# 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

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Abstract

On May 6, 2008, Washington D.C. passed the Pre-K Enhancement and Expansion Act of 2008, providing all three- and four-year olds in DC with universal access to high-quality pre-Kindergarten education. By the 2018-2019 school year, approximately 80 percent of eligible children in the District were enrolled in a public pre-K program. While the primary goal of a 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 intended to increase low-income family pay and maternal labor supply. Using administrative data from the IRS and the District of Columbia, we conducted 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 indicate that after the establishment of universal pre-K in DC, single parents tended to work less after the birth of their child but before their child was eligible for the universal pre-K program. They promptly returned to the work force and possibly worked a little more after their child was eligible for the program, when comparing with earnings before the implementation of the universal pre-K policy and controlling for other factors. This suggests that the city's universal pre-K program produced income effects that significantly impacted the labor supply of single parents in DC with younger children eligible for the 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.

This paper builds upon the original research conducted in 2019 by our colleague, Hyungjun (Simon) Park from The University of Chicago – Harris School of Public Policy.

## I. Introduction

In the last few decades, a growing number of cities and states have committed resources to establish or expand early 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-old and four-year-old children regardless of household income levels. A careful evaluation of the program's impact is expected to contribute to the national conversation on universal pre-K.

Policy makers and researchers interested in pre-K childhood education have focused on two main issues. The first pertains to the impact of early childhood education on the children's later development. A growing body of recent research suggests that quality childcare and pre-K education have positive effects on 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 Magne (2011) find that subsidized child-care has large positive effects on children's long-run adult outcomes, particularly for children from families below median levels of income. However, the issue is not without controversy. A study of a randomized trial of a Tennessee pre-kindergarten program found that pre-K participating children in the treatment group performed better than the children in the control group at the end of pre-K. However, the control group

children caught up with the pre-K participants during the kindergarten year and thereafter and generally overachieved.

The second issue pertains to the impact 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 its potential to increase maternal labor supply[1].

Childcare subsidies could influence maternal labor supply in two opposing ways. On the one hand, considering women's predominant role as primary caregivers for their children, subsidies that lower the expenses of non-maternal childcare are expected to increase the demand for such services compared to maternal childcare. This, in turn, would raise the opportunity costs associated with working fewer hours, ultimately increasing the relative significance of employment. Consequently, it would also likely produce an increase in the labor supply of mothers, reflecting the influence of price effects. Mothers may increase their labor supply by either returning to the labor force (at the extensive margin) or by 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. This "income effect" may lead to a reduction in numbers of hours worked by some mothers, as they increase the consumption of "leisure" time to spend more time with their children. Standard economic theory predicts that childcare subsidies, with universal pre-K being treated as 100 percent of government subsidy, can affect maternal labor supply through price effects, income effects, or a combination of

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

both. The extent of these effects depends on whether the household consumption of non-maternal pre-K childcare exceeds the school day or not (Gelbach 2002). Universal pre-K would therefore create a kink in the budget constraint, providing both marginal price and income subsidies. The amount of change in labor supply would depend on the relative strengths of the price and income effects.

Gelbach's results indicate that cost reduction to preschool programs generally leads to a significant increase in maternal labor supply. Similarly, Cascio (2009) concluded that the availability of public kindergarten has a positive impact on the labor supply decisions of single mothers with no younger children, but no impact for other mothers. Using ACS survey data, Malik (2018) found that DC's universal pre-K expansion contributed to a ten percentage-point increase in the district's labor force participation rate. Even though most studies find a 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). However, when it comes to single mothers, Kimmel (1998), Michalopoulos et al. (1992) and Connelly (1992) found that these elasticities are essentially zero or statistically insignificant.

Discrepancies across studies make it difficult to provide conclusive evidence regarding the employment effects of childcare subsidies, particularly for single mothers. This study aims to add to the economic literature by examining the relationship between a universal pre-K program and the 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 understanding 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 an ACS survey for the period between 2001-2019, a period for which 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. This approach enables us to compare the differences in labor supply of single mothers when their children were under the age of 4 versus when their children were in the preschool age range of 4-5 years old. Our results show that after the establishment of universal pre-K in DC, single mothers 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 suggests that the city's universal pre-K program has notable income effects that impact the labor supply for single mothers in Washington, DC with younger children eligible for the universal pre-K program.

## II. DC Universal Pre-K background

In 2008, Washington, D.C., enacted the pre-K Enhancement and Expansion Act, providing two years of full-day, universal preschool for all three- and four-year-olds in the city. The program encompasses all the city's public school (DCPS) programs, public charter school (PCS) programs, and certain 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 30th. The universal pre-K program adheres to high-quality standards, including mandatory small class sizes, an approved curriculum, and a requirement for lead teachers to hold a bachelor's degree or higher. Additionally, preschool teachers receive competitive compensation: the average starting salary for DCPS early-childhood program teachers is about $53,000[2], which is 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]. In total, 80 percent of all three- and four-year-olds were enrolled in the pre-K program. Additional information can be found in Table 1. As Figure 1 indicates, pre-K enrollment has steadily increased from FY 2012 to FY 2020, with 13,900 students enrolled in both DC public schools and DC public charter schools in FY 2020.

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% |

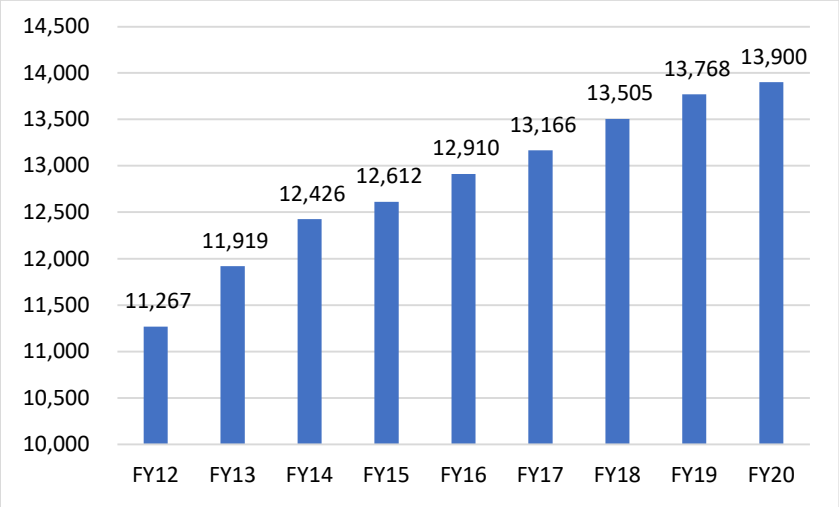
(Data source: DC Office of the State Superintendent of Education, FY 2019 Pre-K report)

[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

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




(Data Source: Author's Calculation)

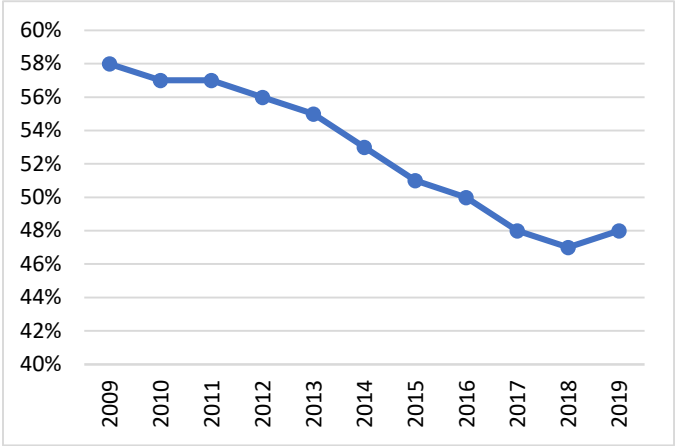
According to the FY 2019 annual report from the DC Office of the State Superintendent of Education, the District of Columbia spends $17,545 per child per year on pre-K programs, which is over three times the national average expenditure of $5,175 per child. The primary reason for the higher spending in DC pre-K programs is the higher salaries paid to teachers, as preschool teachers in the District of Columbia receive the same salaries as elementary school teachers.

## III. Data and Methodologies

This study examines the impact of DC's universal pre-K programs on the labor supply of single mothers. We focus on single mothers for several reasons: Firstly, over the last decade, the majority of children under age 18 in DC have lived in single-parent families. The percentage of households with children headed by single parents has been consistently over 50%, with the exception of recent years due to gentrification (as shown in Figure 2); Secondly, based on our administrative tax data, approximately 80 percent 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 was about $44,000, which is well below the city average income of around $80,000. The welfare of these single parents is of great interest to city 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)

This study analyzes changes in maternal labor supply on the intensive margin, as denoted by their income levels on their annual income tax returns. To conduct this analysis, we use data from IRS and the District of Columbia's individual income tax returns for DC income tax filers from tax year 2002 to 2019. Labor supply on the intensive margin refers to the number of hours worked for employed workers, whereas labor supply on the extensive margin refers to the employment rate. As our database only includes filers with tax records, 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. Consequently, we only analyze tax records of workers with at least seven years of consecutive tax returns.

To simplify the analysis, we limit our data to households with a youngest child who is either three- or four-years-old. We remove households with a preschool eligible child and younger siblings because 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. This circumstance introduces added complexity to the analysis, making it more challenging to disentangle the effect of universal childcare from other factors that may also impact maternal labor supply.

We constructed a balanced panel of income and other explanatory variables for single parent filers with three- and four-year-old children. The panel covers a period of 7 years, beginning from the year before childbirth and ending when a child turns 6 years old. This duration allows us to track the earnings dynamics of mothers from pregnancy through their children's graduation from preschool and entry into elementary school.

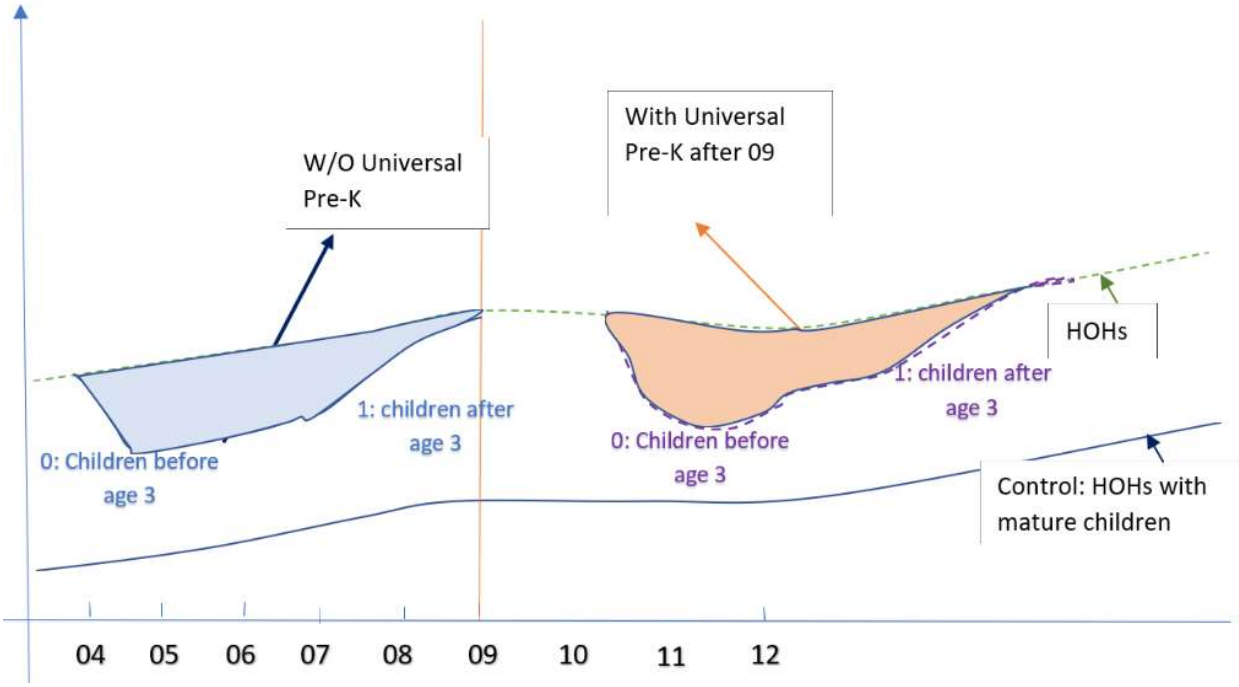
Figure 3 illustrate the earning dynamics for a typical single mother with an eligible pre-K child. We would expect that the annual earning levels for single mothers tend to decline during the time of childbirth and gradually recover after their children can access non-maternal childcare. The shaded blue curve represents the average cumulative amounts and timing of income decreases of working head-of-household mothers that experienced pregnancy and childbirth before 2009, when the District did not have a universal pre-K program for all 3- and 4-year-olds. In contrast, the purple line and orange shaded area represent the annual levels and timing of income decreases of working head-of-household mothers that experienced pregnancy and childbirth after the implementation of the universal pre-K program in 2009.

The top dashed green line shows 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 six or older at the beginning of the 7-year panel. This control group specification ensures 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-year period. We analyze how the policy change in 2009 affects the differences between the two earning patterns.

Figure 3: An Illustration of the 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 examine how the size and shape of the two shaded areas differ before and after the 2009 policy implementation. For instance, we divide the 7-year earning dynamics into two sub-periods: period 0, which represents mothers' earnings when the children are three years old or younger, and period 1, which represents earnings after

the children attend pre-K. This approach enables us to gain further insight into the nuances of earnings changes during different periods. This later specification essentially involves a triple difference analysis.

Our Difference-in-Differences (DID) models try to address several questions regarding how the universal pre-K policy affects the intensive margin labor supply of single mothers in DC. Firstly, does the 2009 universal pre-K policy change the average earnings of single mothers with pre-K eligible children? In other words, does the size of the shaded area change? Secondly, how does the earnings behavior of mothers differ when the children are younger (< 4 years old) compared to when they attend preschool? Finally, for the 7-year earning dynamics, is there a specific year in which mother's earnings exhibit the most significant changes?

We utilize a straightforward DID model, represented by Equation (1), to address our first question:

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

And we employ equation (2) to address our second and third questions.

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

With

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

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

## IV. Results

A significant finding of our study is that the implementation of the universal pre-K program in the District of Columbia resulted in lower overall earnings for single mothers during the 7-year period, assuming everything else was kept the same. The average decline is approximately 12.7 percent, and it is statistically significant, as shown in 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 displays the results of the difference-in-differences (DID) estimation for equation 2, which indicates an 18.7 percent decrease in wages during period 0 (prior to the child turning 4) that is statistically significant and accounted for the majority of the earning decline over the 7-year period. On the other hand, the increase in wages during period 1 (following the child's eligibility for preschool enrollment) is approximately 2.2 percent but is not statistically significant. Overall, the findings suggest that due to the income effect, single mothers have been able to take longer breaks from work and allocate more time to their children before they are old enough to attend preschool. As soon as their children enroll in pre-K programs, the mothers' earnings begin to rebound, returning to the pre-2009 level. It is worth noting that there is a 2.2 percent increase in earnings during the second period, but it is not statistically significant.

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 presents additional insights into the impact of the pre-K program on maternal earnings. The data reveals that following year 2009, maternal earnings experienced the most significant decline (30 percent, p-value of 0.001) during the years of childbirth (year 2 in the model). Furthermore, during the year preceding pre-K enrollment (year 5 in the model), maternal earnings tended to decrease by an average of 14 percent (with weak significance, p-value of 0.039). Although there were no statistically significant declines in earnings during other years, the overall results demonstrate that the city's universal pre-K program is associated with reduced maternal earnings during pregnancy and the first few years after childbirth. The most substantial decrease in earnings occurs before the child reaches three years of age. These findings suggest that the pre-K program has generated an income effect (through the provision of fully subsidized quality childcare), allowing mothers to work less and potentially devote more time to child-rearing by taking longer unpaid maternal leave before their child turns three, knowing that they will not have to pay for childcare when the child is three and four years old.

Table 4. 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

Our study examines the labor supply of single mothers in DC with pre-K eligible children, focusing on the impact of the universal pre-K policy on their earnings. To achieve this, we analyze their tax records and concentrate on the labor supply at the intensive margin. Our research particularly focuses on single mothers who have continuously worked from pregnancy until their children are ready for elementary school. Our findings support the permanent income hypothesis and suggest that the income effects have a greater impact on the labor supply of single mothers in DC than the price effects. Specifically, our results show that the income effects dominate the price effects for this group of individuals.

Our finding is in line with the existing literature, which suggests that the effect of childcare subsidies on the labor supply of unmarried mothers is inconclusive and varies depending on the specific context and population being studied. For instance, Kimmel's (1998) study reports elasticities ranging from -4.54 to +1.38, indicating that the effect of childcare subsidies on the labor supply of unmarried mothers is highly sensitive to the particular study design and context. Similarly, other studies have found that the availability of childcare subsidies can have both positive and negative impacts on the labor supply of unmarried mothers, depending on factors such as the cost of childcare, the availability of alternative care options, and the design of the subsidy program. Our findings contribute to the growing body of evidence that highlights the complexity of the relationship between childcare subsidies and labor supply among unmarried mothers. The impact of universal pre-K policy along the intensive margin is theoretically ambiguous, as it may involve opposing income and price effects. However, in the case of DC, our findings suggest that the income effects are more pronounced. Specifically, our findings indicate that the universal

pre-K policy leads to a decline in labor supply among single mothers in DC, before the child reaches three years of age, primarily through its income effects rather than price effects.

The universal pre-K policy in DC has provided low-income unmarried mothers with higher disposable income due to free pre-K child education, which may have allowed them to spend more time with their children, particularly during the year of childbirth. While some policymakers may have expected an increase in maternal labor supply, our findings indicate that working unmarried mothers tended to decrease their labor supply at the intensive margin, but to their own and their families' benefit. This suggests that the policy has had a positive impact on family and child well-being, by allowing mothers to spend more quality time with their children without sacrificing their economic stability.

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