

Income Effects of DC's Universal Pre-K Program on Parents of 3- and 4-Year-Olds

- Preliminary Results -

August 14, 2019

by Hyungjun (Simon) Park



■ Table of Contents

- Introduction
- Methodology
- Results
- Conclusion and Limitations on Pre-K 3-4
- Comments on Pre-K Expansion



Universal Pre-K

What is the universal Pre-K? Brief Introduction



■ Universal Pre-K in DC

Pre-Kindergarten (PK3 and PK4)

- DCPS places a strong value on early childhood education
- However, students are not required by law to attend preschool (PK3) or prekindergarten (PK4), the “right to attend” is not extended to children in these grades.
- DCPS offers ...
 - seats for 3-year-old children in PK3 and
 - seats for 4-year-old children in PK4.
- But the capacity is not yet at 100%
 - My School DC lottery takes applications.



■ Universal Pre-K in DC : Summary Statistics

	Census	# Enrolled	% Served
3 year olds	8,714	5,657	65%
4 year olds	7,695	6,955	90%
Total	16,409	12,612	77%

	Total Sites	Enrollment	Estimated Capacity	Estimated Utilization
Ward 1	16	1,240	1,320	94%
Ward 2	6	301	322	93%
Ward 3	8	383	378	101%
Ward 4	24	1,853	2,014	92%
Ward 5	28	2,270	2,768	82%
Ward 6	23	1,936	2,252	86%
Ward 7	18	1,816	2,030	89%
Ward 8	30	2,813	2,896	97%
Total	153	12,612	13,980	90%

District-Wide Enrolled Pre-K Children		
	Count	Percentage
Gender		
Male	6,338	49%
Female	6,572	51%
Race/Ethnicity		
Black	8,866	69%
Hispanic/Latino	1,824	14%
White	1,701	13%
Multiracial	314	2%
Asian	171	1%
Native American	21	0.2%
Pacific Islander	13	0.1%



Source: District of Columbia Office of the State Superintendent of Education
The State of Pre-K in the District of Columbia 2015 Pre-K Report



■ Universal Pre-K in Other States

Who Offers Universal Pre-K?

- Currently, **39 states** other than the District of Columbia offer *some form of voluntary Pre-K*, but *NOT every child is eligible*.
- In order to be considered universal Pre-K, the program must be offered to all children, no matter the circumstances.
- **Florida, Georgia, and Oklahoma** are the only states that offer Universal Pre-K for all 4-year-old children other than DC.



■ Universal Pre-K : Debates

On maternal labor force participation

- Extensive Margin : how many people work?
- **Intensive Margin : how much do people work on average?**

Other Dimensions...

- Cost-Benefit Analysis : from the revenue perspective
- Child's Development
 - : Does universal Pre-K provide better quality education?
 - : Does Pre-K enhance cognitive and non-cognitive skills?
 - : Does early development lead to better job market outcomes?



■ Universal Pre-K in Other Countries

TABLE 1

Universal, full-time child care allows more women to participate in the labor force

Notable child care and maternal labor force participation studies

Country	Type of intervention	Effect on maternal labor force participation
Canada (Québec)	Phased-in universal child care from 1997 to 2000, with a \$5–\$7 per day fee for parents	+7.7 percentage points (for women in 2-parent families)
Germany	Beginning in 1996, introduced free part-time child care for 3- and 4-year-olds	+6.5 percentage points
Chile	Beginning in 2006, introduced free full-time child care available for children younger than age 5	+8.8 percentage points (for mothers of toddlers)
Israel	Beginning in 1999, gradual rollout of compulsory free preschool for all 3- and 4-year-olds	+8.1 percentage points
England	Free full-time child care at age 4 (30 hours per week)	+5.7 percentage points
	Free part-time child care at age 3 (15 hours per week)	+2.1 percentage points

Sources: Michael Baker, Jonathan Gruber, and Kevin Milligan, "Universal Child Care, Maternal Labor Supply, and Family Well-Being," *Journal of Political Economy* 116 (4) (2008): 709–745; Pierre Lefebvre and Philip Merigan, "Child-Care Policy and the Labor Supply of Mothers with Young Children: A Natural Experiment from Canada," *Journal of Labor Economics* 26 (3) (2008): 519–548; Mike Brewer and others, "Free Childcare and Parents' Labour Supply: Is More Better?" (Bonn, Germany: IZA - Institute of Labor Economics, 2016); Stefan Bauernschuster and Martin Schlotter, "Public child care and mothers' labor supply—Evidence from two quasi-experiments," *Journal of Public Economics* 123 (2015): 1–16; Claudia Martinez and Marcela Peticarà, "Childcare effects on maternal employment: Evidence from Chile," *Journal of Development Economics* 125 (2017): 127–137; Analia Schlosser, "Public Preschool and the Labor Supply of Arab Mothers: Evidence from a Natural Experiment," *The Economic Quarterly* 53 (3) (2006): 517–553.



■ Universal Pre-K in DC : Existing Studies

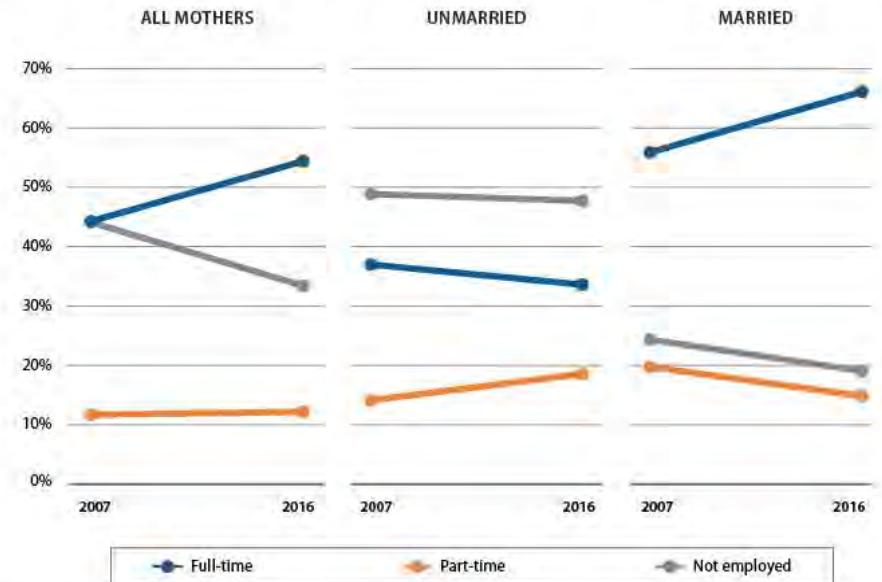
FIGURE 1
Universal preschool has increased labor force participation by 10 percentage points in Washington, D.C.
 Washington, D.C., and synthetic Washington, D.C.



Note: "Maternal labor force participation rate" is for women with at least one child under age 5.
 Source: Author's analysis of Integrated Public Use Microdata Series American Community Survey data. See Steven Ruggles and others, "Integrated Public Use Microdata Series, U.S. Census Data for Social, Economic, and Health Research, American Community Survey: 5-year estimates" (Minneapolis: Minnesota Population Center at the University of Minnesota), available at <https://usa.ipums.org/usa/> (last accessed August 2018).



FIGURE 4
Full-time work increased among married mothers, while part-time work increased among unmarried mothers in Washington, D.C.
 Maternal employment, by marital status



Note: "Full-time worker" is defined as one who usually works more than 35 hours per week.
 Source: Author's analysis of Integrated Public Use Microdata Series American Community Survey data. See Steven Ruggles and others, "Integrated Public Use Microdata Series, U.S. Census Data for Social, Economic, and Health Research, American Community Survey: 5-year estimates" (Minneapolis: Minnesota Population Center at the University of Minnesota), available at <https://usa.ipums.org/usa/> (last accessed August 2018).



■ Universal Pre-K in DC : Hypothesis

Question Does universal Pre-K implemented in DC affect the **mean wage level** of the eligible tax filers?

- ✓ **Hypothesis** We would expect the universal Pre-K to
1. induce the filers to **enroll in Pre-K facilities**
 2. having enrolled in the Pre-K provides the filers with **child-free time**
 3. thus, the filers now have an **option to participate** in the labor force
 4. if they rejoin the labor force, the participating filers' **income should grow faster** than its counterpart



Data Cleaning

Data cleaning procedures and the models for analysis



■ Data Source

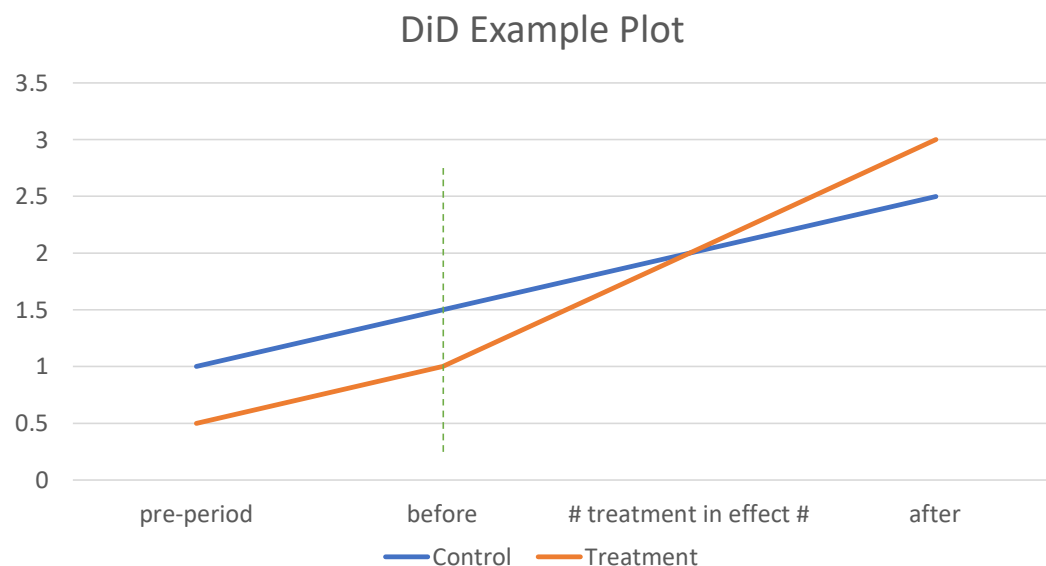
- Original Data Source : **Income Tax Data**
- Main : DC geocoded IIT
 - all dependent and important independent variables
- Supplement : Federal IIT
 - additional controls (dob of the filer and the child, age of the filer)
- Date of Birth and Census Tract restoration
 - data interpolation
- 5-year panel structure (balanced, tracking individuals)



■ Model

Difference-in-Differences $\text{Wage} \sim \text{Policy} + \text{Post} + \text{Age} + \text{Age}^2 + \text{Policy} * \text{Post}$ *OLS*

- Interest: the slope difference between the control and the treatment
- Pros: do not need to adjust for fluctuations (e.g. inflation...)



Results (example)

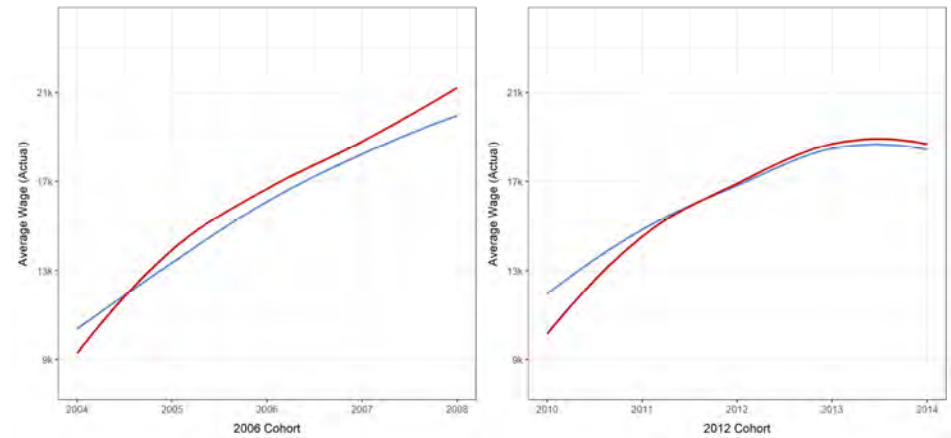
Filter
Example

Population Distribution

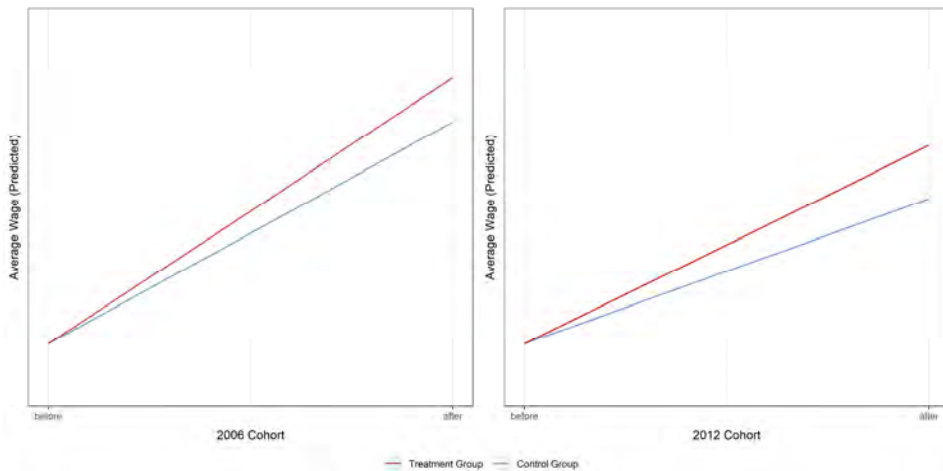
Distribution of Children in the District of Columbia 2001~2016 (avg)



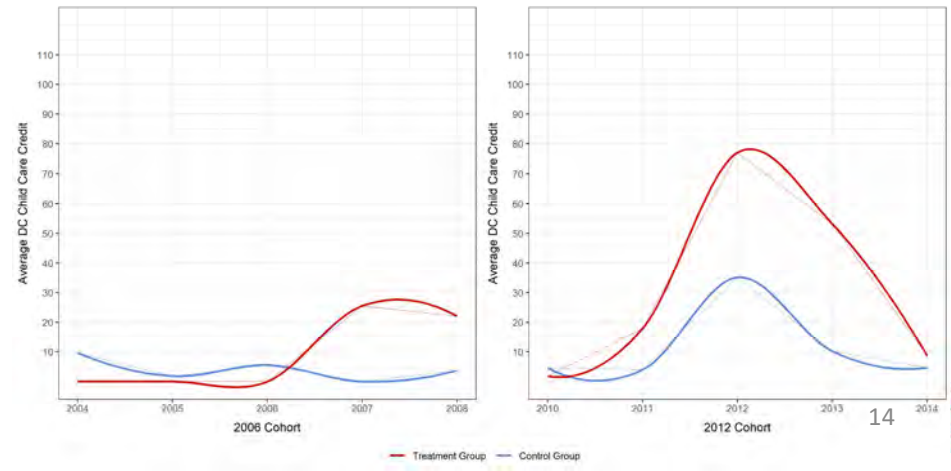
Average Wage Trend



DiD Regression Plot

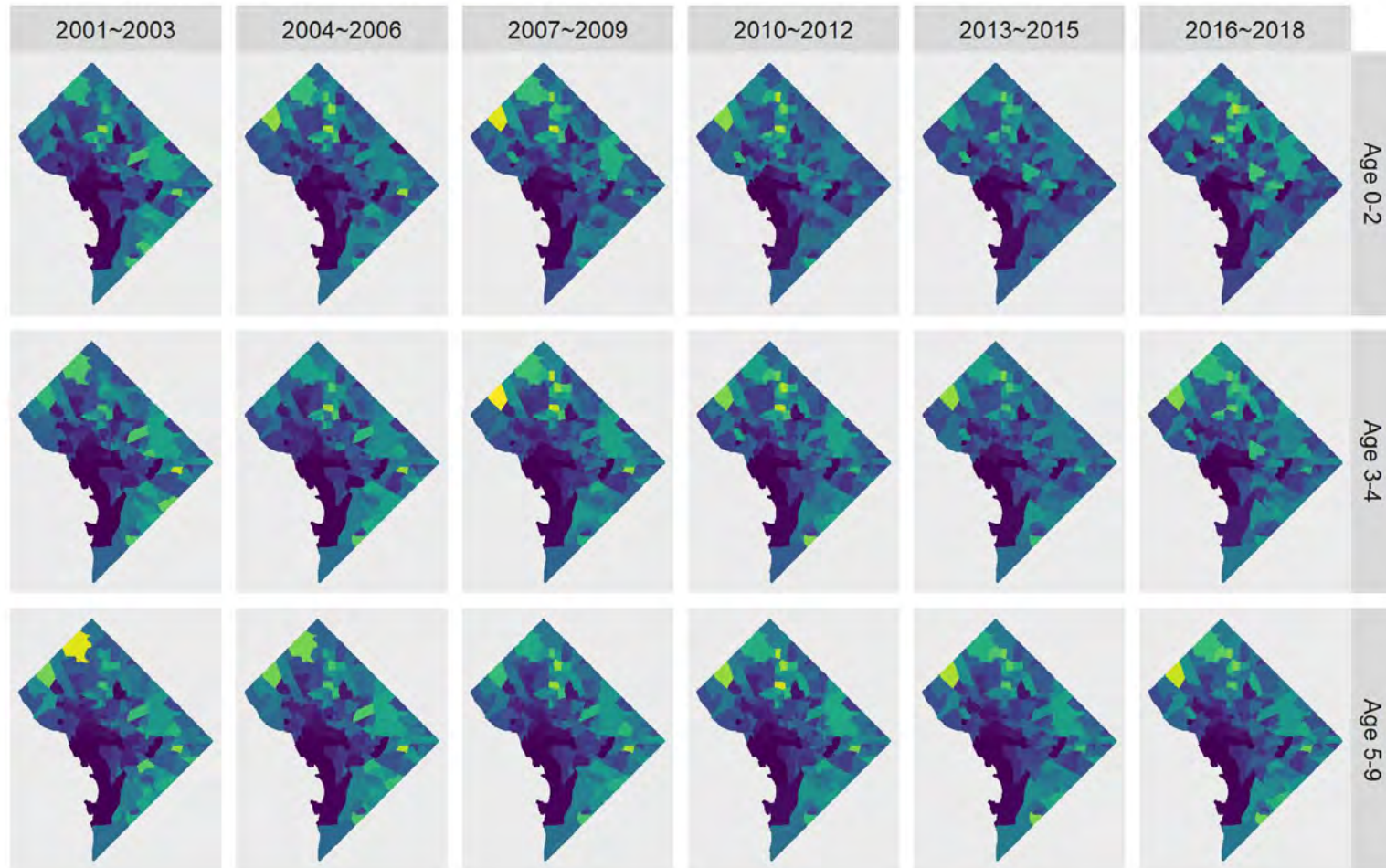


Childcare Credit (Claimed) Trend

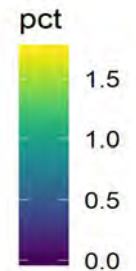


Population Trends : Demographics of Filers with a Single Child

Distribution of Children in the District of Columbia



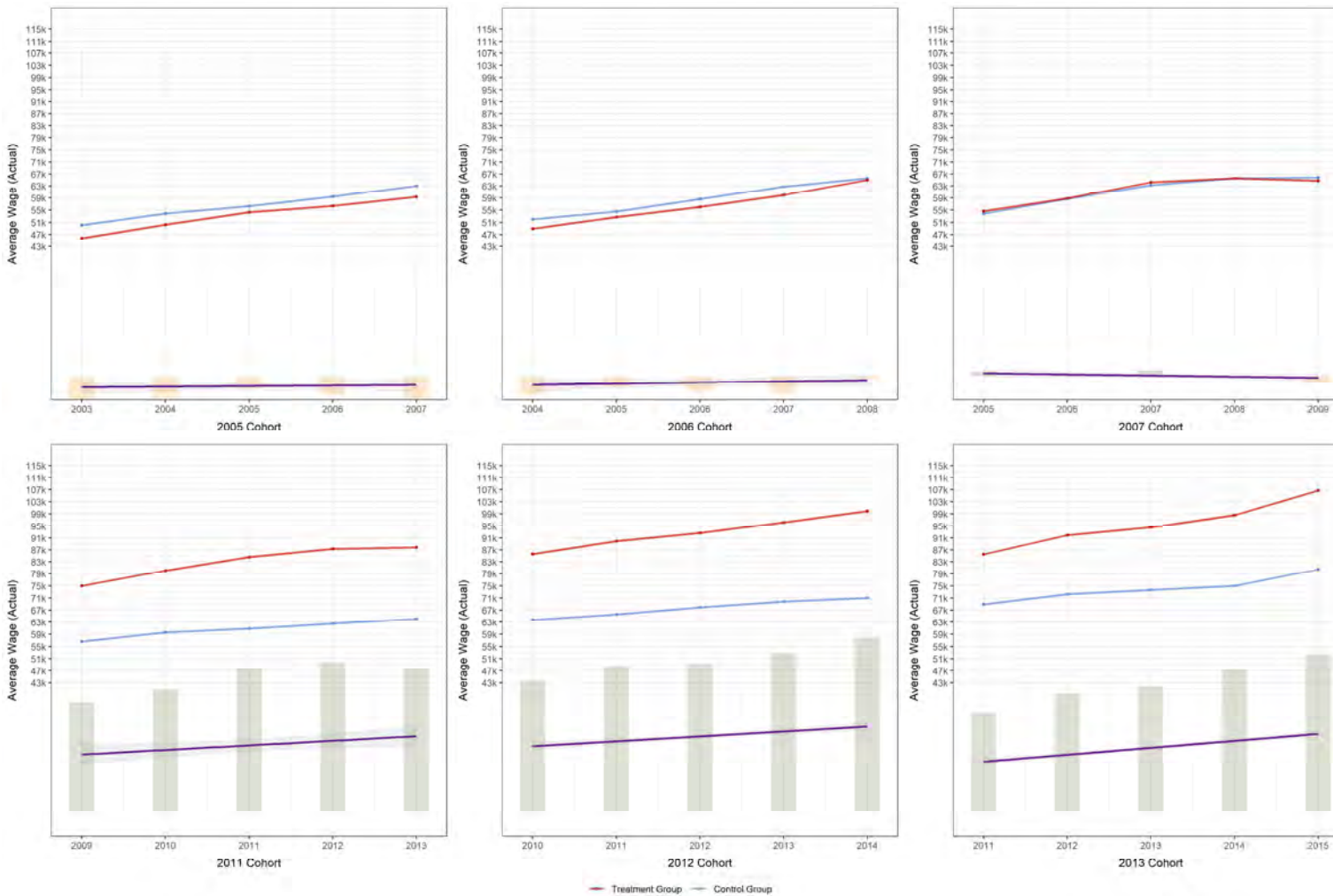
Filter
NONE



```
#####
Pop. of 1 Child by Age in DC
age 0-2 age 3-4 age 5-9
2001 2668 2678 6669
2002 2636 2807 7132
2003 2716 2847 7486
2004 2769 2587 7292
2005 3721 3203 8930
2006 4619 3460 9154
2007 4813 3799 9219
2008 4974 4314 9293
2009 4902 4644 9430
2010 5021 4975 10232
2011 5553 5375 11288
2012 5644 5257 11861
2013 6002 5702 13595
2014 5626 5536 13411
2015 5612 5585 13967
2016 4996 4894 12981
avg. 4517 4229 10121
#####
```



Wage Trends (Actual Level)



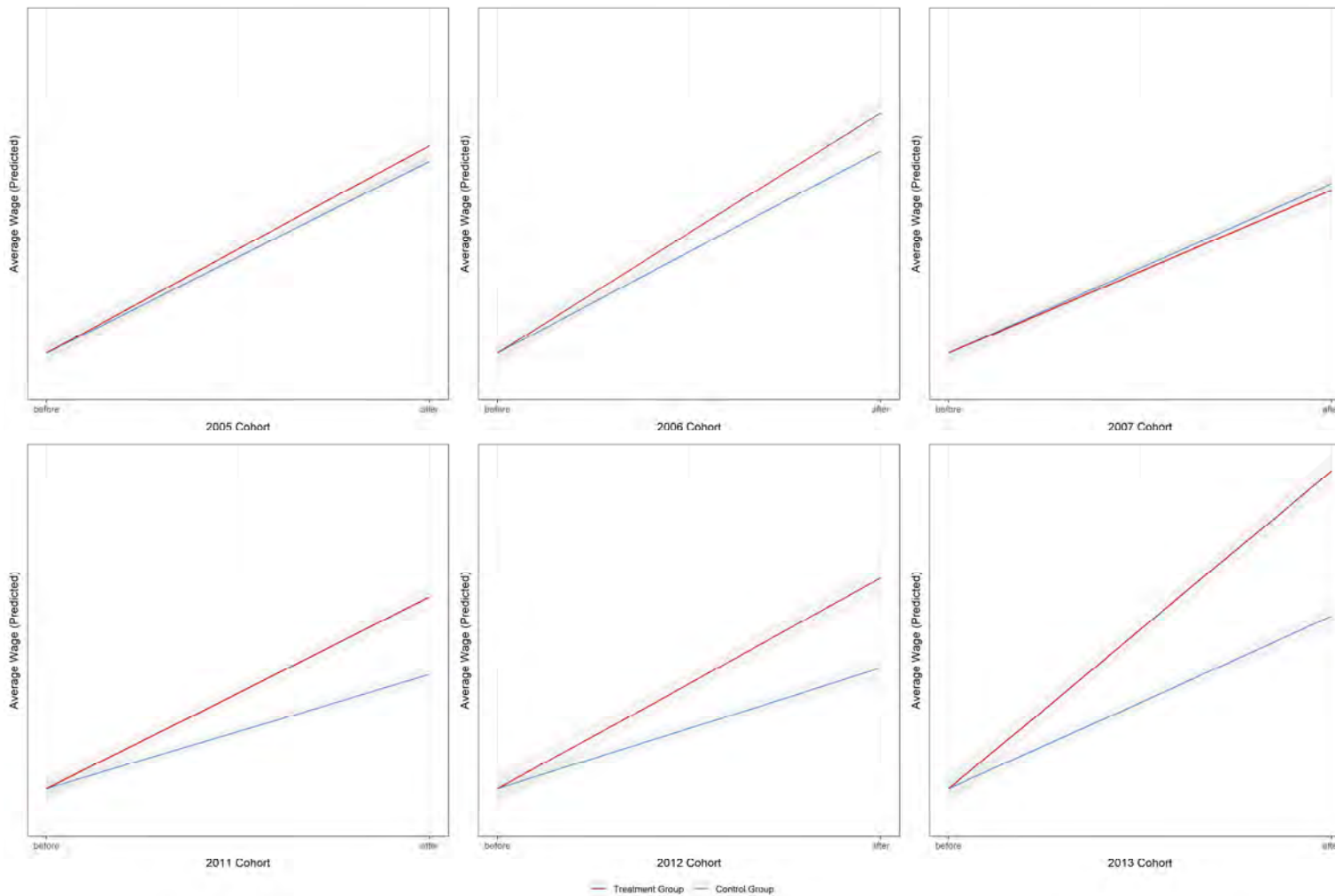
Filter
NONE

Cohort	Treatment	Control
2005	860	3,179
2006	829	3,322
2007	1,055	4,025

Cohort	Treatment	Control
2011	1,511	3,768
2012	1,390	3,835
2013	1,459	4,143



DiD Regression (Predicted Level)



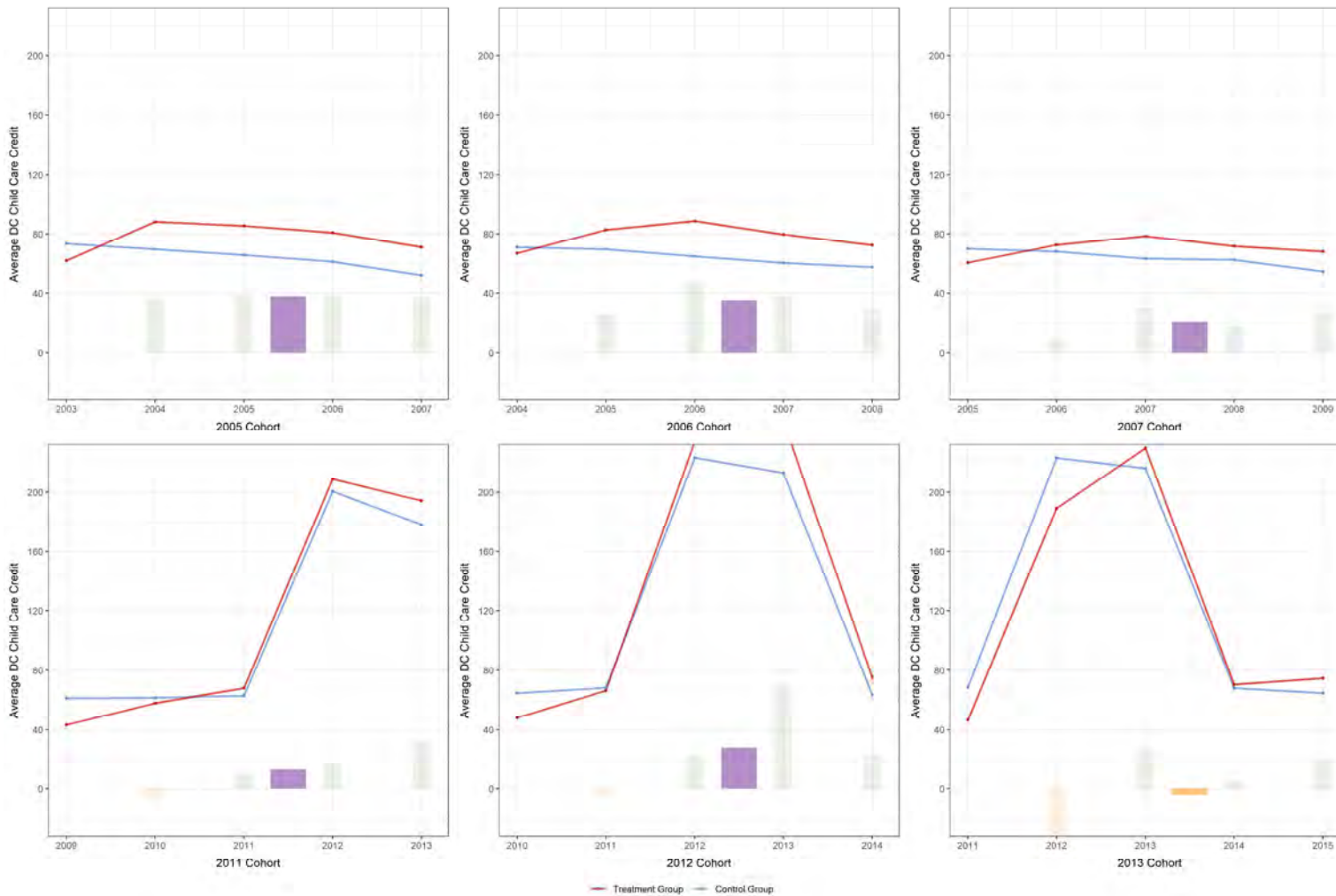
Filter
NONE

Cohort	Treatment	Control
2005	851	3,139
2006	816	3,282
2007	1,033	3,946

Cohort	Treatment	Control
2011	1,500	3,737
2012	1,329	3,686
2013	1,402	4,006

```
#####
DiD analysis for tot_all PK3 Cohorts
: significance level, Pr(>|t|)
cohort_2005 cohort_2006 cohort_2007
0.7935      0.5663      0.9163
cohort_2011 cohort_2012 cohort_2013
0.1650      0.1824      0.0351 *
#####
```

Child Care Credit Trends (Actual Level)



Filter
NONE

Cohort	Treatment	Control
2005	860	3,179
2006	829	3,322
2007	1,055	4,025

Cohort	Treatment	Control
2011	1,511	3,768
2012	1,390	3,835
2013	1,459	4,143



■ Analysis

Subset Options

- Types (filling status)
 - ① **All** ② **Married** ③ **Head of Household**
- Income threshold
 - ① **NA** ② **top 70%** ③ **bottom 30%**
- By Ward: singly and jointly

Spoiler...

- Types X Inc : **[HoH × NA]** **[HoH × b30]** **[MAR × NA]** **[MAR × b30]**
- Ward : **[1+4 × b30]**



Findings

Interesting results from the set of analyses

HoH : CANNOT observe any behavioral change

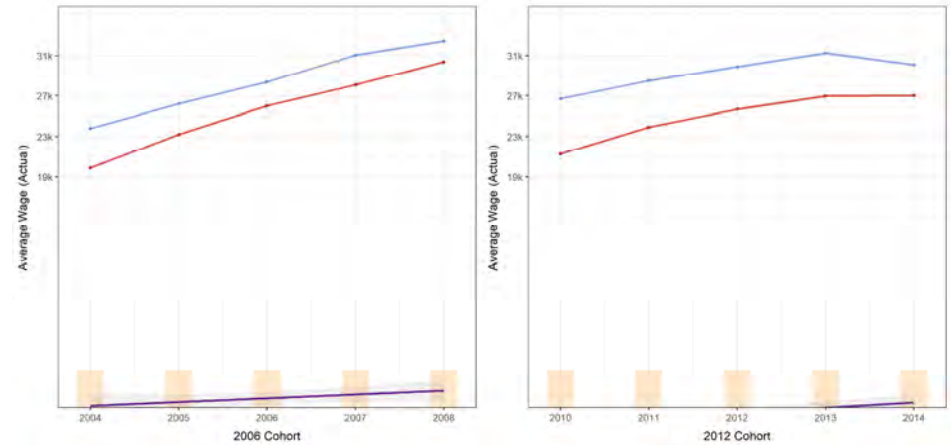
Filter
HoH × NA

Population Distribution

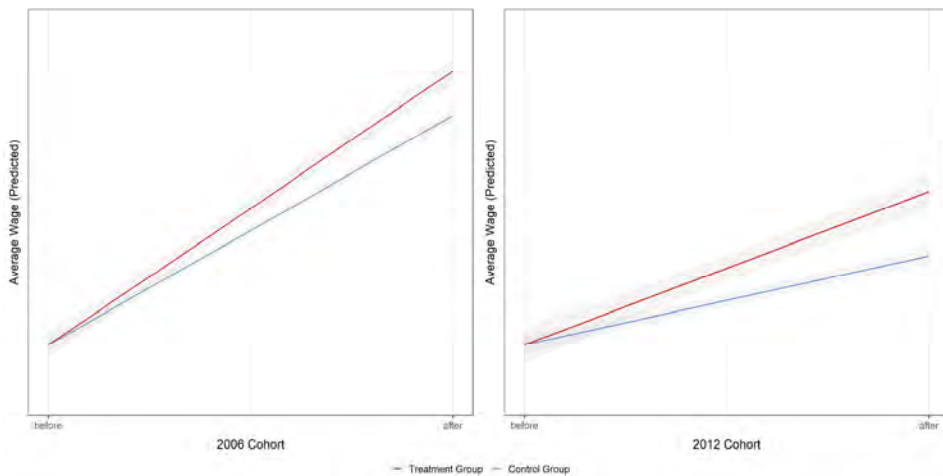
Distribution of Children in the District of Columbia 2001~2016 (avg)



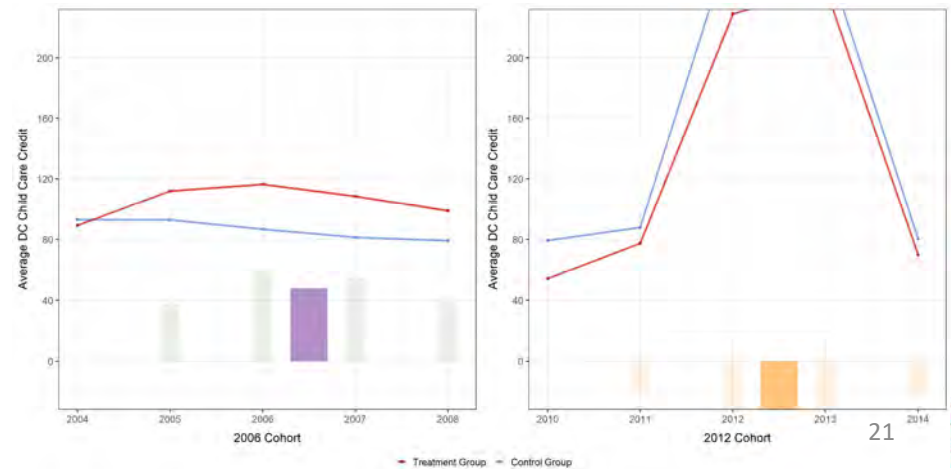
Average Wage Trend



DiD Regression Plot



Childcare Credit (Claimed) Trend



```
#####
Pop. of 1 child by Age in DC
  Age 3 Age 7-9 Total
2001 1006 2862 3868
2002 1047 3068 4115
2003 1038 3326 4364
2004 1121 3213 4334
2005 1418 3999 5417
2006 1705 4196 5901
2007 1614 4250 5864
2008 1554 4235 5789
2009 1482 4169 5651
2010 1434 4365 5799
2011 1461 4618 6079
2012 1461 4757 6218
2013 1443 5528 6971
2014 1289 5498 6787
2015 1264 5686 6950
2016 1117 5268 6385
avg. 1341 4315 5656
#####
```

```
#####
DiD analysis for hoh_all PK3 Cohorts
: significance level, Pr(>|t|)
cohort_2005 cohort_2006 cohort_2007
0.0424 * 0.2460 0.2988
cohort_2011 cohort_2012 cohort_2013
0.2037 0.1297 0.1998
#####
```

```
#####
mean 67719, median 33643
mean 96493, median 44141
#####
```

```
#####
```

DiD analysis for 2006

```
Call:
lm(formula = wage ~ policy + post + age + age^2 + policy * post,
    data = dta)
```

```
Residuals:
    Min       1Q   Median       3Q      Max
-38202 -10788  -1135   8676 120479
```

```
Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept) -4519.39   2219.70  -2.036  0.0418 *
policy       -766.66   1042.69  -0.735  0.4622
post         8678.71    708.87  12.243 <2e-16 ***
age          872.89    66.65  13.096 <2e-16 ***
policy:post  1672.08   1441.09   1.160  0.2460
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
Residual standard error: 16690 on 2921 degrees of freedom
Multiple R-squared:  0.1217,    Adjusted R-squared:  0.1205
F-statistic: 101.2 on 4 and 2921 DF,  p-value: < 2.2e-16
```

```
#####
```

```
#####
```

DiD analysis for 2012

```
Call:
lm(formula = wage ~ policy + post + age + age^2 + policy * post,
    data = dta)
```

```
Residuals:
    Min       1Q   Median       3Q      Max
-42205 -13228  -2335   9070 291164
```

```
Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept) -22312.85   2562.43  -8.708 < 2e-16 ***
policy        202.18   1173.30   0.172  0.863
post         3377.65    818.84   4.125 3.79e-05 ***
age          1567.71    79.73  19.662 < 2e-16 ***
policy:post   2440.38   1610.31   1.515  0.130
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
Residual standard error: 21880 on 3847 degrees of freedom
Multiple R-squared:  0.1042,    Adjusted R-squared:  0.1033
F-statistic: 111.9 on 4 and 3847 DF,  p-value: < 2.2e-16
```

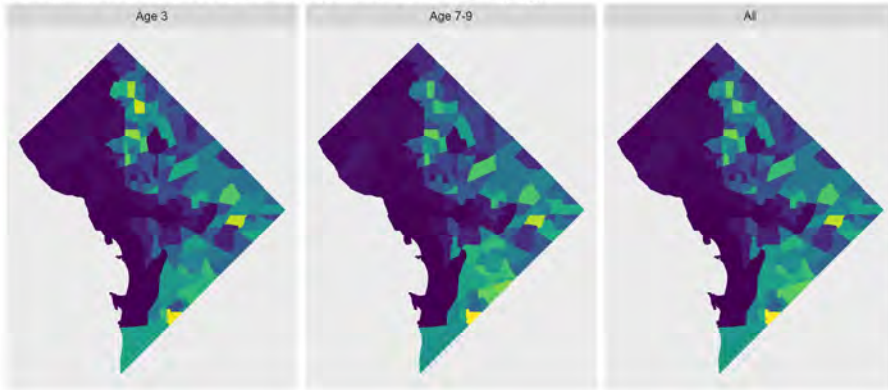
```
#####
```

HoH : CANNOT observe any behavioral change

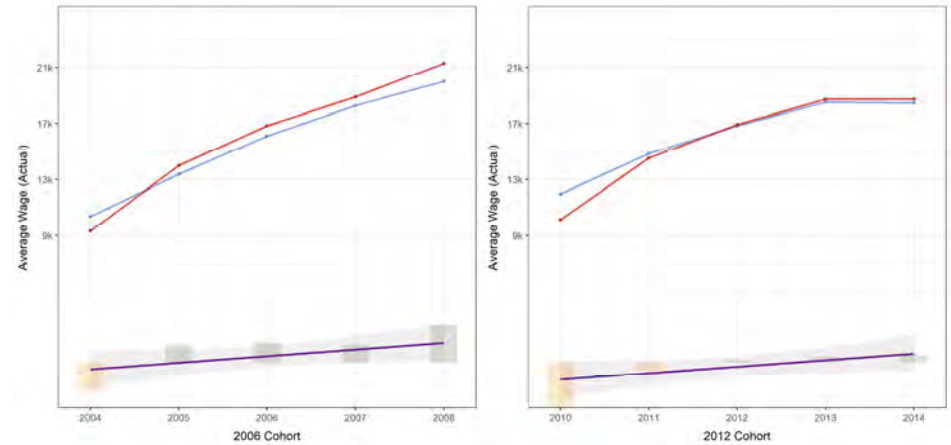
Filter
HoH × b30

Population Distribution

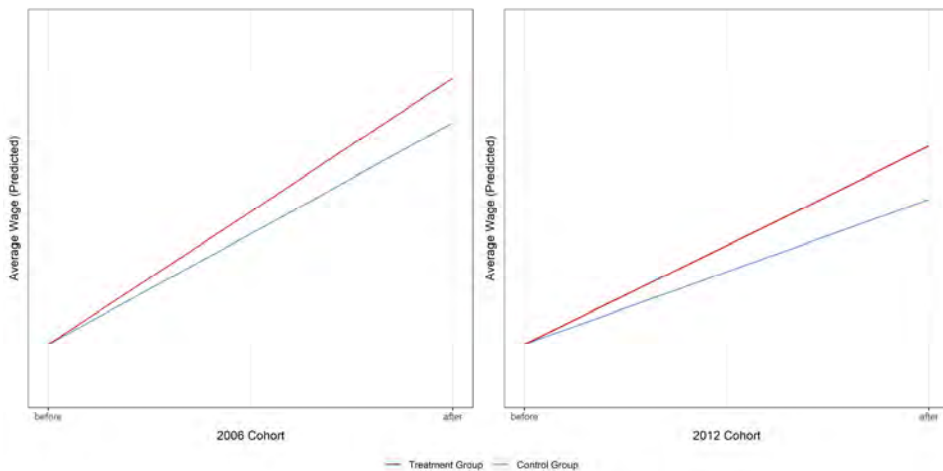
Distribution of Children in the District of Columbia 2001~2016 (avg)



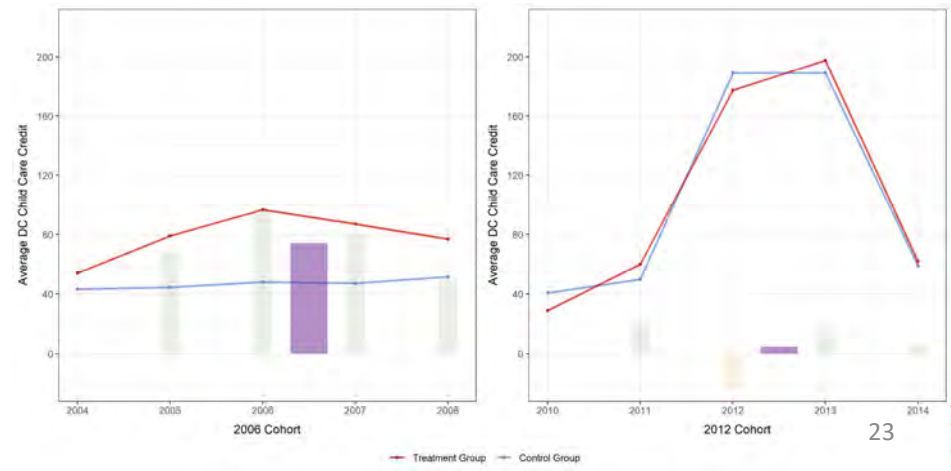
Average Wage Trend



DiD Regression Plot



Childcare Credit (Claimed) Trend



```
#####
Pop. of 1 Child by Age in DC
  Age 3 Age 7-9 Total
2001  466    790 1256
2002  503    912 1415
2003  491    999 1490
2004  563   1045 1608
2005  709   1309 2018
2006  889   1391 2280
2007  840   1442 2282
2008  821   1467 2288
2009  813   1482 2295
2010  789   1526 2315
2011  808   1725 2533
2012  808   1804 2612
2013  832   2132 2964
2014  662   1924 2586
2015  694   2321 3015
2016  617   2096 2713
avg.   707   1523 2229
#####
```

```
#####
DiD analysis for hoh_b30 PK3 Cohorts
: significance level, Pr(>|t|)
cohort_2005 cohort_2006 cohort_2007
0.0008 *** 0.0898 . 0.9114
cohort_2011 cohort_2012 cohort_2013
0.0093 ** 0.0283 * 0.0929 .
#####
```

```
#####
mean 15916, median 14640
mean 15718, median 15116
#####
```

```
#####
```

DiD analysis for 2006

```
Call:
lm(formula = wage ~ policy + post + age + age^2 + policy * post,
    data = dta)
```

```
Residuals:
    Min     1Q   Median     3Q    Max
-20971 -5767    486   5584 46949
```

```
Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept) 11277.60   1756.08   6.422 1.94e-10 ***
policy      -1084.91    838.84  -1.293  0.1961
post        9786.19    641.47  15.256 < 2e-16 ***
age         -29.33     54.43  -0.539  0.5901
policy:post 1959.87   1154.49   1.698  0.0898 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
Residual standard error: 9207 on 1187 degrees of freedom
Multiple R-squared:  0.2438,    Adjusted R-squared:  0.2413
F-statistic: 95.7 on 4 and 1187 DF,  p-value: < 2.2e-16
```

```
#####
```

DiD analysis for 2012

```
Call:
lm(formula = wage ~ policy + post + age + age^2 + policy * post,
    data = dta)
```

```
Residuals:
    Min     1Q   Median     3Q    Max
-20338 -7298    179   6727 70509
```

```
Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept) 8463.19   1815.53   4.662 3.36e-06 ***
policy      -1190.09    793.86  -1.499  0.1340
post        6421.16    614.14  10.456 < 2e-16 ***
age         116.50     58.01   2.008  0.0447 *
policy:post 2333.53   1063.16   2.195  0.0283 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
Residual standard error: 10960 on 1907 degrees of freedom
Multiple R-squared:  0.1018,    Adjusted R-squared:  0.09991
F-statistic: 54.03 on 4 and 1907 DF,  p-value: < 2.2e-16
```


MAR : behavioral change?

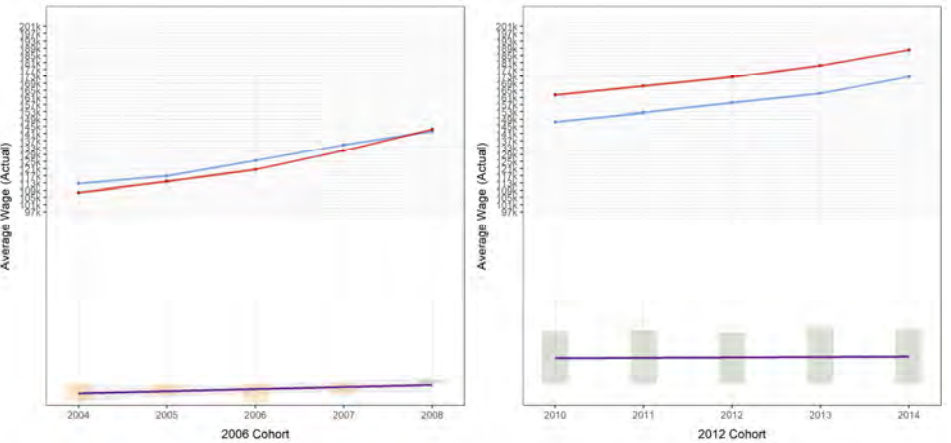
Filter
MAR × NA

Population Distribution

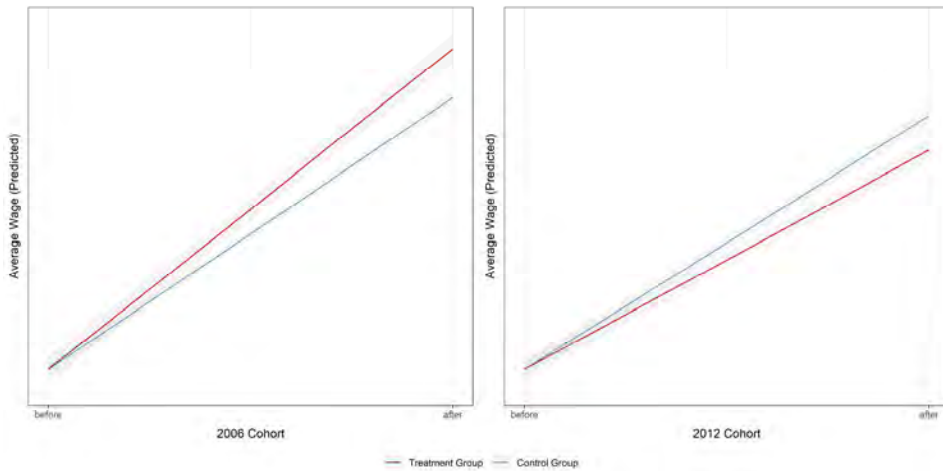
Distribution of Children in the District of Columbia 2001~2016 (avg)



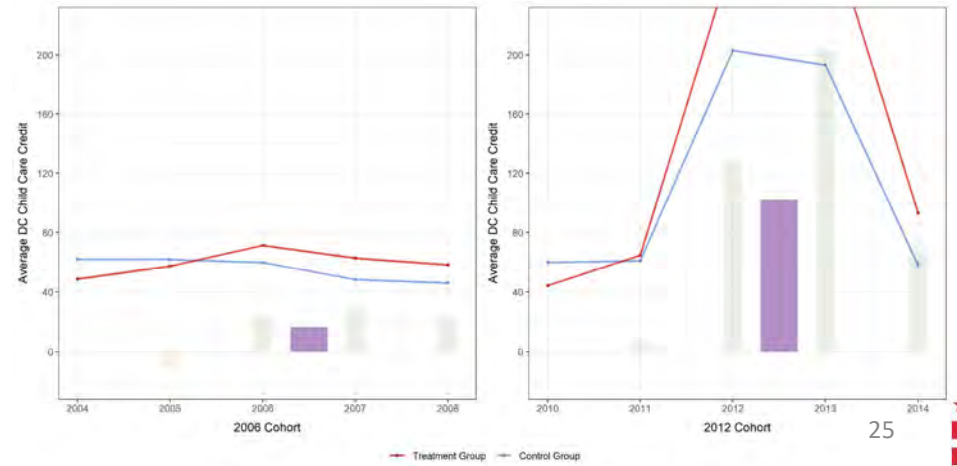
Average Wage Trend



DiD Regression Plot



Childcare Credit (Claimed) Trend



```
#####
Pop. of 1 child by Age in DC
Age 3 Age 7-9 Total
2001 350 910 1260
2002 316 927 1243
2003 372 1048 1420
2004 418 1085 1503
2005 703 1400 2103
2006 946 1381 2327
2007 935 1294 2229
2008 1016 1244 2260
2009 1031 1227 2258
2010 1223 1241 2464
2011 1425 1446 2871
2012 1508 1645 3153
2013 1567 2085 3652
2014 1587 2266 3853
2015 1572 2426 3998
2016 1389 2371 3760
avg. 1022 1500 2522
#####
```

```
#####
DiD analysis for mar_all PK3 Cohorts
: significance level, Pr(>|t|)
cohort_2005 cohort_2006 cohort_2007
0.9518 0.6938 0.8036
cohort_2011 cohort_2012 cohort_2013
0.8799 0.7272 0.3483
#####
```

```
#####
mean 129902, median 101158
mean 167838, median 145832
#####
```

```
#####
```

DiD analysis for 2006

```
Call:
lm(formula = wage ~ policy + post + age + age^2 + policy * post,
    data = dta)
```

```
Residuals:
    Min       1Q   Median       3Q      Max
-167760  -79244  -27416   43406  836931
```

```
Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept) 25073.6   23529.8   1.066  0.28673
policy       2970.2    9962.7   0.298  0.76564
post        30018.5   6323.2   4.747  2.21e-06 ***
age         1967.6    515.6    3.816  0.00014 ***
policy:post  5412.0   13744.2   0.394  0.69380
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
Residual standard error: 124100 on 1951 degrees of freedom
Multiple R-squared:  0.02288, Adjusted R-squared:  0.02088
F-statistic: 11.42 on 4 and 1951 DF, p-value: 3.65e-09
```

```
#####
```

```
#####
```

DiD analysis for 2012

```
Call:
lm(formula = wage ~ policy + post + age + age^2 + policy * post,
    data = dta)
```

```
Residuals:
    Min       1Q   Median       3Q      Max
-227787  -91899  -26035   54770  841695
```

```
Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept) 27703.1   23549.8   1.176  0.239552
policy       29017.9    8188.8   3.544  0.000401 ***
post        28027.3    6893.5   4.066  4.92e-05 ***
age         2770.5     525.2    5.275  1.43e-07 ***
policy:post -3798.8   10887.6  -0.349  0.727180
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
Residual standard error: 139000 on 2709 degrees of freedom
Multiple R-squared:  0.02089, Adjusted R-squared:  0.01945
F-statistic: 14.45 on 4 and 2709 DF, p-value: 1.111e-11
```

```
#####
```

MAR : behavioral change observed!

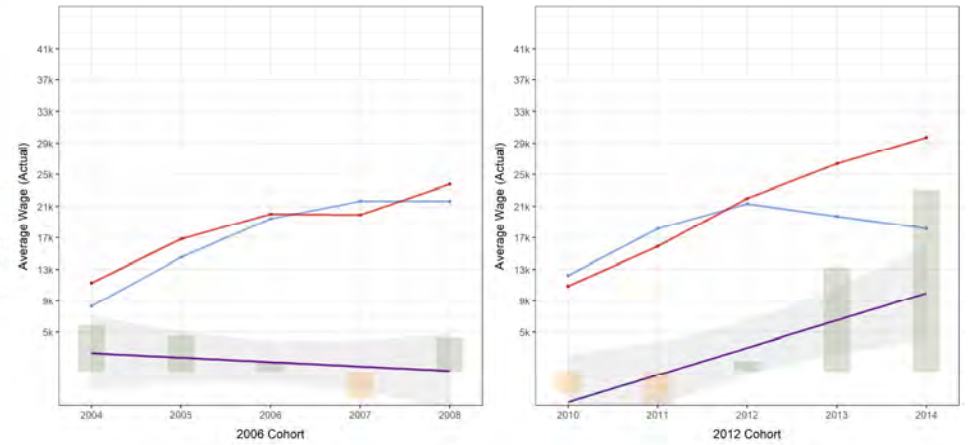
Filter
MAR × b30

Population Distribution

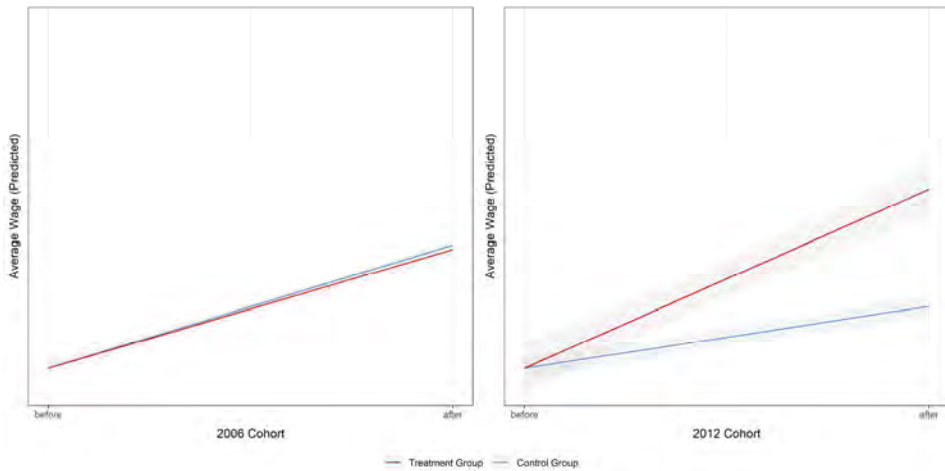
Distribution of Children in the District of Columbia 2001~2016 (avg)



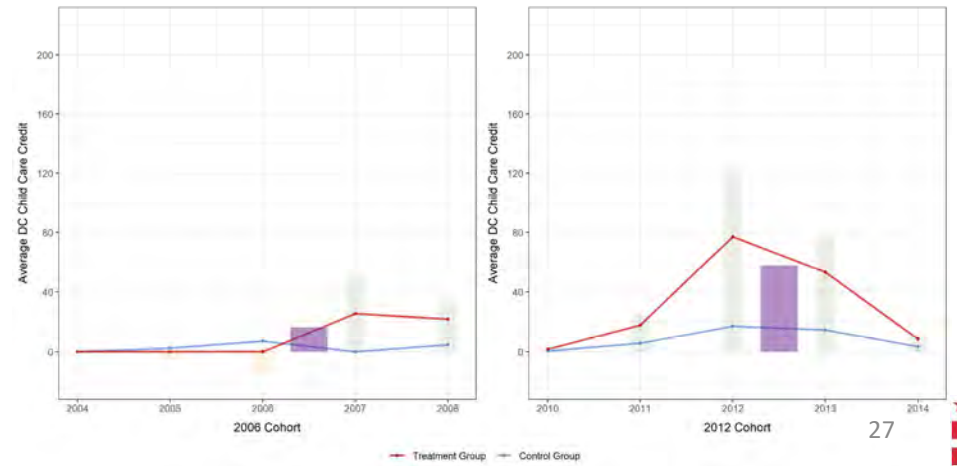
Average Wage Trend



DiD Regression Plot



Childcare Credit (Claimed) Trend



```
#####
Pop. of 1 child by Age in DC
  Age 3 Age 7-9 Total
2001    21    37    58
2002    23    38    61
2003    26    48    74
2004    16    59    75
2005    26    76   102
2006    43    92   135
2007    35    79   114
2008    43   102   145
2009    43    99   142
2010    51    83   134
2011    40    93   133
2012    55    72   127
2013    50    95   145
2014    39    92   131
2015    40   118   158
2016    45    99   144
avg.     37    80   117
#####
```

```
#####
DiD analysis for mar_b30 PK3 Cohorts
: significance level, Pr(>|t|)
cohort_2005 cohort_2006 cohort_2007
0.8618      0.9537      0.5085
cohort_2011 cohort_2012 cohort_2013
0.0499 *    0.0891    . 0.3994
#####
```

```
#####
mean 19649, median 14719
mean 23314, median 19000
#####
```

#####

DiD analysis for 2006

```
Call:
lm(formula = wage ~ policy + post + age + age^2 + policy * post,
    data = dta)
```

```
Residuals:
    Min     1Q   Median     3Q     Max
-23213  -8370   -661    5798  89023
```

```
Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept) 13967.4    9898.8   1.411 0.161505
policy       2107.8    5946.5   0.354 0.723783
post        12986.5   3414.3   3.804 0.000252 ***
age         -133.6     219.4  -0.609 0.544016
policy:post  -468.2     8047.6  -0.058 0.953728
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
Residual standard error: 15460 on 95 degrees of freedom
Multiple R-squared:  0.1616,    Adjusted R-squared:  0.1263
F-statistic: 4.579 on 4 and 95 DF,  p-value: 0.002001
```

#####

#####

DiD analysis for 2012

```
Call:
lm(formula = wage ~ policy + post + age + age^2 + policy * post,
    data = dta)
```

```
Residuals:
    Min     1Q   Median     3Q     Max
-29059  -8670   -505    6224 110089
```

```
Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept) 38055.7    9935.9   3.830 0.000213 ***
policy      -4946.7    5233.8  -0.945 0.346634
post        6541.1    3998.5   1.636 0.104700
age         -619.0     229.8  -2.694 0.008163 **
policy:post 12312.4     7177.6   1.715 0.089064 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
Residual standard error: 17880 on 111 degrees of freedom
Multiple R-squared:  0.163,    Adjusted R-squared:  0.1328
F-statistic: 5.404 on 4 and 111 DF,  p-value: 0.0005167
```

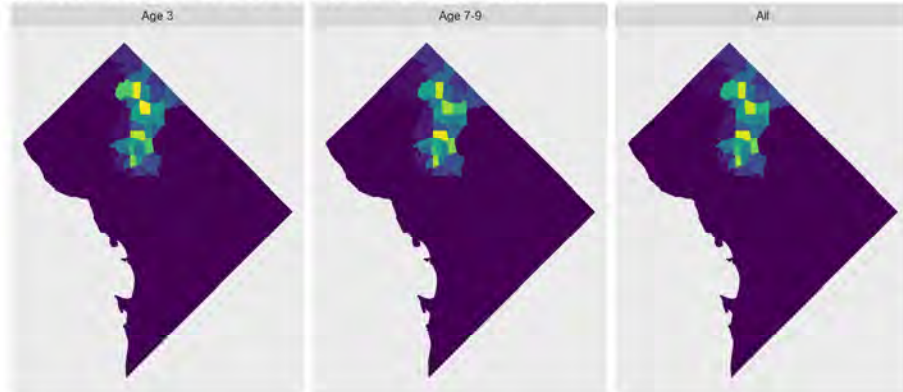
#####

Ward 1+4 : behavioral change observed!

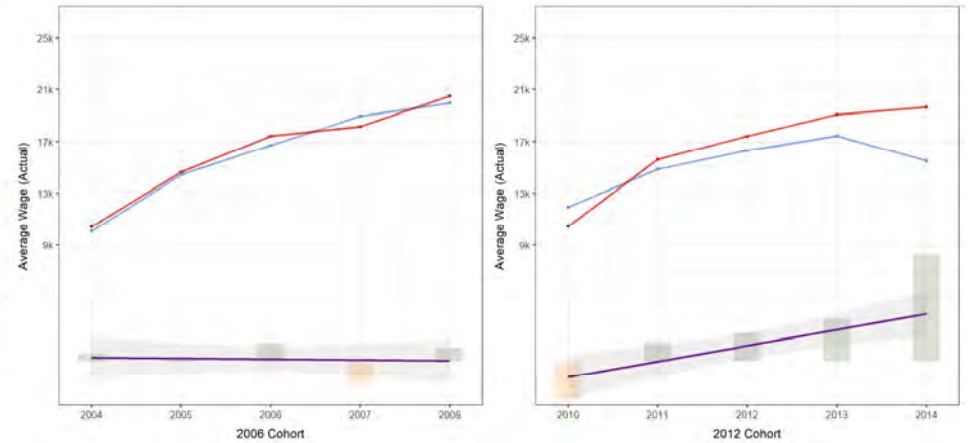
Filter
W1+4 × b30

Population Distribution

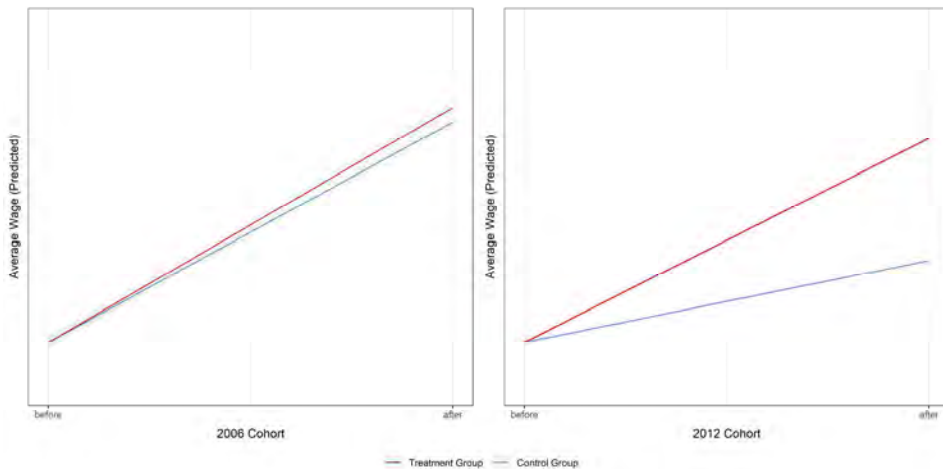
Distribution of Children in the District of Columbia 2001~2016 (avg)



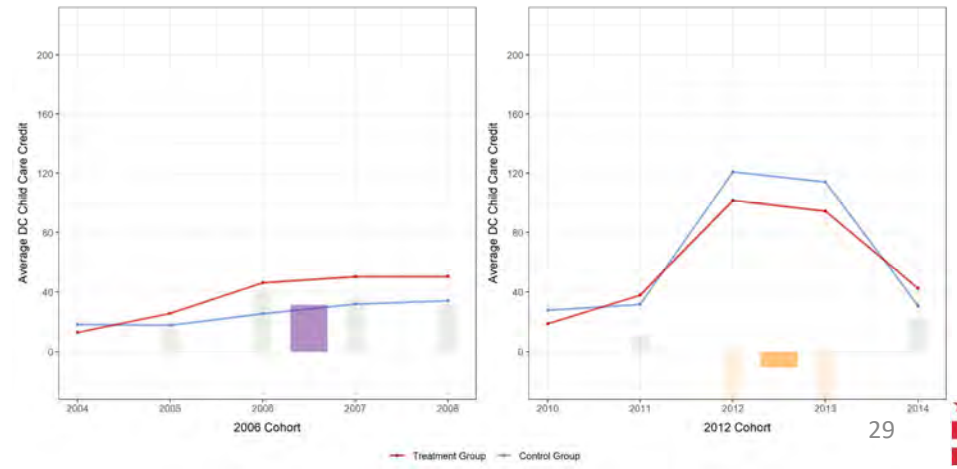
Average Wage Trend



DiD Regression Plot



Childcare Credit (Claimed) Trend



```
#####
Pop. of 1 Child by Age in DC
  Age 3 Age 7-9 Total
2001  127   174   301
2002  139   194   333
2003  138   256   394
2004  167   271   438
2005  239   348   587
2006  296   383   679
2007  256   360   616
2008  287   389   676
2009  308   443   751
2010  253   442   695
2011  251   513   764
2012  262   537   799
2013  232   611   843
2014  176   459   635
2015  197   591   788
2016  178   519   697
avg.  219   406   625
#####
```

```
#####
DiD analysis for w14_b30 PK3 Cohorts
: significance level, Pr(>|t|)
cohort_2005 cohort_2006 cohort_2007
0.7630      0.7601      0.6841
cohort_2011 cohort_2012 cohort_2013
0.0880      0.0027      ** 0.1034
#####
```

```
#####
mean 15877, median 14638
mean 16099, median 15477
#####
```

```
#####
```

DiD analysis for 2006

```
call:
lm(formula = wage ~ policy + post + age + age^2 + policy * post,
    data = dta)
```

```
Residuals:
  Min      1Q  Median      3Q      Max
-21329 -6850   151   5551  55695
```

```
Coefficients:
              Estimate Std. Error t value Pr(>|t|)
(Intercept)  16157.92   1961.55   8.237 1.75e-15 ***
policy       -1226.69   1540.44  -0.796  0.42624
post         9766.34   1042.44   9.369 < 2e-16 ***
age         -148.22    44.23   -3.351 0.00087 ***
policy:post   645.31   2111.67   0.306  0.76005
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
Residual standard error: 9889 on 471 degrees of freedom
Multiple R-squared:  0.218,    Adjusted R-squared:  0.2113
F-statistic: 32.82 on 4 and 471 DF,  p-value: < 2.2e-16
```

```
#####
```

```
#####
```

DiD analysis for 2012

```
call:
lm(formula = wage ~ policy + post + age + age^2 + policy * post,
    data = dta)
```

```
Residuals:
  Min      1Q  Median      3Q      Max
-21129 -9219   464   6800  66697
```

```
Coefficients:
              Estimate Std. Error t value Pr(>|t|)
(Intercept)  16548.60   1728.19   9.576 < 2e-16 ***
policy       -2207.73   1296.72  -1.703 0.089028 .
post         3621.78   970.76   3.731 0.000204 ***
age         -118.86    40.84   -2.910 0.003708 **
policy:post   5424.84   1799.97   3.014 0.002658 **
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

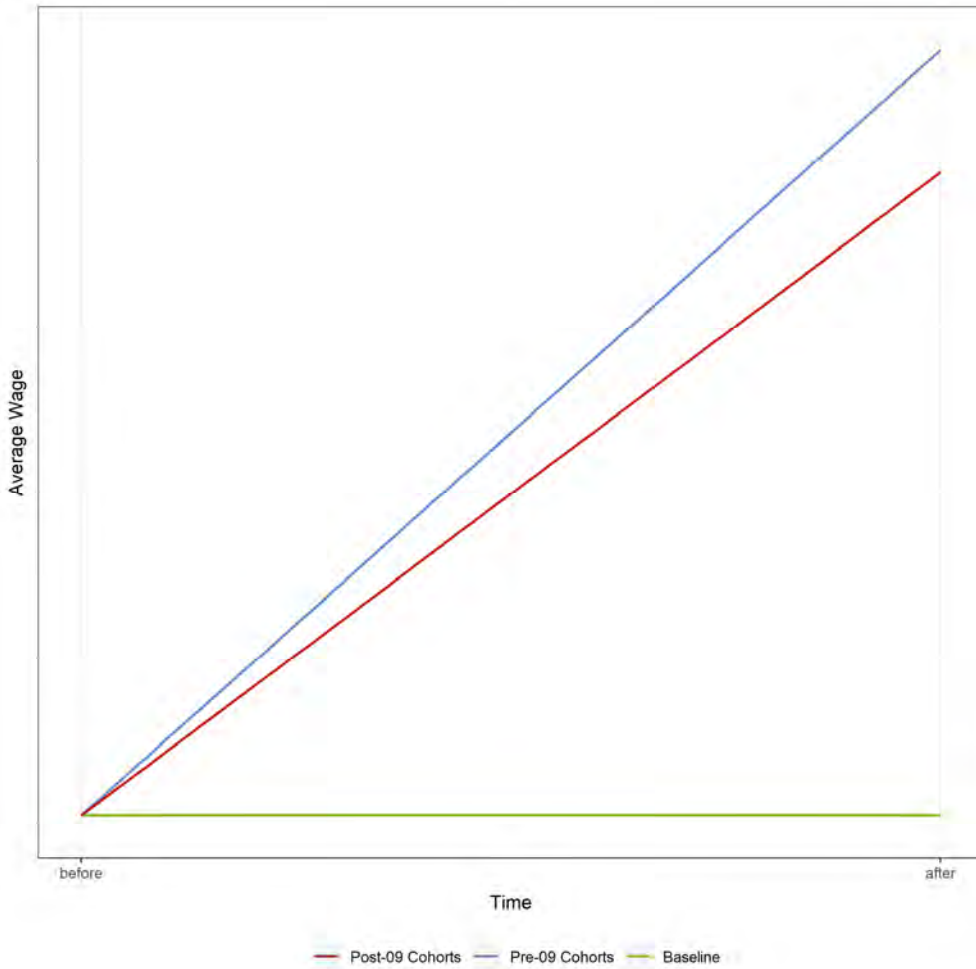
```
Residual standard error: 11790 on 827 degrees of freedom
Multiple R-squared:  0.06751,    Adjusted R-squared:  0.06299
F-statistic: 14.97 on 4 and 827 DF,  p-value: 8.126e-12
```

```
#####
```

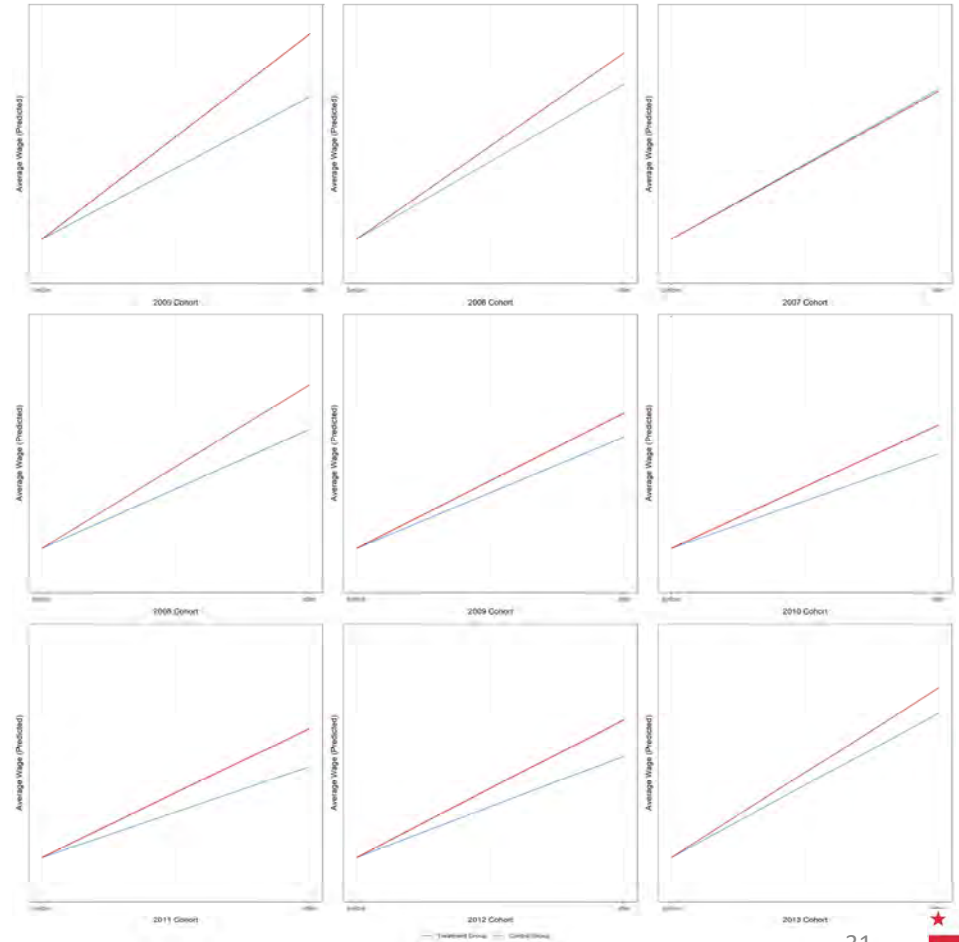
HoH : Triple Difference Method (Imperfect)

Filter
HoH × b30

Triple Difference Regression Plot



DiD Regression Plot



```
Call:
lm(formula = wage ~ policy + eligib + age + age^2 + factor(cohort) +
    policy * eligib - 1, data = aggpanel)
```

```
Residuals:
```

```
    Min       1Q   Median       3Q      Max
-43956 -13518   -482   10757  382680
```

```
Coefficients: (1 not defined because of singularities)
```

	Estimate	Std. Error	t value	Pr(> t)	
policy	-4316.75	971.26	-4.444	8.86e-06	***
eligib	6593.93	638.64	10.325	< 2e-16	***
age	64.64	30.01	2.154	0.0313	*
factor(cohort)2003	-5600.48	1160.47	-4.826	1.40e-06	***
factor(cohort)2004	-5068.20	1146.48	-4.421	9.89e-06	***
factor(cohort)2005	-4734.24	1118.57	-4.232	2.32e-05	***
factor(cohort)2006	-5026.57	1090.31	-4.610	4.05e-06	***
factor(cohort)2007	-7420.35	1051.57	-7.056	1.77e-12	***
factor(cohort)2008	-6237.93	1034.36	-6.031	1.66e-09	***
factor(cohort)2009	-1162.48	638.23	-1.821	0.0686	.
factor(cohort)2010	-815.24	636.18	-1.281	0.2000	
factor(cohort)2011	-762.70	620.66	-1.229	0.2191	
factor(cohort)2012	-1361.57	617.07	-2.207	0.0274	*
factor(cohort)2013	718.03	601.31	1.194	0.2324	
policy:eligib	-934.65	807.96	-1.157	0.2474	

```
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
Residual standard error: 20320 on 19507 degrees of freedom
Multiple R-squared:  0.02596, Adjusted R-squared:  0.02522
F-statistic: 34.67 on 15 and 19507 DF, p-value: < 2.2e-16
```


Conclusion

Universal Pre-K 3/4



■ Universal Pre-K in DC : Conclusions

■ Observations

1. We observe **no overall effect** for the whole population
2. We observe some **behavioral change of MAR × b30** population
The policy appears correlated with increased labor market participation for parents of 3- & 4-year-olds (married filers who are in the bottom 30 percent of all married filers).
- 3. We can infer some **welfare improvement for HoH** population

■ Preliminary Conclusions

The policy appears to contribute to wage growth for a married filers who are in the bottom 30 percent of all married filers. Presumably, this effect is associated with increased participation in the labor force. However, the policy does not appear to induce detectable behavioral change for unmarried parents (head-of households) of 3- & 4-year-olds and appears to work like a tax credit (an income effect).



Comments

Implications for Potential Policy Expansion : *Universal Pre-K 0/1/2*

■ The End...

Thank you!