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The Effect of Washington, D.C. Universal Pre-K Program on Maternal Labor Supply

Yi Geng
Office of Revenue Analysis
District of Columbia Government

Daniel Muhammad
Office of Revenue Analysis
District of Columbia Government

Bradley Hardy
McCourt School of Public Policy
Georgetown University

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Abstract

On May 6, 2008, Washington D.C. passed the Pre-K Enhancement and Expansion Act of 2008 to provide all three- and four-year olds in DC universal access to high-quality pre-Kindergarten education. By school year 2018-2019, around 80 percent of eligible children in the District were served in a public Pre-K program. 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 increasing low-income family pay and maternal labor supply. Using administrative data from the IRS and the District of Columbia, we designed a study to analyze the impact of the DC universal Pre-K program on the labor supply of unmarried working mothers using a Different-in-Differences (DID) framework. Our results show that after the establishment of universal Pre-k in DC, single parents tended to work less before the child was eligible for the universal Pre-k program and recover to pre-policy when the child was eligible for the program, when comparing with earnings before the implementation of the universal pre-K policy and controlling other factors. This seems to imply that the city's universal Pre-K program produced income effects that significantly affected the labor supply for single parents in DC with younger children eligible for universal Pre-K program.

***** The views expressed in this research are solely those of the authors and do not reflect the official positions or policies of the District of Columbia Government, the Office of the Chief Financial Officer, or the Office of Revenue Analysis. The authors accept responsibility for all errors.

I. Introduction

In recent years, universal pre-k policy has attracted growing public attention and has prompted vigorous national policy debates. For example, the "Build Back Better Act" is currently being debated in the U.S. Congress; if enacted, the bill would create a universal preschool program available to all three- and four-year old children regardless of income or other eligibility requirements. Over the past few decades, a growing number of cities and states have committed resources to establish or expand earlier childhood education programs. Georgia and Oklahoma were the first to establish universal pre-K programs in the 1990s, followed by Florida and Illinois in the 2000s. The District of Columbia established a universal pre-K program in its 2008 legislative session. In comparison to similar programs in other states, which currently only enroll four-year-old children, the DC universal pre-K is the most comprehensive pre-K program as it covers both three-year-olds and four-year-olds children regardless of household income levels. A careful evaluation of the program's impact would contribute to the national universal pre-K conversation.

Policy makers and researchers interested in pre-K childhood education have focused on two main issues. The first is the impact of early childhood education on the children's later development. A growing body of recent research has found that early childhood education such as quality childcare and pre-K education has contributed to children's later school performance and social and cognitive skills (Busse and Gathmann, 2020; Sommer et al, 2020). 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) 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. However, this is not without controversy. A study of a randomized trial of a Tennessee pre-kindergarten program finds that at the end of pre-K, pre-K participating children in the treatment group performed better than the children in the control group. But, the control group children caught up with the pre-k participants during the kindergarten year, and generally overachieved thereafter.

The second issue is related to the effect of early childhood education on the maternal labor supply. While the primary goal of universal pre-K education is to invest in the human capital of children that low-income families are unable to provide, the program is also justified by helping increase maternal labor supply[1].

Childcare subsidies could influence maternal labor supply in two opposing directions. On the one hand, since women tend to be the primary caregivers for their children, subsidies that reduce the price of non-maternal childcare would likely increase the demand of non-maternal childcare relative to maternal childcare, creating higher opportunity costs for working less hours, thereby increasing the value of employment, and increasing mother's labor supply (the price effects). Mothers can increase their labor supply by either re-entering the labor force (at the extensive margin) or increasing the number of hours they are willing to work (at the intensive margin). On the other hand, as tuition for private, high-quality preschool can cost up to tens of thousands of dollars per year, free public preschool can significantly increase the expected income for single families with younger children before or at preschool age. This "income effect" may reduce numbers of hours worked and increase the consumption of "leisure" for some mothers so that

[1] Fathers' labor supply has not been found responsive to changes in childcare cost, according to Doiron and Kalb,2002

they can spend more time with their children. Standard economic theory predicts that childcare subsidies, where universal pre-K can be treated as 100 percent of government subsidy, may affect maternal labor supply through either the price effects or the income effects, or a combination of the two, depending on whether the household consumption of non-maternal pre-K childcare exceeds the school day or not (Gelbach 2002) . Universal pre-K would therefore induce a kink in the budget constraint and would provide both marginal price and income subsidies. The relative strengths of price and income effects will determine the amount of changes in labor supply.

Gelbach's results indicate that cost reduction to preschool programs generally leads to significant increase in maternal labor supply. Casio (2009) affirms the same conclusion that the availability of public kindergarten has positive impact on the labor supply decisions of single mothers with no younger children, but no impact for other mothers. Using ACS survey data, Malic (2018) finds that DC's universal pre-K expansion contributed ten percentage points increase to the district's labor force participation rate. Even though most studies find significant labor supply response to childcare prices among married mothers, the range of these estimates is rather large. For example, price elasticities in the U.S. have been estimated to be around -0.08 by Ribar, (1995), or -.20 by Connelly (1992), or -0.38 by Blau and Robins (1998). As for single mothers, Kimmel (1998), Michalopoulos et al. (1992) and Connelly (1990) find that these elasticities are essentially zero or statistically insignificant.

Discrepancies across studies make it difficult to provide conclusive evidence of the employment effects of these childcare subsidies, especially regarding single mothers. This study attempts to contribute to the economic literature in the relationship between universal pre-K program and intensive margin maternal labor supply of single parents in the District of Columbia. While most

childcare studies use survey-based data, this study uses actual family earnings from administrative tax data, which may provide a more accurate picture of labor supply changes at the intensive margin.

We focus on single parents because the majority of families in DC with children under 18 are headed by single parents, according to ACS survey for the period between 2001-2019, a period of where our tax data are available. Additionally, the majority (between 80-90 percent) of these single parents are single mothers. Using administrative data from the IRS and the District of Columbia government, we designed a study to analyze the impact of the DC universal Pre-K program on the labor supply of unmarried working mothers using a Different-in-Differences (DID) framework. Our results show that after the establishment of universal Pre-k in DC, head of household parents tend to work less before the child was eligible for the universal Pre-k program, but work more when the child was eligible for the program. This seems to imply that the city's universal Pre-K program produces income effects that significantly affect the labor supply for single mothers in DC with younger children eligible for universal Pre-K program.

II. DC Universal Pre-K background

In 2008, Washington, D.C., passed the Pre-K Enhancement and Expansion Act, providing two years of universal, full-day preschool for all three- and four-year-olds in DC. The universal pre-K system includes all the city's public school (DCPS) programs, public charter school (PCS) programs, and some private preschool programs administered by community-based organizations (CBOs). To be eligible for Pre-K enrollment, a child must be a DC resident and be of pre-K age on or before September 30. The law imposed high quality standard for the universal pre-K

program, including small class sizes an approved curriculum, and bachelor's degree or higher requirements for lead teachers. The preschool teachers are also well compensated: the average starting salary for DCPS early-childhood program teachers is about $53,000[2], more than double the average salary of day-care providers[3].

As of 2019, approximately 89 percent of the District of Columbia's four-year-olds and 72 percent of the city's 3-year-olds were enrolled in publicly funded preschool through the expansion, and this is a stark contrast to the national pre-K enrollment averaging 5.7 percent for the three-year-olds and 33 percent for the four-year-olds[4]. Combined, a total of 80 percent of all three-year-olds and four-year-olds were enrolled in the pre-K program. Detailed information can be found in Table 1. As Figure 1 indicates, the enrollment of pre-K students has continued to increase from FY 2012 through FY 2020, increasing to 13,900 students in both the DC public schools and DC public charter schools.

Table 1. 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%

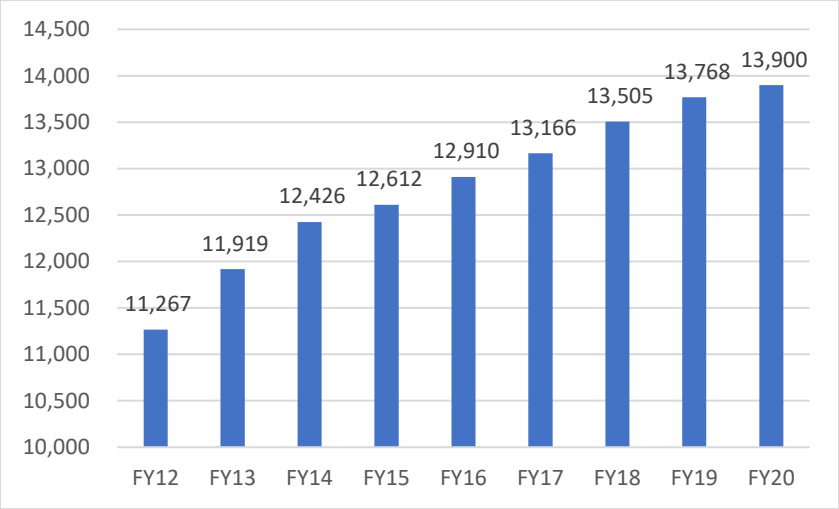
(Data source: DC Office of the State Superintendent of Education, FY 2019 Pre-K report)

Figure 1. DC Pre-K Enrollment from FY2012 to FY2020

[2] https://dcps.dc.gov/sites/default/files/dc/sites/dcps/publication/attachments/ET-15%20FY%2017%20Pay%20Schedule.pdf

[3] https://www.bls.gov/ooh/personal-care-and-service/childcare-workers.htm

[4] See https://osse.dc.gov/sites/default/files/dc/sites/osse/publication/attachments/OSSE%20Annual%20Pre-K%20Report%202019.pdf



(Data Source: Author's Calculation)

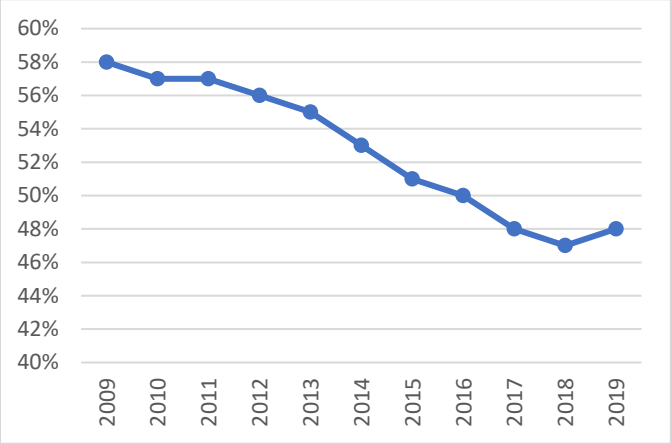
Based on the FY 2019 annual report from the DC Office of the State Superintendent of Education, the District of Columbia spends $17,545 per child per year, which is more than three times the national average expenditure of $5,175 per child. The higher spending in DC pre-K programs stems mostly from higher teacher salaries, as the District of Columbia pays preschool teachers the same as elementary school teachers.

III. Data and Methodologies

This study focuses on how DC universal pre-K programs affect maternal labor supply of single mothers. We are interested in the labor supply of single mothers primarily due to three reasons: Firstly, over the last decade, the majority of children under age 18 in DC live in families with single parent. The percentage of single parent households with children as a percentage of all households with children has been consistently over 50% until recent few years due to gentrification (Figure 2); Secondly, most (around 80 percent, based on calculation from our administrative tax data) of single parents with children are single mothers; And lastly, the average income of

single mothers in DC is significantly lower than the city average: in 2018, the average adjusted gross income for single parents with 3- or 4-year-old children is about $44,000, well below the city average income of about $80,000. The welfare of these single parents is of great interest to policy makers.

Figure 2. Single Parent Households with Children as a Percentage of All Households with Children in DC



(Data Source: U.S. Census Bureau ACS 5-year estimates)

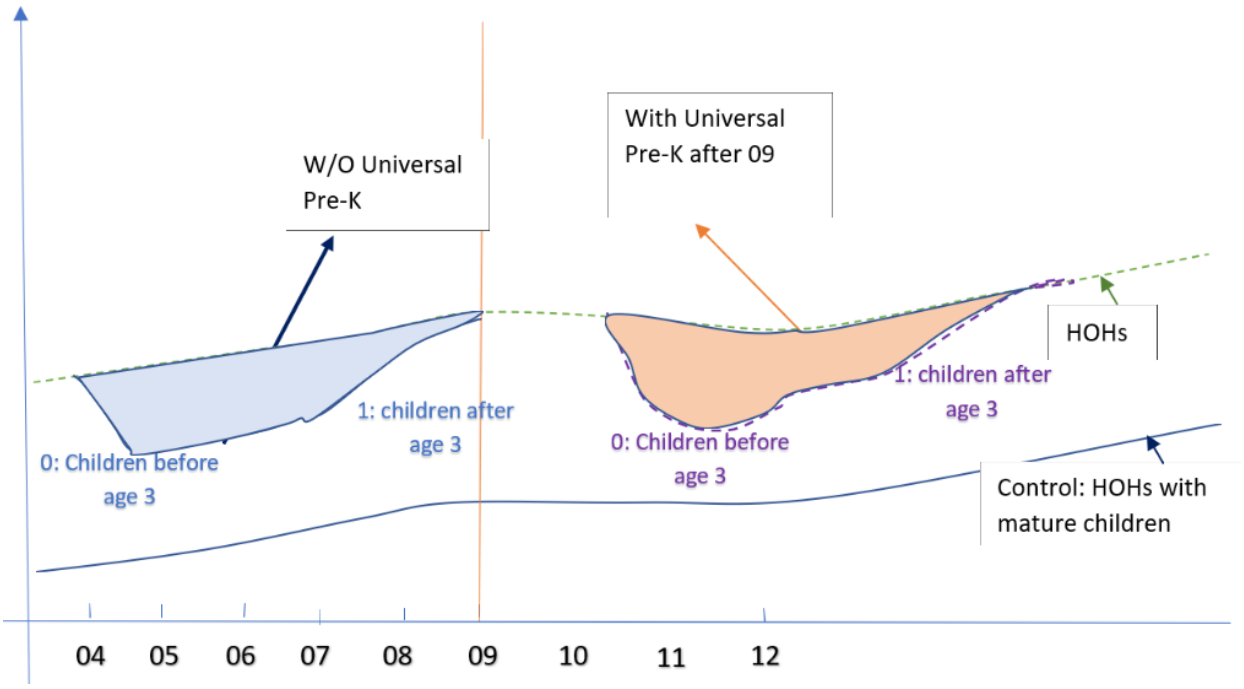
The study uses data from IRS and the District of Columbia's individual income tax returns for DC tax filers from tax year 2001 to 2018 to analyze the maternal labor supply changes on the intensive margin, as denoted by their income levels on their annual income tax returns. Labor supply on the intensive margin refers to number of hours worked for employed workers, while labor supply on the extensive margin refers to employment rate. Due to the nature of our database, single parents who have been unemployed for several years most likely would not have income and would not have filed tax returns in those years. Thus, we only analyze tax records of workers with a least seven years of consecutive tax returns.

We also 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. Mothers

who have both an eligible child and a younger child must find childcare for the younger child even if the three- or four-year-old is enrolled, which complicates the analysis.

We build a balanced panel of income and other explanatory variables for single parent filers with three- and four-year-old children. We track the tax filers for 7 years, starting from the year before childbirth, all the way to when a child turns to 6 years old, such that the panel can cover the mother's earnings dynamics from pregnancy all the way to when their children graduate from the preschool and enter elementary school. Figure 3 illustrate the earning dynamics for a typical single mother with an eligible pre-K child. We would expect the annual earning levels for single mothers to decline during the time of childbirth and then gradually rebound 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 (when the District implemented a universal pre-K program for all the district's 3- and 4-year-olds), and 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, and 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. This specification would guarantee that single parents in the control group would not benefit from the universal pre-K policy during the study period. We compare the earnings dynamics of mothers with pre-K eligible children with the earnings dynamics of a control group of tax filers for the same 7 years and analyze how the differences between the two earning patterns are affected by the policy change in 2009.

Figure 3: The Illustration of DID Model



It should be noted that the shaded areas in Figure 3 represent the differences in earning dynamics between the mothers in treatment and control groups. We analyze how the size and shape of the two shaded areas differ, before and after the 2009 policy implementation. For example, in an exercise, 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. This specification allows us to dig deeper into the subtlety of earnings changes during different periods. This later specification is essentially a triple difference analysis.

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?

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

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

And use equation (2) for question 2 and 3.

$$Log_{wage} = \beta_0 + \beta_1 * Treatment + \beta_2 * Policy + \beta_3 * Period + \beta_{int1} * Policy * Treatment + \beta_{int2} * Period * Policy * Treatment + \varepsilon_{it} \quad (2)$$

With

$$DID(period = 1) = \beta_{int1} + \beta_{int2}$$

$$DID(period = 0) = \beta_{int1}$$

IV. Results

(Preliminary)

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 is about 12.7 percent and is statistically significant (see Table 2).

Table 2. DID Estimates for Equation 1

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

Table 3 shows a DID estimate of 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. The 2.2 percentage increase in earnings in the second period is statistically insignificant, however.

Table 3. DID Estimates (Period 0 vs. Period 1) for Equation 2

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

Table 4 shows that 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) and 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 during childbirth and just before the child turns three years old. This suggest

that the universal pre-K program has produced an income effect (via fully subsidized quality childcare) 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 child care when the child is three and four years old.

Table 3. Model Results After Policy Implementation (By Year)

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	.	.	.

V. Conclusions

We focus our study on the labor supply of single mothers in DC that have pre-K eligible children and analyze our tax records to understand how the universal pre-K policy affect their earnings. Our attention is 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 (For example, Kimmel (1998) reports elasticities ranging from -4.54 to +1.38). Theoretically, the effect of universal pre-K policy along the intensive margin is ambiguous might be due to opposing income and price effects. In the case of DC, it seems the income effects are more evident.

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 (100 percent subsidy) 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. Thus, whereas the program may have caused some policy analysts to think that a likely outcome might be an increased maternal labor supply, 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.

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