ECON 7010: Applied Microeconomics

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Problem Set 1

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Exercise 1.

(a) Reproduce CK Table 2.

Figure 1: MEANS OF KEY VARIABLES

Variable	NJ	PA	t_stat
1. Distribution of Store Types (percentages)			
a. Burger King	41.1	44.3	-0.5
b. KFC	20.5	15.2	1.2
c. Roy Rogers	24.8	21.5	0.6
d. Wendy's	13.6	19	-1.1
e. Company-owned	34.1	35.4	-0.2
2. Means in Wave 1			
a. FTE Employment	20.4 (0.50)	23.3 (1.30)	-2.0
b. Percentage full-time employees	32.8 (1.3)	35.0 (2.7)	-0.7
c. Starting wage	4.60 (0.00)	4.60 (0.00)	-0.4
d. Wage = $4.25 (percentage)	30.5 (2.5)	32.9 (5.3)	-0.4
e. Price of full meal	3.40 (0.00)	3.00 (0.10)	4.0
f. Hours opwn(weekday)	14.4 (0.2)	14.5 (0.3)	-0.3
g. Recruiting bonus	23.6 (2.3)	29.1 (5.1)	-1.0
3. Means in Wave 2			
a. FTE Employment	21.0 (0.50)	21.2 (0.90)	-0.1
b. Percentage full-time employees	35.9 (1.3)	30.4 (2.8)	1.8
c. Starting wage	5.10 (0.00)	4.60 (0.00)	10.8
d. Wage = $4.25 (percentage)	0.0 (0.0)	25.3 (4.9)	-5.1
e. Wage = $5.05 (percentage)	85.5 (1.9)	1.3 (1.3)	36.4
f. Price of full meal	3.40 (0.00)	3.00 (0.10)	5.1
g. Hours opwn(weekday)	14.4 (0.1)	14.7 (0.3)	-0.6
h. Recruiting bonus	20.3 (2.2)	23.4 (4.8)	-0.6

(b) Using the data provided, calculate primary Card and Krueger difference-in-differences result.

To calculate the difference-in-differences in CK's paper, we are reproducing the results in Table 3 columns (i) to (iii) and rows (1) to (3). We firstly calculate the difference of FTE employment in NJ and PA before minimum-wage increase, and then we subtract it from the difference of FTE employment in NJ and PA after the minimum wage increase to estimate the primary difference-in-differences result.

(c) Reproduce Card and Krueger Table 3, columns (i) through (iii).

Table 1: AVERAGE EMPLOYMENT PER STORE BEFORE AND AFTER THE RISE IN NEW JERSEY MINIMUM WAGE

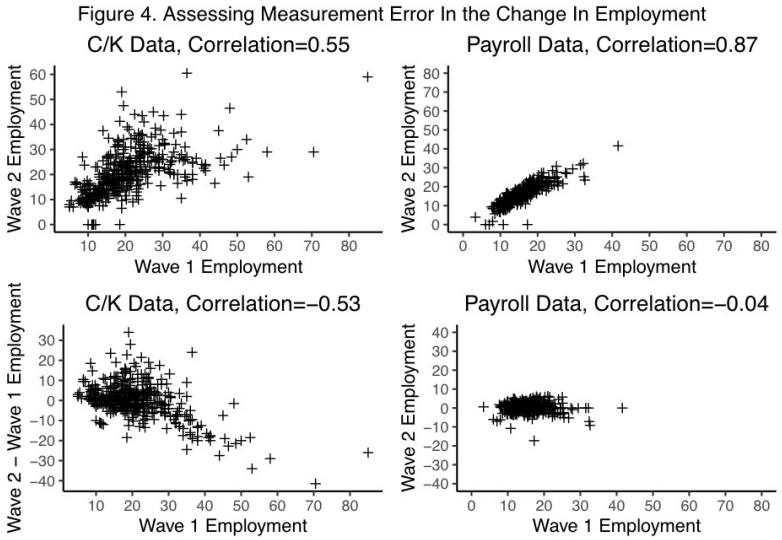
Variable	Stores by state		
	PA (i)	NJ (ii)	Difference, NJ-PA (iii)
1. FTE employment before, all available observations	23.33 (1.35)	20.44 (0.51)	-2.89 (1.44)
2. FTE employment after, all available observations	21.17 (0.94)	21.03 (0.52)	-0.14 (1.08)
3. Change in mean FTE employment	-2.16 (1.65)	0.59 (0.73)	2.75 (1.54)
4. Change in mean FTE employment, balanced sample of stores	-2.28 (1.25)	0.47 (0.48)	2.75 (1.34)
5. Change in mean FTE employment, setting FTE at temporarily closed stores to 0	-2.28 (1.25)	0.23 (0.49)	2.51 (1.35)

(d) Create a table of summary statistics for the administrative data used in Neumark and Wascher.

Figure 2: NW2000 SUMMARY STATISTICS OF FTE

chain	Observation	Mean	Standard deviation	Maximum	Minimum
PA - Wave1					
Burger King	31	16.9	4.4	29.4	11.1
Roy Rogers	32	12.9	2.8	18.1	8.0
Wendy's	9	18.2	2.4	21.5	13.7
NJ - Wave1					
Burger King	63	16.0	4.1	24.5	7.7
KFC	10	20.4	11.3	41.6	9.2
Roy Rogers	74	17.3	6.1	32.7	3.3
Wendy's	16	18.4	4.5	25.1	11.2
PA - Wave2					
Burger King	31	19.6	4.8	30.8	13.3
Roy Rogers	32	11.1	3.6	18.8	0.0
Wendy's	9	20.0	2.9	24.6	16.3
NJ - Wave2					
Burger King	63	17.4	4.0	24.5	8.4
KFC	10	19.2	12.3	41.6	7.0
Roy Rogers	74	15.4	6.2	27.4	0.0
Wendy's	16	20.4	5.8	28.6	11.2

(e) Replicate Neumark and Wascher Figure 4. Comment on what this figure tells us about the data used in the two papers.



Comments:
Figure 4 helps assess the measurement error in the change in employment in CK's data relative to the NW's payroll data and shows us the correlation of the measurement error over time.

The upper panels show the plots of wave 2 vs. wave 1 employment, with upper-left panel using CK's data and upper-right panel using NW's payroll data (note that we replicate NW's work by randomly

selecting the payroll period a/b/c/d when there was more than one payroll period data available). We would expect a strong positive correlation between employment level in wave 1 and wave 2 because of the persistent sizes of fast-food establishments, while the correlation might be weaker if there is substantial measurement error. We can see from upper panels that the correlation for CK's data is 0.55, and the correlation for NW's payroll data is 0.87. The correlation is largely higher in the payroll data and weaker in the CK's data, suggesting that there might be larger measurement error in CK's data.

The bottom panels of Figure 4 show the plots of the change in employment against the initial employment level, with bottom-left panel using CK's data and bottom-right panel using NW's payroll data. We would expect the correlation between the change in employment and the initial level to be near zero if the employment changes are mostly unpredictable based on initial employment, and the correlation should be negative if the classical measurement error is uncorrelated over time. We can observe from the bottom plots that the correlation in CK's data is strongly negative (correlation is -0.53), while the correlation is relatively small and near zero in NW's payroll data (with a correlation of -0.04), indicating that there might be classical measurement error in CK's data. Combing these 4 plots in Figure 4, we can observe that there might exist classical measurement error in CK's data that is uncorrelated over time.

(f) Replicate the analysis of Card and Krueger Table 3, columns (i) through (iii) using the Neumark and Wascher administrative data. Compare these results to your work in part (c).

Table 2: AVERAGE EMPLOYMENT PER STORE BEFORE AND AFTER THE RISE IN NEW JERSEY MINIMUM WAGE (NW data)

Variable	Stores by state		
	PA (i)	NJ (ii)	Difference, NJ-PA (iii)
1. FTE employment before, all available observations	15.27 (0.48)	17.07 (0.45)	1.8 (0.66)
2. FTE employment after, all available observations	15.88 (0.69)	16.88 (0.48)	1 (0.84)
3. Change in mean FTE employment	0.61 (0.84)	-0.19 (0.66)	-0.8 (1.22)
4. Change in mean FTE employment, balanced sample of stores	0.6 (0.41)	-0.19 (0.22)	-0.8 (0.46)

Comparison: First, the table produced using NW2000 data has smaller mean FTE for both states before and after the minimum wage policy compared with CK1994's data, which may be due to the nature of NW2000's payroll data. Second, NW2000 data shows that the mean FTE for NJ after the policy is lower while CK1994's data suggests that NJ witnessed an increase in FTE after the minimum wage policy. Third, for the Diff-in-Diff term (i.e., row 4 column 3), NW2000 has a negative value, suggesting that the minimum wage policy leads to a decrease in employment, which contradicts CK1994's result (i.e., 2.75).

(g) Replicate Neumark and Wascher Table 4, Panel A.

Table 3: REPLICATION RESULTS FOR
REDUCED-FORM MODELS FOR CHANGE IN EMPLOYMENT,
DIFFERENCE-IN-DIFFERENCES ESTIMATES OF MINIMUM-WAGE EFFECTS

	Card/Krueger data				Payroll data	
	CK results (1)	Add observations missing starting wages or data on managers (2)	Drop observations on BK and KFC company-owned restaurants (3)	Sampled universe (4)	Single payroll period (5)	Averages of payroll data (6)
New Jersey dummy, no controls	2.37 (1.12)	2.94 (1.12)	3.24 (1.24)	1.39 (1.2)	-0.8 (0.42)	-0.85 (0.49)
New Jersey dummy, controls for chain and ownership	2.33 (1.12)	2.97 (1.12)	3.34 (1.25)	0.38 (1.22)	-0.58 (0.34)	-0.45 (0.39)
Implied elasticity	0.63	0.8	0.9	0.07	-0.16	-0.12
Percentage effect	13.67	17.38	19.6	1.54	-3.41	-2.65
Number of observations	366	391	330	52	235	235
Adjusted R^2	0.013	0.02	0.02	0.091	0.366	0.4

(h) You have now seen two approaches to estimating the effect of the minimum wage on employment using the early-90s New Jersey minimum wage expansion. Imagine that you were studying labor markets in the early 90s, and decided to study the New Jersey minimum wage expansion. What would you do to estimate the treatment effect? I.e., what data would you collect, and how would you analyze it? Finally, even after executing your research plan perfectly, what challenges would you face (if any) in estimating the true treatment effect?

In terms of data, we would collect employment data of other industries in NJ and PA before and after the minimum wage policy to address the generalizability issue in CK and NW's paper. Specifically, we would like to gather big retailers' data like Walmart, Kroger, Safeway, and JCPenny. Moreover, we also want to obtain manufacturing's employment data in NJ and PA before and after the policy.

In terms of estimation method, we would like to use Diff-in-Diff with multiple time periods. This method is better than previous paper in that it allows us to explore the time-varying effects of minimum wage policy on employment. Moreover, we could use event study analysis to formally test the parallel trend assumption, making our study more reliable.

For the challenges, the parallel trend assumption may still fail given that NJ is in a recession. Also, there may be spillover effect that confounds our estimates. For example, the labor in two states may migrate towards higher-wage state, leading to the bias in treatment effect of minimum wage expansion on employment.

Exercise 2.

(a) replicate table 2 -

Table 4: Summary statistics: Men aged 25-34

Statistic	N	Mean	St. Dev.
BTB	855,772	0.193	0.395
Employed	855,772	0.834	0.372
No high school diploma or GED	855,772	0.077	0.267
No college degree	855,772	0.588	0.492
College degree or more	855,772	0.412	0.492
Enrolled in school	855,772	0.015	0.120
Age	855,772	29.492	2.884
White	855,772	0.793	0.405
Black	855,772	0.097	0.295
Hispanic	855,772	0.110	0.313
Northeast	855,772	0.188	0.391
Midwest	855,772	0.256	0.437
South	855,772	0.240	0.427
West	855,772	0.315	0.465
Metro area	855,772	0.709	0.454

Table 5: Summary statistics: Men aged 35-64

Statistic	N	Mean	St. Dev.
BTB	2,873,182	0.187	0.390
Employed	2,873,182	0.803	0.398
No high school diploma or GED	2,873,182	0.085	0.278
No college degree	2,873,182	0.580	0.493
College degree or more	2,873,182	0.420	0.493
Enrolled in school	2,873,182	0.002	0.048
Age	2,873,182	48.930	8.065
White	2,873,182	0.840	0.367
Black	2,873,182	0.089	0.285
Hispanic	2,873,182	0.071	0.257
Northeast	2,873,182	0.215	0.411
Midwest	2,873,182	0.253	0.435
South	2,873,182	0.220	0.414
West	2,873,182	0.312	0.463
Metro area	2,873,182	0.682	0.466

(b) Balance table -

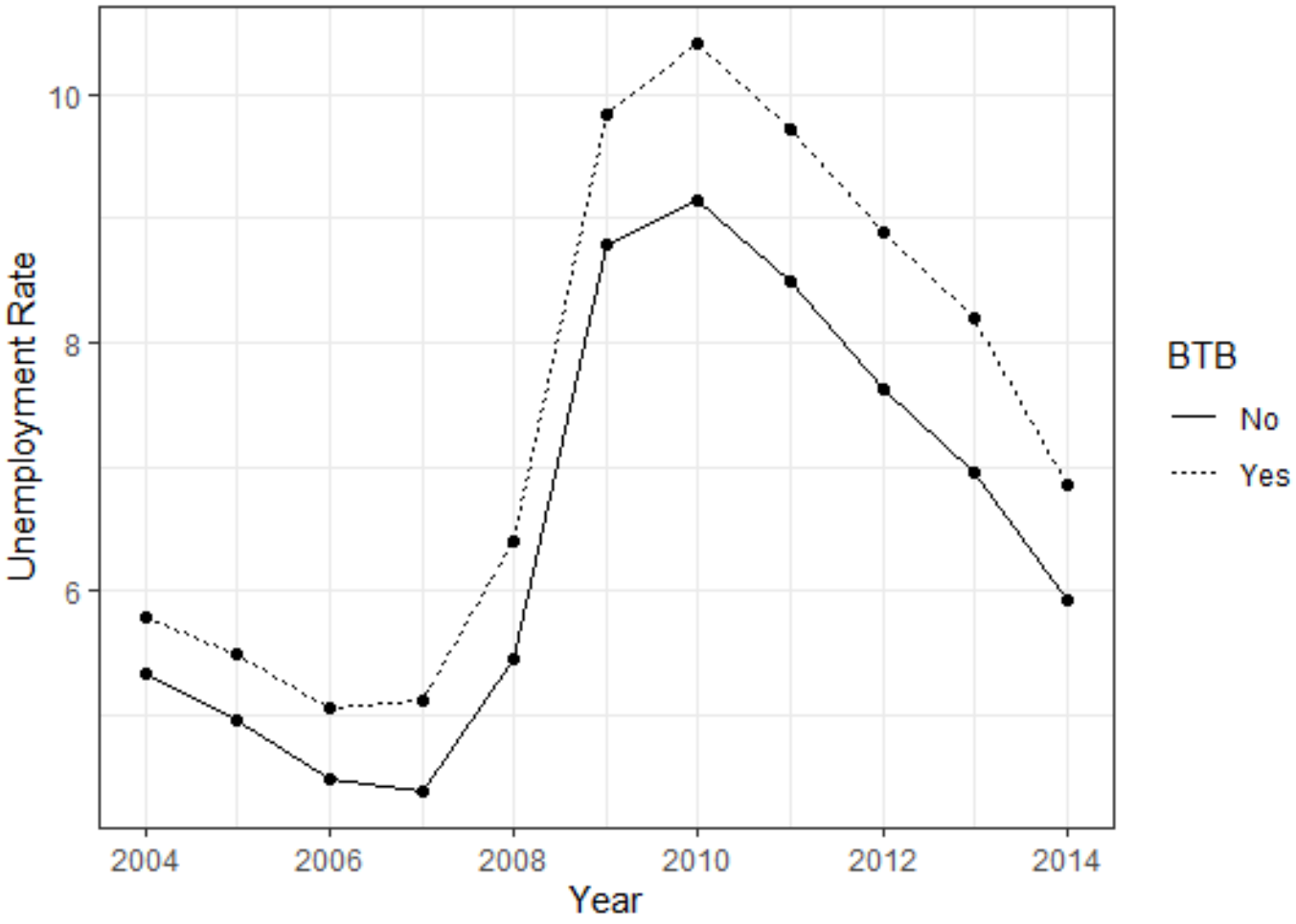
It is difficult to argue that we can produce unbiased estimates by comparing BTB and non-BTB individuals because BTB was not radnomly adopted by MSAs. However, given the data, we attempt to check if in given sample, the non-BTB individuals are a good control. In order to do that, we first create a balance table comparing the BTB and non-BTB individuals (we tried to replicate table 3 of the paper), segregated by race. We see that BTB participants tend to be concentrated among the metro areas and the geographies of adoption vary by race. For example, among black non-Hispanics, BTB was adopted more in the Northeast and Midwest regions. Apart from the geographical distribution, the other characters tics seem more or less balanced with small changes between the treatment and control means which are statistically significant. Since the control groups differ from the treatment group on baseline characteristics it may be worth trying to use matching methods to compare similar BTB and non-BTB individuals instead of conducting a pooled analysis. However, the power might suffer in this case.

Next, we check for unemployment rate pre-tends to check if we non-BTB metros might be good controls for BTB metros. Figure 1 (below) plots the past unemployment rate among BTB and non-BTB metros. We see that the past unemployment rates are similar across treatment and control groups, which is re-assuring for having the non-BTB metros as a control group.

Table 6: Balance table for Men Aged 25-34 with No College Degree

	Never adopted BTB	Adopted BTB	p-value
White non-hispanic -			
BTB	0.0000000	0.3523268	0.0000000
Employed	0.8109240	0.8054354	0.0000296
No high school diploma or GED	0.1176632	0.0933198	0.0000000
Enrolled in school	0.0098376	0.0139048	0.0000000
Age	29.4162301	29.3905554	0.0067706
Northeast	0.1564644	0.2306122	0.0000000
Midwest	0.2591032	0.3191805	0.0000000
South	0.2346421	0.2414129	0.0000012
West	0.3497903	0.2087945	0.0000000
Metro area	0.4347764	0.8765743	0.0000000
N	229426	157212	
Black non-hispanic -			
BTB	0.0000000	0.3561918	0.0000000
Employed	0.6600201	0.6536742	0.1050856
No high school diploma or GED	0.1611829	0.1368972	0.0000000
Enrolled in school	0.0121026	0.0143850	0.0128526
Age	29.3943891	29.3139093	0.0006032
Northeast	0.0414523	0.1861048	0.0000000
Midwest	0.1092564	0.2453059	0.0000000
South	0.0755024	0.1187681	0.0000000
West	0.7737888	0.4498212	0.0000000
Metro area	0.6145675	0.9695690	0.0000000
N	27019	35523	
Hispanic-			
BTB	0.0000000	0.4476742	0.0000000
Employed	0.8126593	0.7785760	0.0000000
No high school diploma or GED	0.2423017	0.2134494	0.0000000
Enrolled in school	0.0144807	0.0154677	0.2815949
Age	29.2365302	29.3169620	0.0002192
Northeast	0.0409884	0.2006470	0.0000000
Midwest	0.0902367	0.1157684	0.0000000
South	0.3073095	0.5597066	0.0000000
West	0.5614654	0.1238781	0.0000000
Metro area	0.7025747	0.9266481	0.0000000
N	28935	43898	

Figure 3: Unemployment Rate Change of BTB and Non-BTB Metros



(c)

Figure 4: Dynamic Effects of BTB on Metro Unemployment Rate

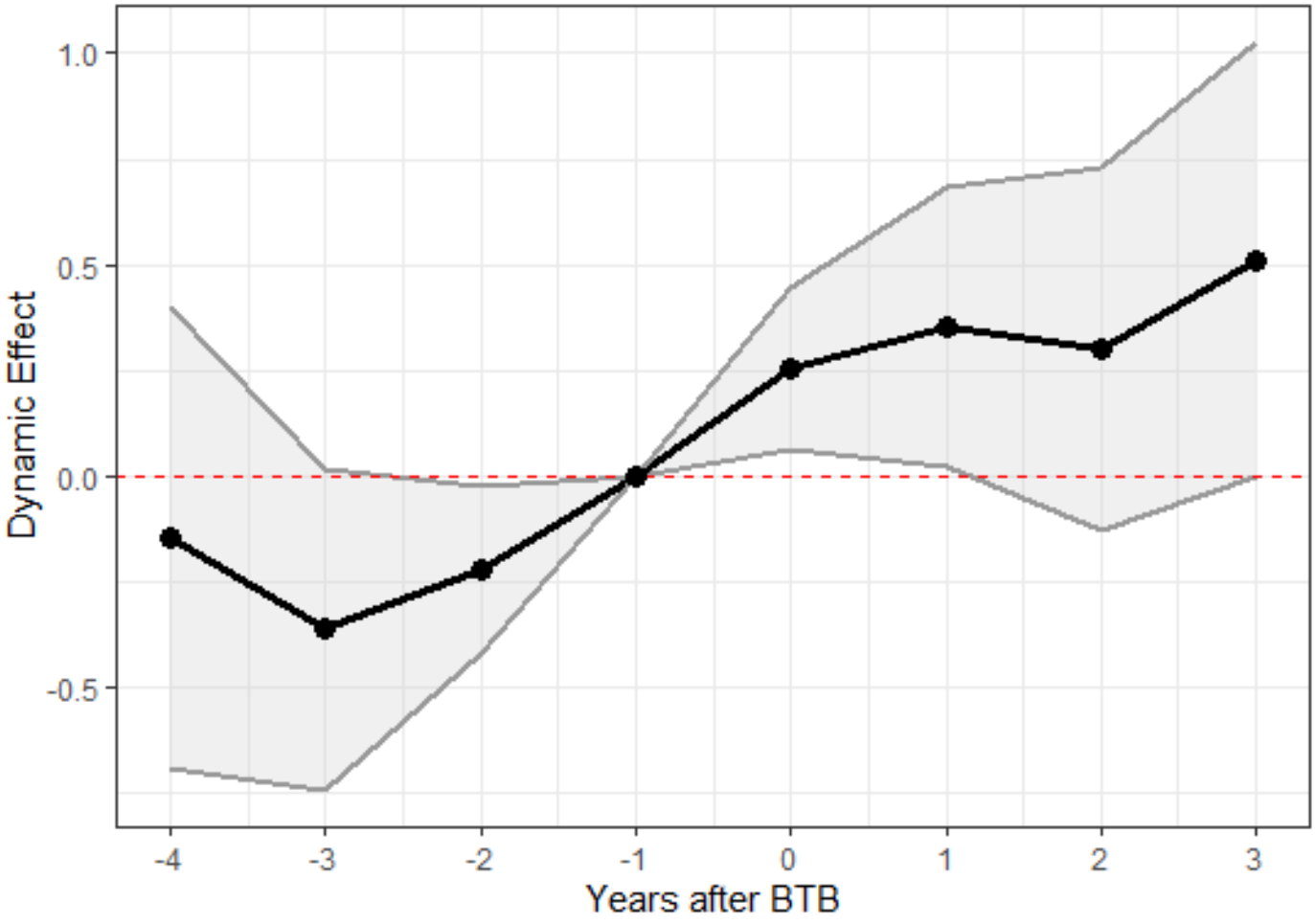


Table 7: Effects on Employment for Men Aged 25-34 with No College Degree, Main results

Dependent Variable:	employed							
Model:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Variables								
White X BTB	-0.0501***	-0.0420***	-0.0100	-0.0072	-0.0028	-0.0091	-0.0048	-0.0088
	(0.0088)	(0.0089)	(0.0073)	(0.0058)	(0.0061)	(0.0064)	(0.0078)	(0.0061)
Black X BTB	-0.0716***	-0.0605***	-0.0320***	-0.0296***	-0.0342**	-0.0291**	-0.0305**	-0.0306**
	(0.0112)	(0.0118)	(0.0115)	(0.0103)	(0.0149)	(0.0143)	(0.0138)	(0.0145)
Hispanic X BTB	-0.0489***	-0.0476***	-0.0120	-0.0046	-0.0234*	-0.0227*	-0.0197	-0.0229*
	(0.0088)	(0.0097)	(0.0114)	(0.0126)	(0.0130)	(0.0120)	(0.0148)	(0.0119)
Fit statistics								
Observations	503,419	503,419	503,419	503,419	503,419	336,641	227,645	336,641
Pre-BTB baseline								
White	0.822	0.822	0.822	0.822	0.822	0.823	0.822	0.823
Black	0.676	0.676	0.676	0.676	0.676	0.676	0.676	0.676
Hispanic	0.800	0.800	0.800	0.800	0.800	0.800	0.800	0.800
Controls								
MSA fixed effexts	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Demographics		Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time X region fixed effects			Yes	Yes	Yes	Yes	Yes	Yes
MSA specific trends				Yes	Yes	Yes	Yes	Yes
Fully interacted with race					Yes	Yes	Yes	Yes
MSA unemployment								Yes
Sample								
Full sample	Yes	Yes	Yes	Yes	Yes			
MSAs only						Yes		Yes
BTB-adopting only							Yes	

Clustered (stateFIPS) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*