \$7.25 in July 2009. Five years later, its inflation-adjusted purchasing power had fallen by over 9%, prompting local minimum wage ordinances in San Francisco, Chicago, Seattle, and Minneapolis, among others. Beyond impacts on wages and hours, these ordinances can influence other features of the labor market in urban areas, like the usage of public transportation.

We analyze the July 1, 2018 Minneapolis minimum wage increase. This increment of the Minneapolis Minimum Wage Ordinance (MMWO) increased the minimum wage paid by small firms from \$7.87 to \$10.25 and by large firms from \$10.00 to \$11.25. We estimate the causal impact of this change on bus ridership using a difference-in-differences (DD) strategy. We compare changes in ridership in Minneapolis at bus stops near fast-food restaurants to changes at similarly situated stops around the metro area. We find that the minimum wage increase caused bus ridership to increase by 1,828 rides per day, or about 3.5% of post-treatment ridership. We argue that an increase in the intensive margin of employment (additional hours) is consistent with our results and labor market data. We do not observe a reduction in demand for bus ridership, which would be consistent with reductions in employment and hours. Beyond the importance for demand planning, these results contribute to our understanding of the short-run impacts of the minimum wage.

Our DD identification strategy is ideally suited to study the MMWO. First, Minneapolis adopted a higher minimum wage while another nearby city, St. Paul, kept its minimum wage the same – as did the rest of the surrounding metro area. Second, we demonstrate common pre-treatment trends between Minneapolis and relevant comparison groups speaking to the central identifying assumption of common counterfactual trends required by DD analyses. Third, we isolate treated observations by focusing on bus stops near fast-food restaurants, under the assumption that they are more likely used by minimum wage workers. Nationally, 53.2% of minimum wage workers are employed in the food preparation and serving industry (BLS 2018). This strategy follows ample precedence in the literature in looking for the effects of minimum wage changes in the fast-food industry (e.g. Card and Krueger 1994; Allegretto et al. 2018).

Our paper directly extends and underscores the findings in Schipper and Del Ponte (2020). While they show that the minimum wage resulted in increased ridership in Minneapolis generally, we show that the effects are highly concentrated at bus stops near fast-food restaurants. This approach is important because it provides an intuitive causal link between lower-wage workers and bus ridership with geographic predictions for demand planning. Our approach connects our work to the large literature on fast-food workers and the minimum wage. Our results speak to the complex interaction of public transit and labor market access in urban areas (e.g. Ihlanfeldt and Young 1996; Sanchez 1999; Holzer et al. 2003).

2 Data & Methodology

Each observation in our data is aggregate daily boardings for a stop-route-direction (SRD) combination. A bus stop can have multiple daily observations depending on how many routes pass through it. Metro Transit collects this data using electronic sensors, and it spans from July 1, 2017 to December 31, 2018. This provides us with one year of pre-treatment and six months of post-treatment data around the July 1 minimum wage change.

Our empirical analysis includes only observations close (0.005 degrees latitude and

Table 1: Summary Statistics

Variable	N	Mean	Std. Dev.	Min.	Max.
Daily Boardings					
Full Sample	2,655,802	17.6	51.5	0	1317
Minneapolis	1,024,633	28.3	67.3	0	1317
St. Paul	464,141	18.7	45.7	0	997
St. Paul & all other cities	1,631,169	10.9	36.9	0	997
Median Household Income ($)					
Minneapolis	687,921	59,078.2	27,015.4	12,070	196,429
St. Paul & all other cities	1,629,141	57,126.6	24,036.3	11,109	201,458

longitude or roughly walking distance) to fast-food restaurants under the assumption that minimum wage workers are more likely to use nearby bus stops. We include large chains that are not delivery-heavy and report average wages below $11.25 according to payscale.com. We match 575 total locations from 11 fast-food chains to SRDs across the metro area yielding over 2.6 million observations.

We pair the ridership data with the median household income of the surrounding census block group, which is the smallest geographic unit reported by the U.S. Census Bureau that can be paired with income data from the American Community Survey. Conventional wisdom suggests that higher income tends to lead individuals to substitute away from bus transportation, given sufficient time. Since our income measure does not vary with respect to time, it should only increase the precision of our estimates (Angrist and Pischke 2009). Table 1 provides summary statistics for both ridership and income data.

We formalize our difference-in-differences (DD) analysis using:

$$boardings_{ijct} = \alpha + \gamma_c + \delta_t + \beta_1 income_{jc} + \beta_2 treatment_{ct} + \epsilon_{ijct}, \qquad (1)$$

where observations are indexed by SRD, i, census block group, j, city (group), c, and time, t. Our two-way fixed effects, γ_c and δ_t, capture time-invariant characteristics at the level of treatment (city) and daily shocks on the entire transportation network, respectively. The variable *treatment* is an indicator for observations in Minneapolis after the minimum wage changed, and its coefficient, β_2, captures the causal impact of the MMWO on bus ridership. The variable *income* is the median income in the neighborhood surrounding a bus stop.

We estimate Equation (1) using both OLS and as a Poisson regression using methods developed in Correia (2017) and Correia et al. (2020) to account for our high-dimensional fixed effects. For completeness, we estimate the model using two comparison groups: the surrounding metro (Full) and only St. Paul (MSP). In the full sample, we allow standard errors to be clustered at the level of treatment (city), and our results are not sensitive to alternative assumptions such as clustering by bus route or bus route and city. We exclude SRDs with less than 50 pre- or 25 post-treatment observations to control for openings, closures, and limited-service routes.

The key identifying assumption in difference-in-differences analyses is that absent treatment the treated group and comparison group would continue to evolve in a similar way, i.e. common counterfactual trends. We argue that Minneapolis and our comparison groups share common pre-treatment trends. Figure 1 shows that monthly boardings evolve similarly prior to treatment. We include rudimentary linear time trends for reference; however, our data allows for a much more rigorous statistical test of common pre-treatment trend. We estimate Equation (1) with a linear time trend in lieu of time fixed effects and interact it with Minneapolis. We are unable to reject common pre-treatment trends between Minneapolis and either of our comparison groups. These results can be found in Table 2. Our groups experience similar shocks to bus boardings, and there is no reason to believe that they would respond differently to external factors in the post-treatment period minimizing the likelihood of conflating events. We briefly discuss another statistical exercise in Section 4 that speaks to our assumption of common counterfactual trends.

Figure 1: Aggregate Monthly Boardings

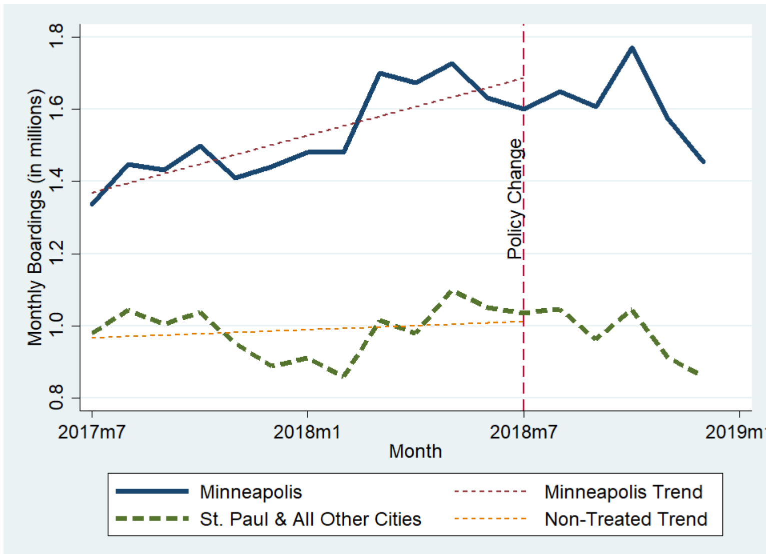

Table 2: Pre-Treatment Trends

Dependent Variable: Daily Boardings				
Regression Type	OLS		Poisson	
Comparison Group	Full	MSP	Full	MSP
$Minneapolis \times time\ trend$	0.010	0.009	0.000	0.000
	(0.006)	(0.006)	(0.000)	(0.000)
N	1,497,855	745,389	1,497,855	745,389

$Minneapolis \times time\ trend$ tests whether there exists a difference in linear time trends between the treated city, Minneapolis, and non-treated cities. We report standard errors in parentheses and significance of coefficients using t-tests for OLS and z-tests for Poisson.

3 Results & Robustness

We present our main findings in Table 3. They show that the MMWO caused an average increase of 1.5 rides per day at SRDs near fast-food restaurants compared to similar SRDs in the metro area. For example, we expect that Bus #18 heading south will see an extra 1.5 boardings per day at each of its 71 stops in Minneapolis near fast-food restaurants. Column 3 shows that the coefficient estimate is slightly larger at 1.7 boardings when compared to similar SRDs in St. Paul only. Our Poisson regression yields similar results: a 7.5% and 7.0% average daily increase in rides for the full and MSP samples respectively. Across regressions, our results highlight a statistically significant causal impact of the minimum wage change on bus ridership.

Table 3: Results

Dependent Variable: Daily Boardings				
Regression Type	OLS		Poisson	
Comparison Group	Full	MSP	Full	MSP
income	-1.690***	-2.197***	-0.104***	-0.096***
	(0.498)	(0.019)	(0.014)	(0.000)
treatment	1.509***	1.681***	0.075***	0.070***
	(0.279)	(0.219)	(0.025)	(0.010)
Total Policy Effect	1,828	2,037	2,356	2,197
N	2,263,408	1,122,515	2,263,408	1,122,515

We report standard errors in parentheses. Coefficients designated with *** are significant at the 1% level using t-tests for OLS and z-tests for Poisson.

Table 3 reports a total policy effect that quantifies the daily impact of the minimum wage increase on all treated SRDs. We calculate it as the daily average of the difference between expected boardings conditional on treatment and expected boardings for non-treated SRDs. Using OLS and the full sample comparison group yields an average daily increase of 1,828 rides at all SRDs near fast-food restaurants in Minneapolis after the minimum wage increase. This is 2.2% of all daily post-treatment boardings in Minneapolis and 3.5% for our estimation sample. The other regression-comparison group combinations give larger estimates. The narrow range across regressions underscores the robustness of our results.

Our identification strategy assumes that minimum wage workers are more likely to use bus stops near fast-food restaurants. We examine the validity of this assumption by decreasing the maximum distance from a fast-food restaurant to a bus stop for inclusion in our sample. We find that the treatment effect generally increases as we reduce the maximum allowable distance from restaurant to stop (see Table 4 in the Appendix). This increase is consistent with capturing a greater proportion of treated minimum wage workers and supports our identifying assumption.

4 Discussion & Conclusion

We find that an increase in the minimum wage causes an increase in bus ridership, which is consistent with Schipper and Del Ponte (2020). However, our estimated treatment effect is much larger than that of Schipper and Del Ponte (2020). When running our DD strategy on SRDs outside our estimation sample – i.e. those far from fast-food restaurants – we find insignificant results (reported in Table 5 of the Appendix). Thus, the impact of the minimum wage increase on bus ridership is felt most acutely near fast-food restaurants where minimum wage workers are likely to work. This also speaks to the identifying assumption of counterfactual trends: Minneapolis stops with few minimum wage workers continued to evolve similarly to non-treated SRDs.

Ideally, our data would speak to the mechanism that generates our results. Unfortunately, the data does not identify individual riders. Instead, we use local area employment statistics to suggest that an increase in employment hours generates our observed increase in ridership in Minneapolis. We augment Equation (1) with monthly employment figures for Minneapolis and St. Paul (see summary statistics in Table 6 and results in Table 7, both in the Appendix). This exercise asks: does the minimum wage impact bus ridership beyond changes in employment? The treatment coefficient remains largely the same (1.331 vs. 1.681) indicating that the bulk of the effect is not generated by an increase in employment. Labor market metrics at other levels of aggregation are consistent with this story – weekly wages increased slightly in the county containing Minneapolis compared to St. Paul's and hours increased throughout the metro area. Between the different levels of aggregation for employment statistics and the uncertainty in the minimum wage literature about employment effects (e.g. Allegretto et al. 2018; Jardim et al. 2018), we argue that our results are consistent with an increase in the intensive margin of labor supply (hours). Future research that tracks individual riders may speak more directly to the mechanism through which the minimum wage affects bus ridership.

The results of this paper are important for several reasons. First, industry-specific research – particularly in relation to the fast-food industry – is necessary when assessing the impact of the minimum wage. Second, municipal authorities may use these results for demand planning. For instance, bus routes with a relatively large number of stops near fast-food restaurants are likely to see increased ridership following minimum wage increases. Finally, it provides indirect evidence that public transit continues to be a vital way in which lower-wage workers access labor markets.

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Appendix

Table 4: Geographic Restriction Results

Dependent Variable: Daily Boardings		
Comparison Group	Full (OLS)	MSP (OLS)
Full distance (original sample)		
treatment	1.509***	1.681***
	(0.279)	(0.219)
N	2,263,408	1,122,515
75% distance		
treatment	2.036***	2.250***
	(0.379)	(0.291)
N	1,633,749	804,285
50% distance		
treatment	2.372***	2.053***
	(0.481)	(0.416)
N	1,015,810	500,893
25% distance		
treatment	3.078***	3.551***
	(0.200)	(0.814)
N	432,337	224,718

Headers in the first column represent gradually smaller samples as a percent of our original sample's maximum distance from a fast-food restaurant to a bus stop. We report standard errors in parentheses. Coefficients designated with *** are significant at the 1% level using standard t-tests.

Table 5: Counterfactual Results

Dependent Variable: Daily Boardings				
Regression Type	OLS		Poisson	
Comparison Group	Full	MSP	Full	MSP
income	-0.796**	-1.401***	-0.145***	-0.164***
	(0.340)	(0.004)	(0.025)	(0.000)
treatment	0.012	0.000	-0.002	-0.003
	(0.021)	(0.058)	(0.006)	(0.006)
N	5,892,007	2,253,536	5,892,007	2,253,536

Counterfactual refers to a sample of SRDs far from fast-food restaurants. We report standard errors in parentheses. Coefficients designated with *** or ** are significant at the 1% or 5% level, respectively, using t-tests for OLS and z-tests for Poisson.

Table 6: Employment Summary Statistics

Variable	Before Mean	After Mean	Difference
Employment (total)			
Minneapolis	233,905.4	236,167.3	2,261.9 (0.97%)
St. Paul	154,391.2	155,752.8	1,361.6 (0.88%)
			900.3 (0.09%)
Hours Worked			
Full Sample	20.49	21.90	1.41 (6.87%)
Weekly Wages ($)			
Hennepin (Minneapolis)	418.75	442.50	23.75 (5.67%)
Ramsey (St. Paul)	376.25	394.00	17.75 (4.75%)
			6.00 (0.95%)

We use the following data: city-level, monthly employment across all industries from the Local Area Unemployment Statistics (LAUS); metro-level, monthly average weekly hours worked for the food services and drinking places industry from Current Employment Statistics (CES); and, county-level, quarterly average weekly wages across all industries from the Quarterly Census of Employment and Wages (QCEW).

Table 7: Employment-Augmented Model Results

Dependent Variable: Daily Boardings		
Regression Type	OLS	Poisson
Comparison Group	MSP	MSP
income	-2.197***	-0.096***
	(0.020)	(0.001)
employment	3.880**	0.029
	(1.923)	(0.087)
treatment	1.331***	0.068***
	(0.284)	(0.013)
N	1,122,515	1,122,515

We report standard errors in parentheses. Coefficients designated with *** or ** are significant at the 1% or 5% level, respectively, using t-tests for OLS and z-tests for Poisson.