THE EFFECTS OF WASHINGTON DC UNIVERSAL PRE-K PROGRAM ON MATERNAL LABOR SUPPLY

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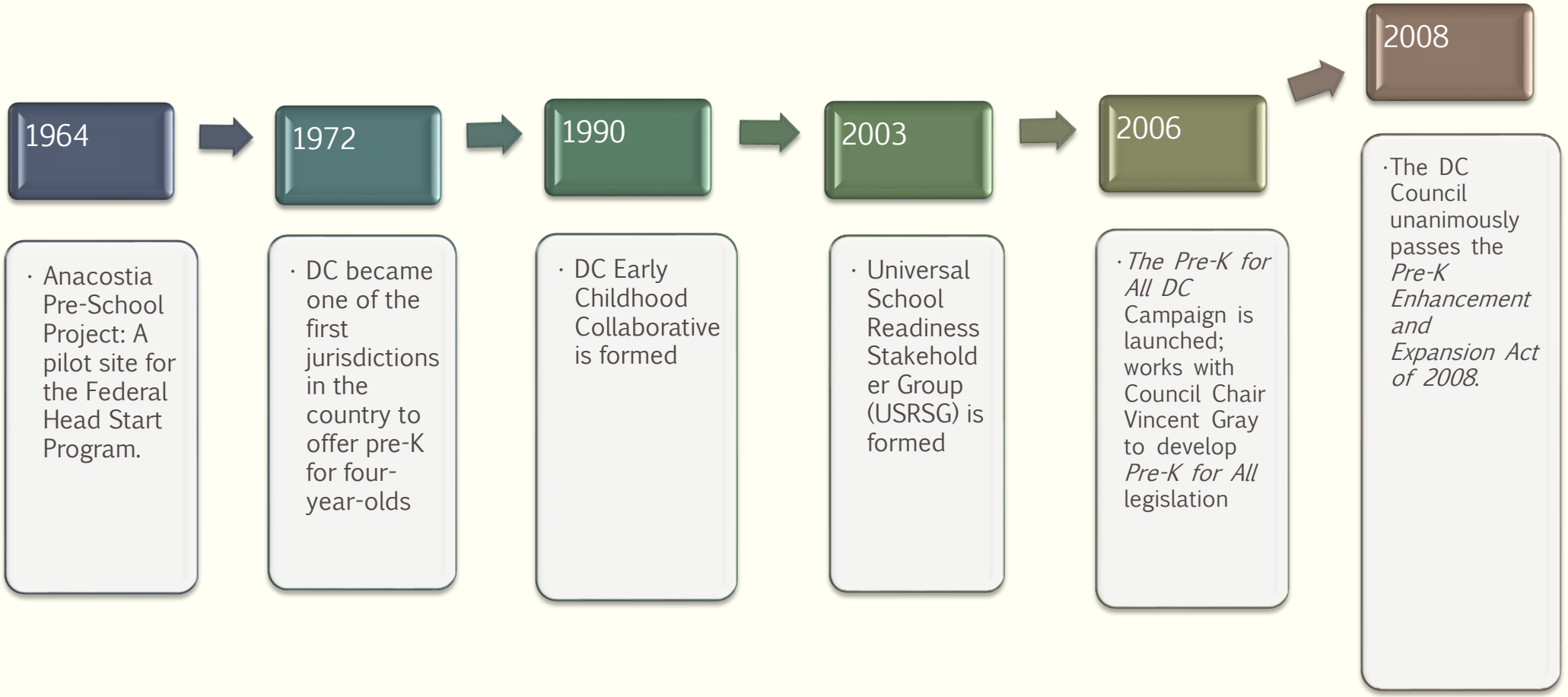
Universal Pre-K in DC, an Introduction

- On May 6, 2008, DC passed *the Pre-K Enhancement and Expansion Act of 2008*, providing all three- and four-year-olds in DC universal access to high-quality pre-Kindergarten education.
- Quality requirement:
  - Small class sizes (16 children and 2 adults)
  - An approved curriculum
  - Lead teachers must have a bachelor's degree or higher, and assistant teachers need at least an associate's degree
- Allowing Pre-K system to include all publicly funded community-based organizations (CBOs), Public School (DCPS) and Public Charter School (PCS) programs
- District of Columbia spends $17,545 per child per year in 2019, which is more than three times the national average expenditure of $5,175 per child.

The Development Of The DC Universal Pre-K Program

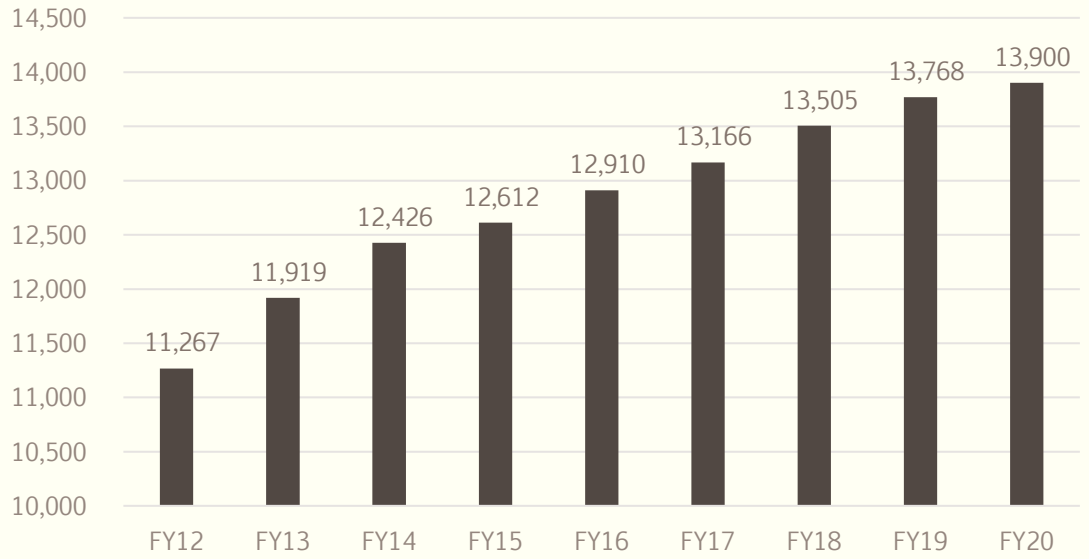


Pre-K Enrollment

Three-year-olds and four-year-olds served in DC in FY 2019

Age	Census Data	Number Enrolled	Percentage Served
3-year-olds	8,908	6,405	72%
4-year-olds	8,289	7,363	89%
Total	17,197	13,768	80%

DC Pre-K Enrollment from FY2012 to FY2020



Benefits of Universal Pre-K, a Literature Review

- Policy makers and researchers interested in pre-K childhood education have focused on two main issues

  1): Impact of early childhood education on the children's later development

  Pre-K programs may contribute to children's human capital and improves future income (Heckman (2006) and Heckman and Masterov (2007) argue that high-quality child-care may help promote social skills and reduce rates of crime, teenage pregnancy, high school dropout rates, adverse health conditions, and other social problems; Havnes and Mogstad (2011, 2015) find that subsidized child-care has large positive effects on children's long-run adult outcomes, and that the positive effects are particularly large for children from families below median levels of income.)

  2): The effect of early childhood education on the maternal labor supply

  Pre-K programs may increase maternal labor supply (While the primary goal of universal pre-k program is to invest in the human capital of children that low-income parents are unable to provide, the program is also justified by helping increase parental, especially maternal labor supply. (Blau and Robins (1988), Gustafsson and Stafford (1992), Ribar (1995), Gelbach 2002 and Powell (2002) find that government subsidies to childcare, and childcare cost reduction in general increase labor supply substantially). Most studies have found evidence of a significant negative labor-supply response to child-care prices among married mothers, though the range of estimated employment elasticities is rather large, from 0 to -1.6. For single mothers, the literature is inconclusive. For example, Kimmel (1998) reports elasticities ranging from -4.54 to +1.38.)

- The effect of universal pre-k on labor supply is a combination of a positive price elasticity and a negative income elasticity of employment.
  - Childcare price elasticity is generally negative, as childcare costs associated impact decision to replace maternal care with nonmaternal care (see Gelbach 2002.)
  - Providing access to public school can be thought of as offering a 100% marginal price subsidy for childcare
  - Depending on the budget constraint, subsidy to childcare also has income effect as income subsidy generally reduces employment
  - Discrepancies across studies make it difficult to provide conclusive evidence of the employment effects
  - What do we expect to find in DC? Focus on the intensive margin of maternal labor supply

Our Study

- Focus on the impact of universal pre-K on maternal labor supply of single mothers at the intensive margin.
  - Over the last decade, most children under age 18 in DC live in families with single parent, and most of single parents with children are single mothers
  - Single mothers who have been unemployed for several years most likely would not have income and would not have filed tax returns in those years.
- Data:
  - IRS and DC personal income tax from 2001-2018
  - We limit our data only to those households whose youngest child is either three- or four-year-old, removing households with a preschool eligible child and younger siblings (see table in next slide)
  - Building a panel of wage and AGI data with explanatory variables, Tracking annual wage and AGI across time (for 7 consecutive years) and across cohorts. Wages are used as a proxy for hours worked.
- Methodology:
  - DID and DDD

Pre-K Enrollment Statistics

Total Number of First Year Enrollment

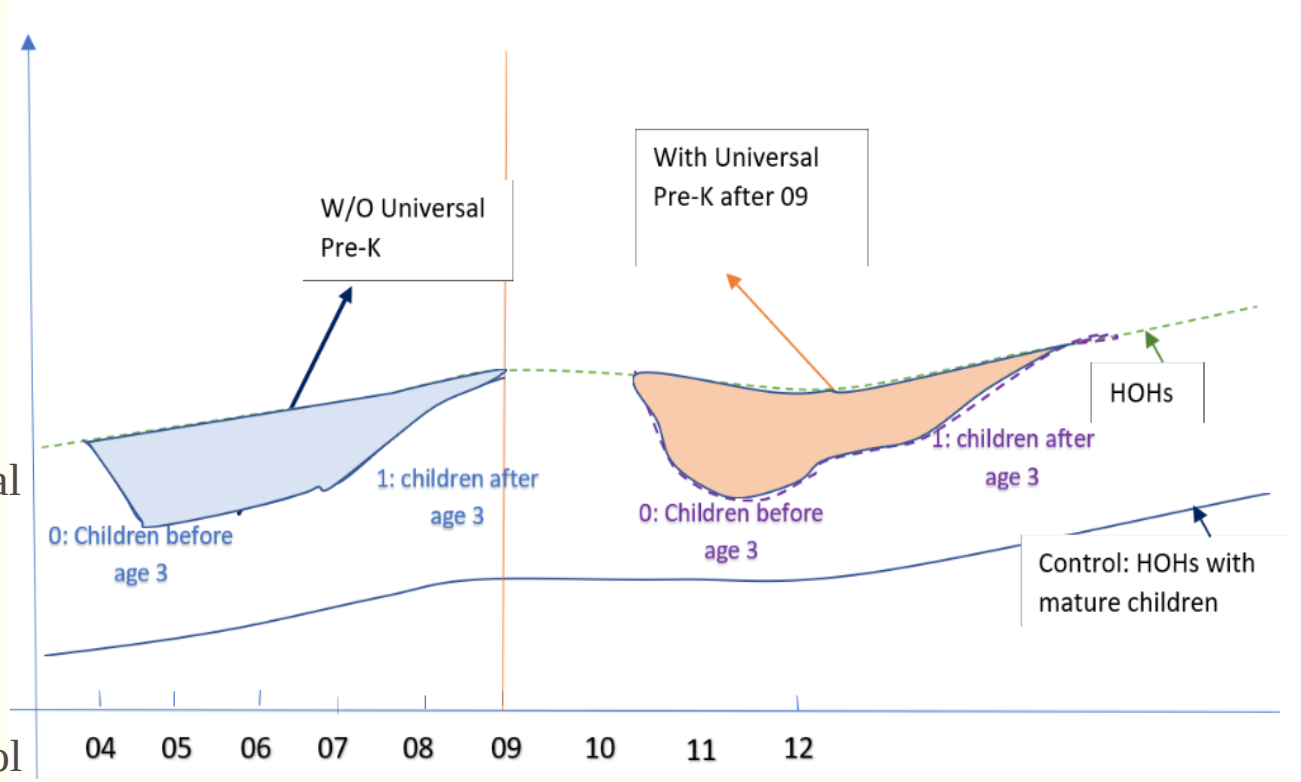
Year	# of filers with Pre-K Enrollment	Taxpayer Age	Childcare Expenses Credit	Credit for Child	Mean EITC	Median Wages	Mean Wages
2006	5,024	32.2	$204	$532	$1,408	$26,838	$50,711
2007	5,135	31.4	$190	$583	$1,390	$28,917	$53,869
2008	5,106	31.6	$200	$530	$1,440	$29,325	$56,018
2009	5,066	31.8	$196	$513	$1,576	$29,463	$60,925
2010	5,503	31.8	$189	$487	$1,611	$28,819	$64,496
2011	5,695	31.7	$187	$449	$1,757	$27,682	$63,454
2012	6,276	31.4	$183	$436	$1,879	$27,567	$64,510
2013	6,550	31.3	$166	$422	$1,992	$26,943	$60,715
2014	6,485	31.3	$177	$409	$1,970	$28,265	$66,639
2015	6,497	31.3	$182	$429	$1,873	$30,648	$75,438
2016	6,484	31.3	$188	$433	$1,881	$32,145	$79,280
2017	6,478	31.4	$195	$441	$1,888	$33,140	$82,687
2018	6,429	32.1	$195	$1,753	$1,815	$36,154	$86,150

No Younger Siblings For pre-k Children

Year	# of filers with Pre-K Enrollment	Taxpayer Age	Childcare Expenses Credit	Credit for Child	Mean EITC	Median Wages	Mean Wages
2006	2,645	32	$192	$489	$1,359	$24,725	$39,468
2007	2,764	31.3	$182	$538	$1,341	$26,919	$38,996
2008	2,662	31.2	$187	$485	$1,404	$27,078	$42,051
2009	2,499	31.2	$171	$462	$1,480	$26,645	$42,367
2010	2,706	31.7	$170	$431	$1,492	$25,276	$45,055
2011	2,869	31.3	$166	$420	$1,673	$24,193	$42,612
2012	3,144	30.9	$161	$403	$1,752	$24,405	$42,401
2013	3,278	30.7	$145	$394	$1,797	$24,651	$43,264
2014	3,393	30.6	$158	$381	$1,861	$24,683	$46,525
2015	3,283	30.5	$160	$405	$1,762	$26,748	$53,902
2016	3,162	30.6	$149	$420	$1,781	$28,246	$51,762
2017	3,155	30.7	$164	$428	$1,742	$29,587	$56,866
2018	3,081	31.7	$159	$1,239	$1,705	$31,716	$59,929

The Difference in Differences (DID) Methodology I

- The Figure on the right panel illustrate the earning dynamics for a typical single mother with an eligible pre-K child.
- Annual earning levels for single mothers expected to decline during the time of childbirth and then gradually rebound (to pre-trend) after their children can access to non-maternal childcares.
- The blue curve and shaded area represent the annual levels and timing of income decreases before 2009
- The purple line and shaded area represent the annual levels and timing of income decreases after 2009
- The top dashed green line represents the estimated annual income levels for working head-of household mothers if they had not experienced pregnancy and childbirth,
- The lower solid blue line is our control and represents annual income levels for working head-of household mothers with children aged 6 years old or older in the starting year of the 7-year panel, so that parents in control group will be benefit from Pre-K policy
- Without 09 policy change, the two areas should be similar

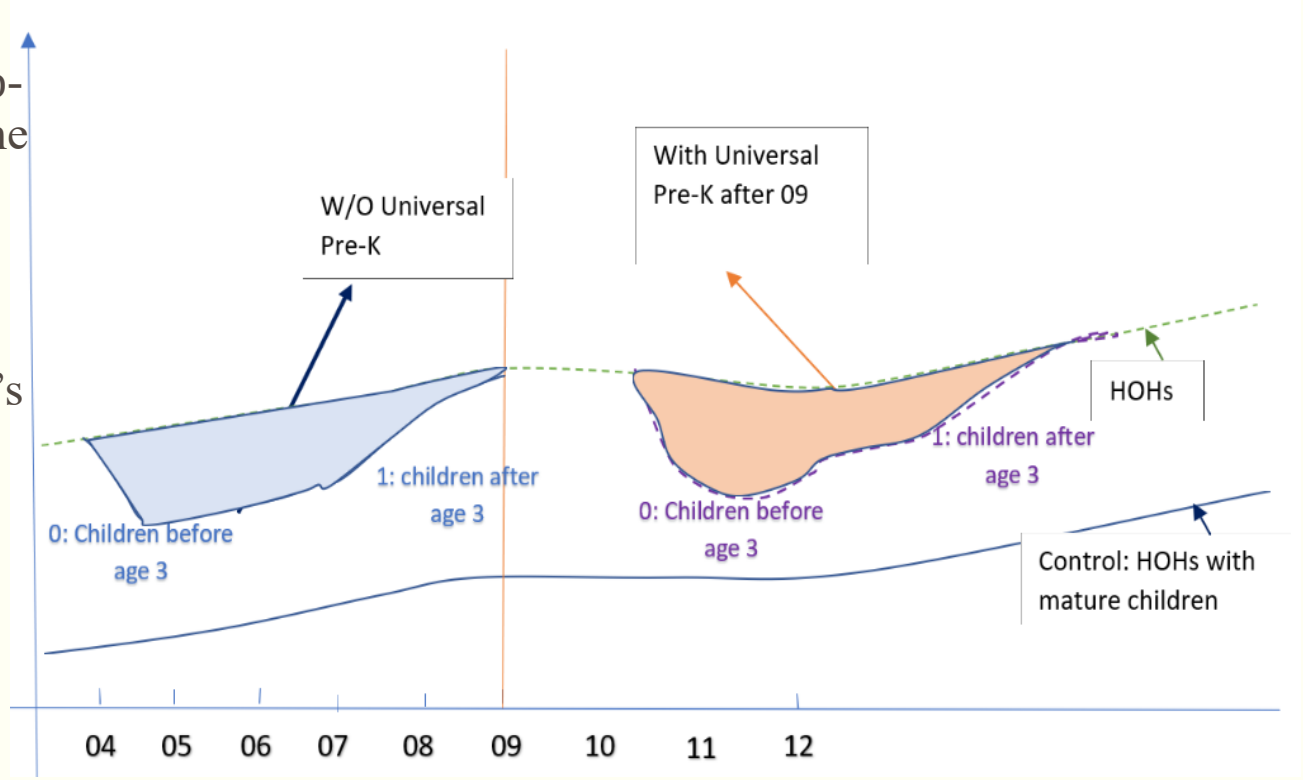


The Difference in Differences (DID) Methodology II

- We analyze how the size and shape of the two shaded areas differ, before and after the 2009 policy implementation.

- we separate the 7-year earning dynamics into two sub-period: period 0 represents mothers' earnings when the children are 3 years old or younger, and period 1 represents earnings after the children go to pre-K.

- Our DID models try to answer several questions regarding how the universal pre-K DC single mother's intensive margin labor supply:
  - 1) Does the 2009 universal pre-K policy change the average earnings of single mothers with pre-K eligible children? (Does the size of the shaded area change?)
  - 2) How does the mothers' earnings behave when the children are younger (< 3 years old), vs earnings behavior when the children go to preschool? and
  - 3) For the 7-year earning dynamics, is there any specific year that mother's earnings change the most?

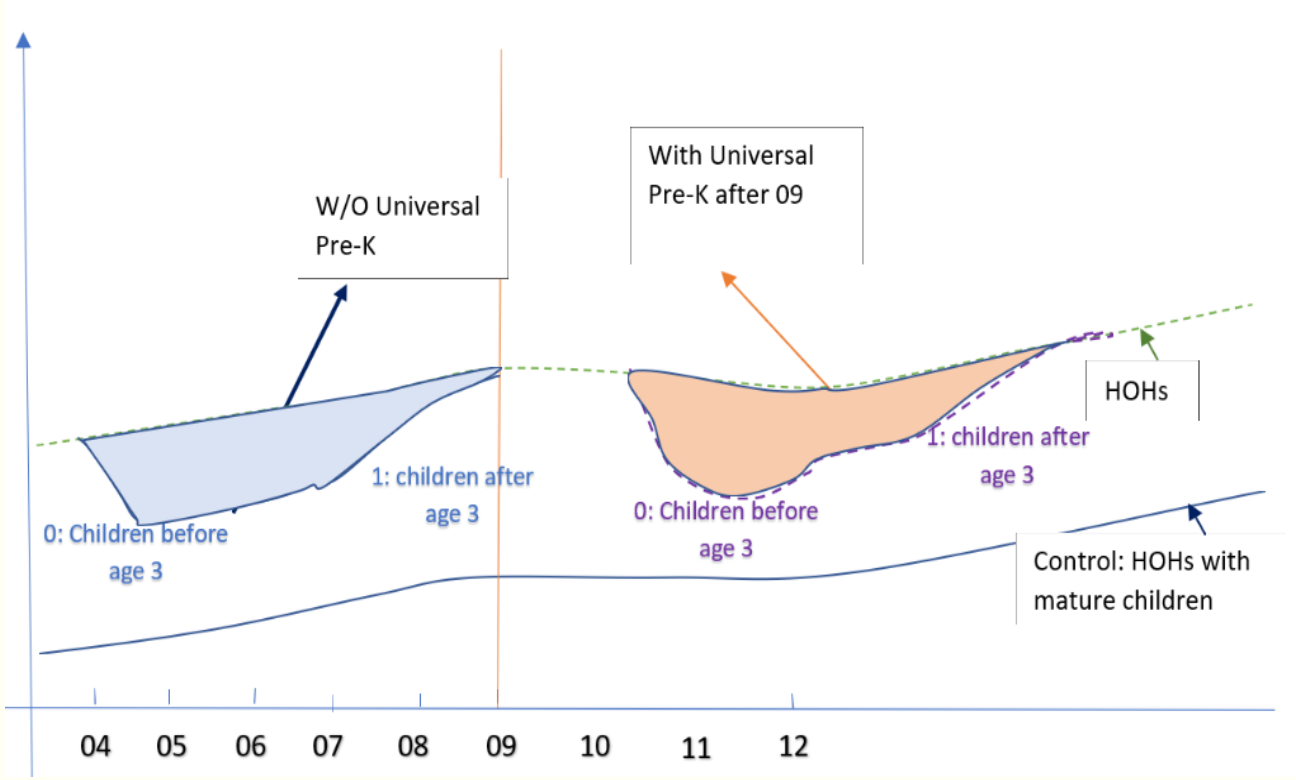


The Difference in Differences (DID) Methodology III

- We use a simple DID model Equation (1) to answer our question 1:

  - $Log_{wage} = \beta_0 + \beta_1 * Treatment + \beta_2 * Policy + \beta_{int} * Policy * Treatment + \varepsilon_{it}$ (1)

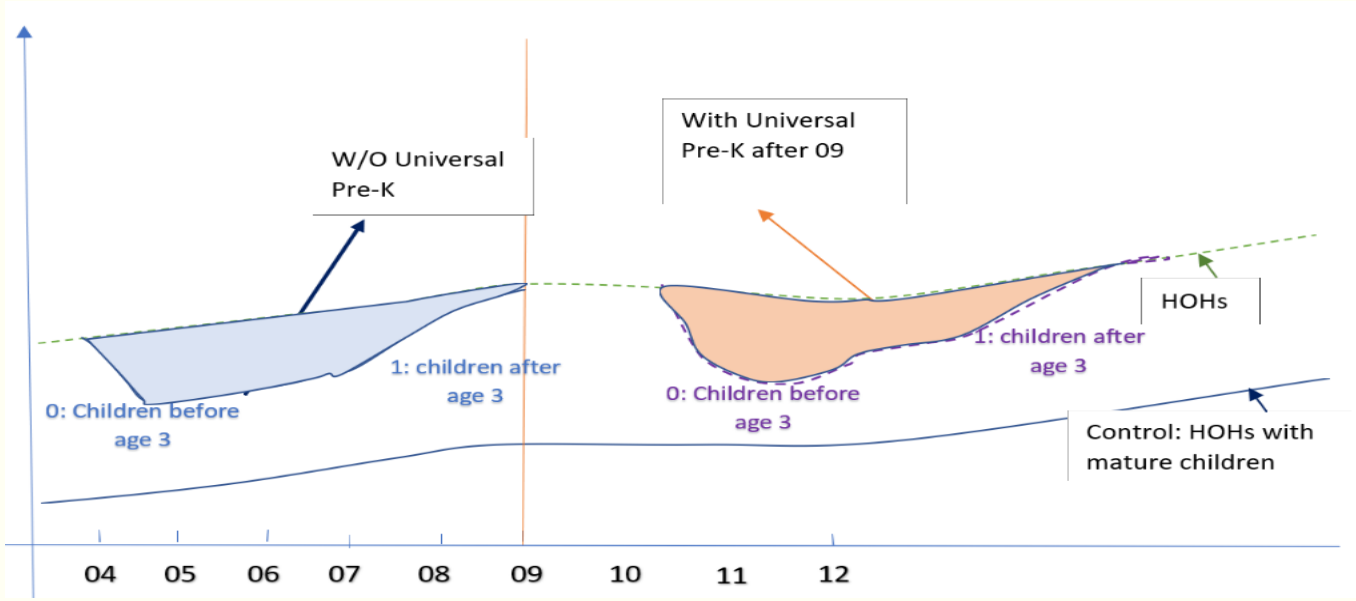
- And use equation (2) for question 2 and 3.
  - $Log_{wage} = \beta_0 + \beta_1 * Treatment + \beta_2 * Policy + \beta_3 * Period + \beta_{int1} * Policy * Treatment + \beta_{int2} * Period * Policy * Treatment + \varepsilon_{it}$ (2)
  - With $DID(period = 1) = \beta_{int1} + \beta_{int2}$
    $DID(period = 0) = \beta_{int1}$



Results I

- The overall earnings for single mothers during the 7-year period tend to be lower after the District of Columbia implemented a universal pre-K program.
- The average decline (orange area compared to blue area) is about 12.7 percent and is statistically significant (see top table).

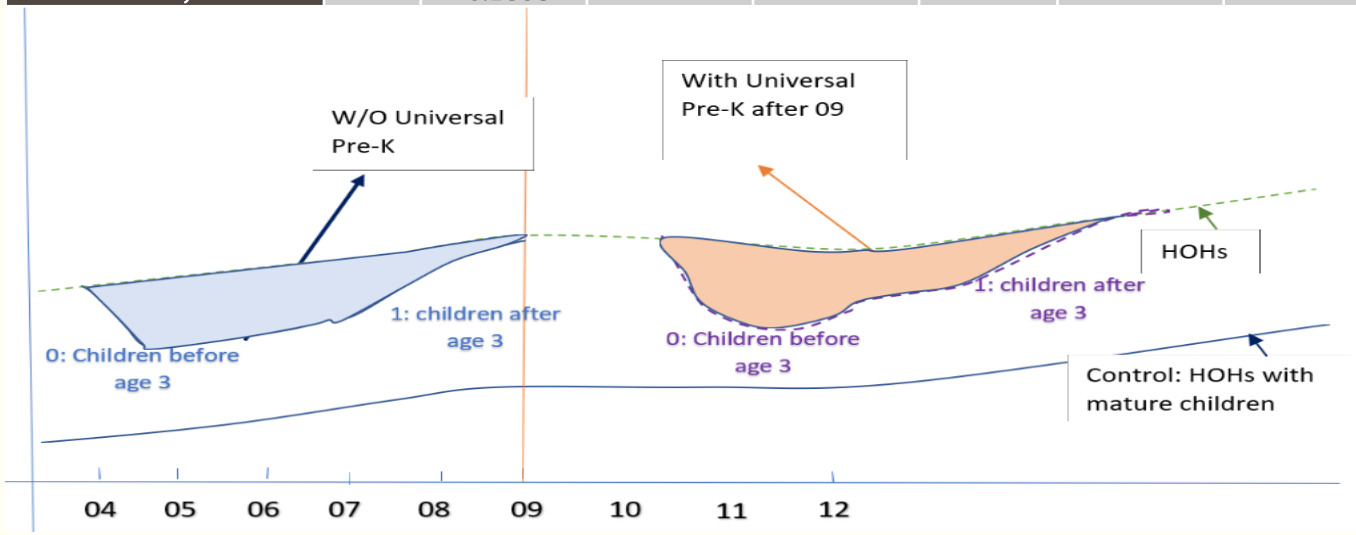
Parameter	DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept	1	9.7163	0.0088	9.6991	9.7335	1224215	<.0001
policy	1	-0.015	0.011	-0.0366	0.0066	1.85	0.1741
treatment	1	0.1105	0.0239	0.0636	0.1574	21.3	<.0001
policy*treatment	1	**-0.1272**	0.0296	-0.1853	-0.0691	18.42	**<.0001**



Results II

- Results show an 18.7 percent drop for wages in period 0 (before children turns to 3) is significant and explains most of the earning drop for the whole 7-year period.
- While the rise in wages in period 1 (after the children are eligible for preschool enrollment) is about 2.2 percent, it is statistically insignificant.
- Taking together, it seems that because of an income effect, single mothers have been able to take more time off from work and spend more time with their children before their children are ready for preschool.
- Once children enroll in the pre-K programs, the earnings start to recover back to before-2009 pattern (2.2% above pre-trend, but insignificant).

Parameter	DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept	1	9.7343	0.0094	9.7159	9.7527	1079211	<.0001
policy	1	-0.015	0.011	-0.0366	0.0066	1.85	0.1741
treatment	1	0.1105	0.0239	0.0636	0.1574	21.3	<.0001
policy*treatment	1	-0.1868	0.0315	-0.2485	-0.125	35.11	<.0001
time	1	-0.063	0.0114	-0.0855	-0.0406	30.31	<.0001
policy*treatment*time	1	0.2084	0.0375	0.1349	0.282	30.84	<.0001
Scale	1	2.6617	0.0035	2.6548	2.6685		
time=1, DID		0.0217				0.29	0.5878
time=0, DID		-0.1868				35.11	<.0001



Results III

- After 2009, maternal earnings tended to decline the most (30 percent at 0.001 p-value) during the years of childbirth (year 2 in the model)
- Earnings tended to decline by an average of 14 percent (weak significance at 0.039 p-value) during the year just before the Pre-K (year 6 in the model. Earnings drops in other years are statistically insignificant.
- All together, these results indicate that the city's universal pre-K program is collated with mothers earning less income when they are pregnant and in the first few years after childbirth, with the steepest declines in income occurring childbirth and just before the child turns three years old.
- This suggest that the universal pre-K program has produced an income effect such that mothers can work less and possibly devote more time to child rearing (i.e., take longer unpaid maternal leave) before the child turns three years old knowing they no longer have to pay for childcare when the child is three and four years old.

Parameter	Estimate		Standard Error	t Value	Pr > |t|
Intercept	12.37991907	B	6.54155364	1.89	0.0584
cohort	-0.00136251		0.00326657	-0.42	0.6766
policy	-0.00587888		0.02488286	-0.24	0.8132
treatment	0.11039133		0.02393760	4.61	<.0001
policy*treatment	-0.01818641	B	0.05419803	-0.34	0.7372
period 1	0.09951620	B	0.01919777	5.18	<.0001
period 2	0.12995694	B	0.01919777	6.77	<.0001
period 3	0.04734975	B	0.01919777	2.47	0.0136
period 4	0.06190871	B	0.01919777	3.22	0.0013
period 5	0.06332941	B	0.01919777	3.30	0.0010
period 6	0.05221428	B	0.01919777	2.72	0.0065
period 7	0.00000000	B	.	.	.
policy*treatm*period 1	-0.13264359	B	0.06849026	-1.94	0.0528
policy*treatm*period 2	-0.29793453	B	0.06849026	-4.35	<.0001
policy*treatm*period 3	-0.08380704	B	0.06849026	-1.22	0.2211
policy*treatm*period 4	-0.09343957	B	0.06849026	-1.36	0.1725
policy*treatm*period 5	-0.14166559	B	0.06849026	-2.07	0.0386
policy*treatm*period 6	-0.02810252	B	0.06849026	-0.41	0.6816
policy*treatm*period 7	0.00000000	B	.	.	.

Conclusions

- We focus our study on the labor supply at the intensive margin, that is, the subjects of our study are single mothers who have been working throughout the period starting from pregnancy all the way to when their children are able to enroll in elementary school.
- Our results are consistent with the permanent income hypotheses and indicate that the income effects dominate the price effects for single mothers' labor supply in DC.
- This finding is also consistent with the existing literature showing that the impact of childcare subsidy on labor supply of unmarried mothers is inconclusive
- Because of the universal pre-K policy, it may be that low-income unmarried mothers in DC not only have been able to enjoy higher disposable income due to free pre-K child education, but also be able to take more time away from work and spend more time with their children, especially during the year of childbirth.
- Our results suggest working unmarried mothers tended to decrease their labor supply (at the intensive margin) but to their own benefit, as well as to the benefit of their families and children.