FEDERAL RESERVE BANK *of* ATLANTA **WORKING PAPER SERIES**

Does Access to Free Pre-Kindergarten Increase Maternal Labor Supply?

Elias Ilin, Samantha Shampine, and Ellyn Terry

Working Paper 2022-3
February 2022

Abstract: In this paper, we evaluate the effects of free pre-kindergarten (pre-K) programs on the labor force participation (LFP) of mothers. We use variation in pre-K rules across all US states, including income eligibility requirements in some states. To estimate the causal effects of access to pre-K on labor supply, we exploit the panel aspect of the monthly Current Population Survey between 2002 and 2019. Specifically, we look at the change in labor market behavior of women when their child becomes age-eligible for pre-K, controlling for individual factors. We find that access to free pre-K programs increases overall maternal LFP by 2.3 percentage points. In particular, we find that mothers with the following demographic characteristics significantly increase their labor supply as a result of an access to free pre-K: married, college educated, residents of metropolitan areas, and with income either below 200 percent or above 400 percent of the federal poverty level. Our results are robust across a series of placebo tests and alternative specifications and sample restrictions.

JEL classification: G50, H21, H23, I31, J01, J08, J15, J16, J18, J21, J22

Key words: maternal labor force participation, childcare policies, universal pre-K, gender equality policies, early education policies

https://doi.org/10.29338/wp2022-03

The authors thank participants of the Society of Economics of the Household 2021 conference, seminar participants at Boston University, and the Federal Reserve Bank of Kansas City for their insightful comments. The views expressed here are those of the authors and not necessarily those of the Federal Reserve Bank of Atlanta or the Federal Reserve System. Any remaining errors are the authors' responsibility.

Please address questions regarding content to Elias Ilin, Federal Reserve Bank of Atlanta, elias.ilin@atl.frb.org; Samantha Shampine, Federal Reserve Bank of Kansas City, samantha.shampine@kc.frb.org; or Ellyn Terry, University of Washington and Federal Reserve Bank of Atlanta, elliet85@uw.edu.

1 Introduction

The prevailing social and gender norms in the United States pressure mothers into taking on most household child care responsibilities. In the absence of work-family policies such as parental leave and subsidized child care, many women choose to leave the labor force instead of paying for high-cost childcare when they have children (Morrissey 2017). This leads to unequal labor market opportunities for men and women and persistent gender labor market inequality and wage gaps (Waldfogel 1997; Bertrand et al. 2010; Kleven et al. 2019).

Publicly subsidized free Pre-Kindergarten (Pre-K) has increasingly caught the attention of policy makers as a potential way to achieve the dual goal of promoting labor force participation (LFP) among mothers who want to work by providing no-cost quality child care while also advancing early childhood education. Indeed, state-funded Pre-K programs have expanded significantly over the last decade and as of 2019, almost all states have programs for three- or four-year-olds. As of this writing, President Biden is working towards passing his American Families Plan. If passed, this plan would provide universal access to high-quality, free Pre-K for all three- and four- year-olds.[1] In order to quantify the potential effectiveness of such a policy we must examine the impact of past Pre-K programs.

In this paper we ask "Do free Pre-K programs increase maternal labor supply?". To estimate the causal effects of access to Pre-K on the labor supply we exploit the panel aspect of the monthly Current Population Survey (CPS) between 2010-2019. Specifically, we estimate the change in LFP of women when their child becomes age-eligible for Pre-K, controlling for individual and family characteristics. Our methodology incorporates the income eligibility limits for each state's Pre-K program. This design feature is crucial when examining the labor market effects of the policy, because it means that only a subset of the population has access to Pre-K programs. To our knowledge, no prior research looking at the effect of Pre-K on labor market decisions has taken into account the income eligibility limits of each state's program. Additionally, much of the prior literature investigating this

[1] https://www.whitehouse.gov/american-families-plan/

question was conducted prior to the introduction of Pre-K programs in many states. Thus our analysis can also be seen as an update to prior studies.

Overall, we find that the existence of free Pre-K programs increases maternal LFP by 2.3 percentage points, on average in our sample. In particular, we find that mothers with the following demographic characteristics significantly increase their labor supply in response to free Pre-K: married, college educated, residents of metropolitan areas, and those with income either below 200 percent or above 400 percent of the Federal Poverty Level (FPL). Our results are robust across a series of placebo tests and alternative specifications and sample restrictions.

2 Background

2.1 Child Care Burden and Female Labor Force Participation

When families in the U.S. have children, it is generally expected that the mother will dedicate more time to unpaid childcare responsibilities than the father. For women that are working prior to having children, this expectation means that they may need to reduce hours of work or leave the labor force altogether to make time for their new duties. In 2019, only 76 percent of 25-54 year old women were in the labor force compared to 89.1 percent of men. Data from the BLS monthly Current Population Survey microdata show that the 13 percentage point gap in LFP between prime-age men and women can be nearly fully accounted for by a difference in those who cite child care responsibilities as the reason for not participating. As shown in Table 1, in 2019, 13.2 percent of prime-age women cite dependent care as their primary reason for being outside of the labor force compared to a mere 1.2 percentage of prime-age men.

Not only is the prime-age female LFP lower than prime-age men's, it has actually dropped 2 percentage points since 2000. This decline in prime-age women's LFP has stirred interest in the role of children in female labor market decisions (Hipple 2016). In particular much

Table 1: U.S. Female and Male Labor Market Statistics, Individuals Age 25-54, 2019

	Women	**Men**
Participating in the Labor Force (% of prime-working age population)	76.0	89.1
Not in the Labor Force because taking care of dependents (% of prime-working age population)	13.2	1.2

Source: Bureau of Labor Statistics Monthly Current Population Survey (CPS). Authors' calculations.

of the focus has been on the role of the cost of child care, which arguably plays a large role in the decision to continue working or leave the labor force for unpaid childcare work. In particular, researchers have examined the LFP effects of four programs which reduce child care costs: direct child care subsidies, Head Start, Kindergarten, and state-funded Pre-K.

A number of studies have examined the effect of direct child care subsidies on labor force participation in quasi-experimental frameworks. In particular, the labor supply decisions of low-income or nonworking single mothers who suddenly receive child care subsidies have been examined by many researchers. Findings from this research provide unambiguous evidence that those who suddenly receive child care subsidies become more likely to participate in the labor force (Granger and Cytron 1999; Blau and Tekin 2007; Meyers et al. 2002).

The effect of the Head Start program has also been studied by many researchers. The Head Start Preschool program is the oldest federally funded preschool program in the United States. To be eligible for Head Start, families must have income below the poverty level.[2] Multiple studies have found evidence that program participants increase their participation in the labor market. Russo (2017) finds positive and significant effects of Head Start eligibility on mothers' likelihood of employment and number of hours worked per week. Using the National Longitudinal Survey of Youth of 1979, and the Children of the National Longitudinal Survey of Youth of 1979 she employs a regression discontinuity model using the eligibility cutoff. Head Start eligible mothers had 2.35 more working hours per week and were

[2]To enroll in Head Start children must be less than 6-years-old. Children from homeless families, and families receiving public assistance such as TANF or SSI are also eligible. Foster children are eligible regardless of their foster family's income. (https://eclkc.ohs.acf.hhs.gov/eligibility-ersea/article/poverty-guidelines-determining-eligibility-participation-head-start-programs)

6 percent more likely to be employed. After restricting the sample to Black mothers, these results increased to 3.89 more hours and 7 percent more likely to be employed. Similarly, Sabol and Chase-Lansdale (2015) use the Head Start Impact Study (HSIS) - a randomized control trial of 4,000 participants - to evaluate the program's effect on parents. They too find significant positive effects on the likelihood of being employed by the time their child is 6 for the parents of the 3 year-old cohort.

Recent literature on the relationship between kindergarten and maternal labor supply provides additional insights into the labor supply effects of subsidized child care. Kindergarten programs are now widely available for five-year-olds across the United States and typically are available to families of all income levels. Cascio (2009) finds that the growth in the kindergarten availability that occurred in the 1960s and 1970s increased the employment of single mothers in the United States with no younger children. Gelbach (2002) uses quarter of births as an instrument for enrollment in kindergarten in 1980 and finds that enrollment in public school improves labor market outcomes such as being employed and weeks worked in 1979 for single mothers whose youngest child is five. He also finds a positive effect on the labor market outcomes for all married mothers, with or without children younger than five. Fitzpatrick (2012) updates Gelbach's estimate using data from the restricted access 2000 Decennial Census data. Using precise information on the date of birth combined with eligibility cutoffs she finds that kindergarten enrollment in 2000 does increase the employment of single mothers without younger children but does not increase that of married mothers, regardless of whether or not they have children. Cannon et al. (2006) study the differential effects of full-time and part-time kindergarten programs and find that mothers whose children attended full-day kindergarten programs were more likely to work full-time than those whose children attended half-day programs.

A number of international studies examine free or subsidized child care programs for children aged 0 to 6. Most studies we examined have found that such programs significantly increase maternal labor force participation, with many studies focusing on married mothers.

Lefebvre and Merrigan (2005) and Baker et al. (2008) explored the effects of a universal childcare policy in Quebec that started in 1997 with subsidized day care costing $5 per day and progressively expanded until 2000 when all children under 5 could attend for the subsidized price. The researchers use a difference-in-differences approach, comparing the employment of mothers across Canadian provinces before and after the program began. Using a sample of married mothers in the Baker et al. (2008) and a sample of both single and married mothers in the Lefebvre and Merrigan (2005), both studies show a statistically significant and sizable increase in employment of around 8 percentage points. Schlosser (2005) studies the introduction of free compulsory public preschool in Israel for children ages 3 and 4. She uses variation in the timing of program introduction across localities to identify the effects of the program on maternal labor supply of married mothers. She finds the program increases married mothers labor force participation rates by about 7 percentage points. Havnes and Mogstad (2011) find less significant results analyzing a 1975 childcare reform in Norway that led to different degrees of federal subsidies to local municipalities. Using a sample of married mothers aged 20 to 55 and a difference-in-differences approach, they found that a 1 percent increase in the supply of child care subsidies for 3 to 6 year olds in the treatment group corresponded to a 0.04 percentage point higher maternal employment rate relative to the comparison group.

While international evidence is important to consider, the policy and cultural context in the U.S. is distinct from other countries. Thus the estimated labor supply effects found in the studies mentioned above cannot be directly applied to evaluating effects of Pre-K programs in the U.S.

There is limited research on the effect of free Pre-K on maternal labor force participation in the U.S. context. Two of the most cited studies were done before the expansion of Pre-K that occurred during the past decade and thus include limited geographies. Fitzpatrick (2010) uses restricted access 2000 Decennial Census data to analyze the effects of Georgia and Oklahoma universal preschool programs. She uses a regression discontinuity framework

to estimate the effects of universal Pre-K availability on overall preschool enrollment and maternal labor supply. She splits the sample of mothers into married and single, with and without children younger than 4 years old. Her results suggest there is no statistically significant increase in employment for any of these populations, on average. Sall (2014) uses a difference-in-differences model exploiting the staggered timing of program funding and introduction of Pre-K into public school districts in 10 states. He finds that implementation of public Pre-K significantly increases the likelihood of being in the labor force by 4.3 percentage points and of being employed by 5.5 percentage points for married mothers with children 4 or older. When examining the labor supply responses of single mothers, Sall does not find an effect on either LFP or employment. One limitation of Sall (2014) is his study does not incorporate income eligibility rules that were in effect for half of the states he examined. This would potentially lead to biased results.

Pulling all the evidence from early childhood programs together - both in the U.S. and from abroad - most studies suggest that such programs increase the labor force participation of married mothers. Studies on the effect of targeted childcare subsidies (Granger and Cytron 1999; Blau and Tekin 2007; Meyers et al. 2002), Head Start (Russo 2017; Sabol and Chase-Lansdale 2015), and free preschool abroad (Lefebvre and Merrigan 2005; Baker et al. 2008; Havnes and Mogstad 2011; Schlosser 2005) find an unambiguous positive effect of these programs on maternal labor force participation. Studies on the effect of kindergarten find a positive effect on the LFP of single mothers, but inconclusive evidence on the LFP of married mothers (Cascio 2009; Gelbach 2002; Fitzpatrick 2012). Evidence on the effect of Pre-K in the U.S. is limited and inconclusive. Two of the most cited studies examine programs in limited geographic areas and find contradictory results. One of the studies (Fitzpatrick 2010) finds Pre-K does not affect the labor force participation of either single or married mothers while the other study (Sall 2014) finds positive effects on married women's LFP.

Our study adds evidence to the body of literature on the effect of Pre-K programs in

the U.S. We use the latest data available, which is important for two reasons. First, the expansion of Pre-K has increased the number of geographic areas that can be studied. The prior studies were conducted over 10 years ago- prior to the expansion of Pre-K programs and thus included limited geographies (one study included 2 states while the other study included 10 states). In contrast, this study includes 44 states and the District of Columbia. Second, there is a need to reevaluate the effects of such policies in light of the current cultural context. Recent analyses of own-wage elasticities of labor supply have revealed that married women are no longer responsive to wage changes (Blau and Kahn 2007; Heim 2007). This decreased responsiveness to wages might mean that child-care subsidies might potentially have less impact on maternal labor supply today than in the past. Finally, our methodology takes into account income eligibility requirements that exist for most Pre-K programs. To our knowledge, all past research on Pre-K programs ignore the fact that many programs are means-tested in nature.

2.2 The Expansion of Pre-K Programs Across the U.S.

In February 2013, President Obama put forward his Preschool for All proposal to establish a federal-state partnership that would provide high-quality preschool for all four-year-olds from low- and moderate-income families.[3] This partnership resulted in a large expansion in publicly financed Pre-K programs across the United States. In the 2015-16 fiscal year, states increased their investments in preschool programs by nearly $767 million (12 percent) over the prior year. Between 2010 and 2019 average enrollment rates increased by 6.89 percentage points, including 8 states who created new programs.[4] By 2019, 44 states and the District of Columbia offered some form of voluntary Pre-K programs.

Of the 45 Pre-K programs across the nation, 13 only include only four-year-olds while 32

[3] https://obamawhitehouse.archives.gov/the-press-office/2013/02/13/fact-sheet-president-obama-s-plan-early-education-all-americans

[4] The states that began programs between 2010 and 2020 are: Alaska (2009-2010), Hawaii (2014-2015), Minnesota (2016-2017), Mississippi (2013-2014), Alabama (2013-2014), Connecticut (2014-2015) Montana (2017), North Dakota (2016-2017). Connecticut had funding for Child Day Care Contracts for 40 years but in 2014-2015 the finance structure changed in ways that met the NIEER's definition of state funded Pre-K.

extend access to three-year-olds. Table 2 shows the age and income eligibility requirements by state for the three and four year old programs. Of the 45 programs in place for four-year-olds, there is an age requirement (but no income requirement) in 17 of them. Twenty-three states have age and income eligibility requirements for their Pre-K programs for four-year-olds. Five states with programs for four-year-olds do not have income eligibility requirements but determine eligibility based on other individual child and family characteristics, such as child's academic ability and disability status. Due to difficulty measuring eligibility requirements other than income, this analysis excludes states in this category. The program differences for three-year-olds can be seen in Table 2.

Table 2: Pre-K Programs Across the U.S.

Pre-K Program Type	**Four-Year-Olds**	**Three-Year-Olds**
No program	Idaho, Indiana, New Hampshire, South Dakota, Utah, Wyoming	Alabama, Florida, Georgia, Hawaii, Idaho, Indiana, Louisiana, Maine, Michigan, Mississippi, Nevada, New Hampshire, North Carolina, North Dakota, Rhode Island, South Dakota, Utah, Virginia, Wyoming
Age and Income Eligibility Requirements	Arizona, Arkansas, California, Colorado, Connecticut, Delaware, Hawaii, Kansas, Kentucky, Louisiana, Maryland, Michigan, Nebraska, New Jersey, North Carolina, North Dakota, Ohio, Oregon, South Carolina, Tennessee, Texas, Virginia, Washington	Arizona, Arkansas, California, Colorado, Connecticut, Delaware, Kansas, Kentucky, Maryland, Nebraska, Ohio, Oregon, South Carolina, Tennessee, Texas, Washington, Minnesota, Wisconsin
Age and Other Eligibility Requirements	Alaska, Illinois, Maine, Mississippi, Nevada	Alaska, Illinois
Age Eligibility	Alabama, District of Columbia, Florida, Georgia, Iowa, Massachusetts, Minnesota, Missouri, Montana, New York, New Mexico, Oklahoma, Pennsylvania, Rhode Island, Vermont, West Virginia, Wisconsin	District of Columbia, Iowa, Massachusetts, Missouri, Montana, New Jersey, New Mexico, New York, Oklahoma, Pennsylvania, Vermont, West Virginia

Source: The State of Preschool 2019, Appendix A: State Survey Data 2018-2019, The National Institute for Early Education Research

3 Methods

We employ a novel methodology to estimate the causal effects of access to Pre-K on labor supply. Using the panel aspect of the monthly Current Population Survey between 2010-2019 we exploit state-level variation in the availability of Pre-K programs and eligibility laws.

Specifically, we look at the change in labor market participation of mothers when their child becomes age eligible for Pre-K, controlling for individual and family factors. Eligibility for Pre-K consists of three parts. First, a family must be a resident of a state that offers Pre-K. Second, family income must be below the income eligibility threshold, provided one exists. Finally, a child must reach a certain age (three or four, depending on the program) by the beginning of a school year (usually September 1).[5]

In theory, stay-at-home mothers who have access to Pre-K programs will be more likely to join the labor force once their child becomes age-eligible relative to mothers whose children become age-eligible but do not have access to a Pre-K program (either because they do not meet the programs income eligible requirements or because there is no program in their area). Likewise, mothers who are working before their child is age-eligible for Pre-K are more likely to continue to work.

Formally, we estimate the following model.

$$y_{ist} = \beta_0 + \beta_1(preK_{st} \times I_{ist} \times A_{ist}) + \beta_2 A_{ist} + u_{st} + \delta_t + \mu_i + \epsilon_{ist} \tag{1}$$

Where, y is the labor force participation of person i in state s at time t. $preK$ is a binary indicator which is equal to 1 if state offers Pre-K program and 0 if not; I is a binary indicator which is set to 1 if a family satisfies all existing income eligibility requirements (or if the state does not have any such requirements). A is a binary indicator that a child's age is above the

[5]To be eligible for the program, the child must be age-eligible (age 4 or 3, depending on a state) by a specific cutoff date. This age cutoff date is September 1 in 30 states. In Arkansas, Kentucky, Missouri, Nebraska, North Dakota, and Tennessee the age cutoff date ranges between July 31 and August 15. In Colorado and Hawaii the age-eligibility cutoff date is October 1, making them the only states with an age cutoff after September 1.

age cutoff before the start of a school year. A is equal to 1 when the child is age-eligible and can change during the survey as children age. Thus, eligibility for Pre-K occurs when $preK$, I and A are all equal to 1. u is a state-level unemployment rate determined for different age and education groups; δ is a year fixed effect and μ is an individual fixed effect.

The coefficient β_1 estimates the average effect of gaining access to a Pre-K program on the labor force participation of mothers in our sample. Specifically, β_1 captures the change in y for the treatment group (mothers that are eligible for Pre-K) relative to the change in y for the control group (Pre-K ineligible mothers, either because of income eligibility or age requirements).

Importantly, the model includes individual fixed effects which control for a multitude of covariates that are idiosyncratic and could theoretically affect y. For example, family-level characteristics such as a spouse's employment, the mother's education level and experience, and importantly, her preferences and attitudes regarding work and parenting duties, can confound the results. Due to the well documented difficulty in explaining female labor market participation this is an important part of the research design (Fernández 2013). The inclusion of individual fixed effects means that a woman whose child becomes eligible for Pre-K serves as its own control in the time periods prior to their child becoming eligible. The model includes A as a separate regressor to control for the potential separate effect of a child being slightly older on mother's LFP.

3.1 Data and Sample

To conduct this analysis we use individual-level data from the 2002-2019 monthly Current Population Survey (CPS). The CPS contains detailed labor market information (labor force participation status, usual hours of work, wage earnings) and rich demographic information over time, including age of children. The CPS is a panel data set that follows households for 16 months and thus can be used to track the short-term changes in labor market behavior. The timing of the survey (shown in Table 3) puts constraints on our analysis. Each household

that enters the panel is surveyed once per month for four months in a row. Then an eight month gap in the survey occurs, during which data is not collected. After the gap, the household is surveyed for an additional four months in a row. Each month, the survey asks each individual in the household about their labor force status and their demographic characteristics (such as age of children). Questions related to income and hours of work however, are asked only twice during the whole panel - in the fourth interview and the last interview. Therefore, to determine whether the household is income eligible we use the first observed income of the household, and thus I from Equation 1 does not vary over time.

Table 3: Timing of Information Collected from the Monthly CPS

	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**
Income				x												x
Employment Status	x	x	x	x									x	x	x	x
Age of Children	x	x	x	x									x	x	x	x

Note: This example assumes that the first month of the interview is January

We then restrict the CPS sample to married and single mothers of prime working age (between 25 and 54) with exactly one child between the ages of 2 and 5. We restrict the sample to families with only one child to simplify the interpretation of the analysis. The labor market decisions of mothers with more than one child may be affected by the age of the other children in the household. For example, mothers with additional younger children may be less impacted by free Pre-K because these mothers may need to stay at home regardless of Pre-K availability. Mothers with older children may be affected by free Pre-K more, especially if their other children are able to help out with childcare responsibilities such as watching younger siblings after school.

We determine eligibility for the Pre-K program by looking at the family's state of residency, family's total income and child's age in each month of the survey. First, a family must be a resident of a state that offers a Pre-K program. Second, families' income must be below the threshold set in states that impose income eligibility. Finally, if we observe that

any time before the September survey a child's age is below state-determined age cut-off then the family is eligible for Pre-K for that entire school year (August-May) and ineligible in the months prior to the school year start. The CPS is conducted in the middle of the month, and in most states the deadline is September 1, thus being age-eligible before the September survey is used as a proxy for meeting the age-eligibility deadline.

4 Results and Discussion

4.1 Effect of the Pre-K Access by Demographic Groups

We estimate Equation 1 using OLS and cluster standard errors at the individual level. Table 4 reports the estimated average effect of access to Pre-K on maternal labor force participation overall for our sample, and among several demographic groups of interest. We do not separate the effects of programs for three- and four-year-olds for two reasons. First, by pooling two age groups together we obtain greater sample size that allows us to produce better statistical inferences. Second, most of the states with Pre-K programs for four-year-olds also have programs for three-year-olds, and all states with Pre-K programs for three-year-olds, also have programs for four-year-olds. Thus, it is difficult to separate the effect of two programs and still maintain adequate sample size and the full sample of states. However, we acknowledge that there might be differences in maternal LFP responses to the two programs that may be of some interest. Thus Appendix A contains separate results for three- and four- year-old programs.

Overall, the existence of a free Pre-K program increases maternal LFP by 2.3 percentage points. The significance and the magnitude of this effect is, however, different across demographic groups. We have five main findings. First, consistent with Sall (2014) we find that the effect of free Pre-K is significant only in the sample of married mothers. Access to Pre-K increases their LFP by 3.2 percentage points. We do not find a significant effect among unmarried mothers. Second, looking at the results by educational attainment, we

Table 4: Estimated Effects of Access to Free Pre-K on Maternal LFP

Demographic Group	**Sample Size**	**Coefficient on Pre-K (Standard Error)**
All	23,202	0.023*
		(0.013)
Not Married	5,690	-0.01
		(0.020)
Married	17,512	0.032*
		(0.016)
Education Level: Less than College	12,071	0.0003
		(0.014)
Education Level: College +	11,131	0.042**
		(0.019)
White, non-Hispanic	15,454	0.023
		(0.016)
Black, non-Hispanic	2,138	-0.059
		(0.058)
Other, non-Hispanic	2,421	0.056
		(0.040)
Hispanic	3,189	0.038
		(0.027)
Residence: Metropolitan	18,991	0.026*
		(0.014)
Residence: Nonmetropolitan	4,043	0.013
		(0.018)
Income: <200% FPL	5,471	0.049**
		(0.022)
Income: b/w 200% and 400% FPL	7,565	-0.021
		(0.024)
Income: >400% FPL	10,166	0.035*
		(0.018)

Note: *,**,*** indicate statistical significance at 10%, 5%, and 1% respectively

Standard errors are clustered at the state level

find a significant effect of free Pre-K on LFP only among mothers with a college degree ; the effect is a significant 4.2 percentage point increase on LFP. Third, we find an average effect of 2.6 percent for mothers that live in metropolitan areas but no effect among those that live in rural areas. Finally, we observe significant effects among the sample of low-income mothers (with family income below 200 percent FPL) and the sample of high income (with family income above 400 percent FPL). This finding is consistent with Malik (2018) who finds similar heterogeneity in responses of mothers at different income levels to the introduction of the universal preschool in D.C.

Arguably, the stronger effects observed for mothers below 200 percent FPL could be due to the greater receipt of public assistance programs with work requirements. For example, the Supplemental Nutrition Assistance Program (SNAP) and the Earned Income Tax Credit (EITC) fully phase out by 200 percent FPL. Mothers who are potentially eligible for government assistance so long as they are working may have an even stronger incentive to re-enter or remain in the labor force. Mothers with income above 400 percent FPL may have a stronger reason to re-enter in the labor market for a similar but distinct reason. They too, may face a high opportunity cost of not participating- but stemming from relatively high lost wages as opposed to lost government assistance programs.

4.2 Placebo Tests

To confirm that the effects estimated in Table 4 represent true causal effects of access to free Pre-K on maternal labor supply, we conduct a series of placebo tests. Specifically, we perform an additional difference-in-differences estimation using five "fake" experiments. We categorize two-, six-, seven-, eight-, and nine-year-olds as being 'age-eligible' for Pre-K in five separate experiments. In all states, children that are two years old or younger do not have access to free preschool, while children who are six or older have access to compulsory schooling. Thus, a child turning 2, 6, 7, 8, or 9 should have no effect on the mother's labor force decision to participate in the labor force. Table 5 summarizes the results of the series

of placebo tests.

Our estimated effect of Pre-K on the labor force participation appears to be robust across the series of placebo tests. Across all tests and samples, the coefficient is insignificant in all but one. We find that Hispanic mothers in states with pre-K increase labor force participation when the child turns seven.

4.3 Separating the Mechanisms - States with and without Income Eligibility Requirements

The difference-in-differences specification of Equation 1 is based on a comparison of the LFP responses of mothers who are eligible for Pre-K and those who are ineligible. Besides not having an age-eligible child, mothers can be ineligible for two reasons. First, a family might live in a state that does not offer a Pre-K program. Second, a family might live in a state that offers a Pre-K program but the family's income may be above the threshold required to meet income eligibility for the program.

As a robustness check, we estimate Equation 1 separately for states with and without income eligibility requirements. For mothers living in states with income eligibility rules, the difference-in-differences estimation captures the change in the LFP of mothers that pass all eligibility criteria (including income) for Pre-K relative to the change in LFP of mothers that are ineligible for Pre-K. For mothers living in states without income eligibility requirements, the difference-in-differences estimation is obtained by comparing the response of mothers in states that offer Pre-K to mothers who live in states without Pre-K programs. Results are reported in Table 6.

Our results show the average effect of Pre-K on the mother's LFP is similar for both specifications. Moreover, these results are similar to the baseline specification reported in Table 4. Not only is the overall effect on LFP positive and significant, similar to the baseline specification, the effect on LFP is significant only for married mothers for both specifications

.

Table 5: Results of the Placebo Tests

Demographic Group	**Coefficient on pre-K (Standard Error)**				
	Placebo 1: Comparing 1- and 2-year-olds	**Placebo 2: Comparing 6- and 5-year-olds**	**Placebo 3: Comparing 7- and 6-year-olds**	**Placebo 4: Comparing 8- and 7-year-olds**	**Placebo 5: Comparing 9- and 8-year-olds**
All	-0.001	-0.012	0.009	-0.003	-0.010
	(0.020)	(0.012)	(0.013)	(0.014)	(0.014)
Not Married	-0.166*	-0.044*	0.015	-0.046	-0.005
	(0.065)	(0.021)	(0.025)	(0.024)	(0.024)
Married	0.033	-0.006	-0.001	0.015	-0.006
	(0.021)	(0.014)	(0.016)	(0.017)	(0.018)
Education Level: Less than College	0.031	-0.033*	0.020	-0.005	-0.002
	(0.031)	(0.017)	(0.017)	(0.019)	(0.020)
Education Level: College +	-0.019	0.015	-0.012	0.019	-0.017
	(0.028)	(0.016)	(0.021)	(0.019)	(0.021)
White, non-Hispanic	0.007	0.001	-0.007	0.006	-0.026
	(0.023)	(0.013)	(0.016)	(0.018)	(0.018)
Black, non-Hispanic	-0.057	-0.058	-0.054	0.014	0.026
	(0.068)	(0.038)	(0.033)	(0.040)	(0.036)
Other, non-Hispanic	-0.033	0.011	0.062	-0.034	0.002
	(0.079)	(0.037)	(0.057)	(0.033)	(0.053)
Hispanic	0.0054	-0.059	0.105**	-0.054	0.016
	(0.069)	(0.039)	(0.032)	(0.041)	(0.037)
Residence: Metropolitan	0.0025	-0.017	0.022	-0.002	-0.010
	(0.023)	(0.013)	(0.014)	(0.015)	(0.015)
Residence: Nonmetropolitan	-0.008	-0.020	-0.057	0.00001	-0.004
	(0.047)	(0.022)	(0.039)	(0.035)	(0.049)
Income: <200% FPL	0.067	-0.021	0.035	0.027	0.029
	(0.061)	(0.029)	(0.041)	(0.036)	(0.045)
Income: b/w 200% and 400% FPL	-0.005	-0.020	0.021	-0.002	-0.005
	(0.045)	(0.018)	(0.020)	(0.025)	(0.023)
Income: >400% FPL	-0.017	-0.002	-0.013	-0.037	-0.006
	(0.025)	(0.018)	(0.020)	(0.022)	

Note: *,**,*** indicate statistical significance at 10%, 5%, and 1% respectively

Standard errors are clustered at the state level

Table 6: Estimated Effects of the Access to Free Pre-K on the Maternal LFP in States with and without Income Eligibility Requirements

Demographic Group	**States with Income Eligibility**		**States without Income Eligibility**	
	Sample Size	**Coefficient on Pre-K (Standard Error)**	**Sample Size**	**Coefficient on Pre-K (Standard Error)**
All	12,001	0.034*	11,201	0.023*
		(0.018)		(0.012)
Not Married	2,341	-0.040	3,349	-0.008
		(0.036)		(0.0226)
Married	9,660	0.081**	7,852	0.039*
		(0.034)		(0.019)
Education Level: Less than College	5,914	0.008	6,157	0.003
		(0.027)		(0.017)
Education Level: College +	6,087	0.086	5,044	0.035*
		(0.061)		(0.018)
White, non-Hispanic	7,675	0.033	7,779	0.023
		(0.029)		(0.021)
Black, non-Hispanic	1,080	-0.034	1,058	-0.067
		(0.039)		(0.051)
Other, non-Hispanic	1,496	0.140	925	-0.009
		(0.137)		(0.041)
Hispanic	1,750	0.021	1,439	0.136**
		(0.005)		(0.054)
Residence: Metropolitan	10,130	0.042	8,861	0.032**
		(0.028)		(0.014)
Residence: Nonmetropolitan	1,793	0.020	2,250	-0.008
		(0.057)		(0.024)
Income: <200% FPL	2,745	0.046	2,726	0.051
		(0.029)		(0.026)
Income: b/w 200% and 400% FPL	4,429	0.043	3,136	-0.016
		(0.043)		(0.019)
Income: >400% FPL	4,827	0.134	5,339	0.035*
		(0.098)		(0.019)

Note: *,**,*** indicate statistical significance at 10%, 5%, and 1% respectively

Standard errors are clustered at the state level

4.4 Return to the Labor Force or a Reason Not to Drop-out?

Access to Pre-K programs can have an impact on the maternal labor force participation through two channels. First, free childcare can induce some non-working mothers to come back to the labor force. Second, it can increase the incentive for working mothers to continue working. To understand the contribution of each mechanism, we split the sample into those mothers who were not in the labor force in the beginning of their panel and those mothers that were in the labor force already. Table 7 reports regression results conducted on these two samples.

The restriction of the data to mothers who were not in the labor force in the beginning of the panel limits the number of observations and our ability to make statistical inferences. However, we do find limited evidence that both channels matter. For both populations - mothers in and out of the labor force at the beginning of the sample- we find statistically significant positive effects of access to Pre-K on the LFP of married mothers. Among those out of the labor force, we find statistically significant evidence that access to Pre-K induces mothers with college education into coming back into the labor force. Among those in the labor force, we find that Pre-K programs incentivize remaining in the labor force for mothers with family income below 200 percent FPL.

5 Conclusion

In 2019, the labor force participation rate of prime-working age women was 13 percent below that of men; this gap can be fully accounted for by the higher share of women who are out of the labor force because they are taking care of their children. Many researchers and policymakers point to the lack of work-family policies in the U.S as the reason for low LFP among prime-age women (Blau and Kahn 2007). For example, the United States is the only country in the OECD that does not offer paid maternity leave at the national level (OECD 2017).

Table 7: Estimated Effects of Access to Free Pre-K on Maternal LFP: Mothers not in the Labor Force versus Mothers in the Labor Force

Demographic Group	**Mothers not in the LF in the beginning of the panel**		**Mothers in the LF in the beginning of the panel**	
	Sample Size	**Coefficient on Pre-K (Standard Error)**	**Sample Size**	**Coefficient on Pre-K (Standard Error)**
All	5,342	0.038	17,860	0.013
		(0.036)		(0.014)
Not Married	886	-0.093	4,804	0.0001
		(0.065)		(0.012)
Married	4,456	0.067**	13,056	0.017*
		(0.037)		(0.017)
Education Level: Less than College	3,224	-0.045	8,847	0.014
		(0.036)		(0.015)
Education Level: College +	2,118	0.126**	9,013	0.014
		(0.057)		(0.021)
White, non-Hispanic	3,207	0.063	12,247	0.009
		(0.060)		(0.013)
Black, non-Hispanic	391	-0.232	1,747	-0.028
		(0.157)		(0.017)
Other, non-Hispanic	800	0.039	1,621	0.066
		(0.063)		(0.056)
Hispanic	944	0.043	2,245	0.0015
		(0.049)		(0.027)
Residence: Metropolitan	4,383	0.055	14,608	0.014
		(0.035)		(0.015)
Residence: Nonmetropolitan	928	-0.057	3,115	0.016
		(0.104)		(0.025)
Income: $< 200\% FPL$	1,450	0.075	4,021	0.031*
		(0.068)		(0.018)
Income: b/w 200% and 400% FPL	1,577	-0.003	5,988	-0.030
		(0.079)		(0.020)
Income: $> 400\% FPL$	2,315	0.054	7,851	0.029
		(0.050)		(0.021)

Note: *,**,*** indicate statistical significance at 10%, 5%, and 1% respectively

Standard errors are clustered at the state level

In this paper, we examine whether Pre-K programs in the U.S. affect the labor supply of mothers. To estimate the causal effects of access to Pre-K on labor supply we exploit the panel aspect of the monthly Current Population Survey (CPS) between 2010-2019. Specifically, we estimate the change in labor force participation of women when their child becomes age-eligible for Pre-K, controlling for individual characteristics. Our methodology incorporates the income eligibility limits for each state's Pre-K program. This design feature is crucial when examining the labor market effects of the policy, because it means that only a subset of the population living in states with Pre-K programs have access to. To our knowledge, no prior research looking at the effect of Pre-K on labor market decisions has taken into account the income eligibility limits of each state's program. Further, much of the prior literature investigating this question was conducted prior to the introduction of Pre-K programs in many states. Thus our analysis can also be seen as an update to prior studies.

Overall, we find that the existence of free Pre-K programs increases the labor force participation rate of mothers with one child age 3 or 4 by 2.3 percentage points, on average. In particular, we find that mothers with the following demographic characteristics significantly increase their labor supply in response to free Pre-K: married, college educated, residents of metropolitan areas, and those with income either below 200 percent or above 400 percent of the Federal Poverty Level (FPL). Our results are robust across a series of placebo tests.

References

Baker, M., Gruber, J., and Milligan, K. (2008). Universal child care, maternal labor supply, and family well-being. *Journal of political Economy*, 116(4):709–745. Publisher: The University of Chicago Press.

Bertrand, M., Goldin, C., and Katz, L. F. (2010). Dynamics of the gender gap for young professionals in the financial and corporate sectors. *American economic journal: applied economics*, 2(3):228–55.

Blau, D. and Tekin, E. (2007). The determinants and consequences of child care subsidies for single mothers in the USA. *Journal of Population Economics*, 20(4):719–741. Publisher: Springer.

Blau, F. D. and Kahn, L. M. (2007). Changes in the labor supply behavior of married women: 1980–2000. *Journal of Labor economics*, 25(3):393–438. Publisher: The University of Chicago Press.

Cannon, J. S., Jacknowitz, A., and Painter, G. (2006). Is full better than half? Examining the longitudinal effects of full-day kindergarten attendance. *Journal of Policy Analysis and Management: The Journal of the Association for Public Policy Analysis and Management*, 25(2):299–321. Publisher: Wiley Online Library.

Cascio, E. U. (2009). Maternal labor supply and the introduction of kindergartens into American public schools. *Journal of Human resources*, 44(1):140–170. Publisher: University of Wisconsin Press.

Federal Reserve Bank of Atlanta (2021). Harmonized variable and longitudinally matched current population survey. Accessed May 9, 2021 https://cps.kansascityfed.org/cps.

Fernández, R. (2013). Cultural change as learning: The evolution of female labor force participation over a century. *American Economic Review*, 103(1):472–500.

Fitzpatrick, M. D. (2010). Preschoolers enrolled and mothers at work? The effects of universal prekindergarten. *Journal of Labor Economics*, 28(1):51–85. Publisher: The University of Chicago Press.

Fitzpatrick, M. D. (2012). Revising our thinking about the relationship between maternal labor supply and preschool. *Journal of Human Resources*, 47(3):583–612. Publisher: University of Wisconsin Press.

Gelbach, J. B. (2002). Public schooling for young children and maternal labor supply. *American Economic Review*, 92(1):307–322.

Granger, R. C. and Cytron, R. (1999). Teenage parent programs: A synthesis of the long-term effects of the new chance demonstration, Ohio's learning, earning, and parenting program, and the teenage parent demonstration. *Evaluation Review*, 23(2):107–145. Publisher: Sage Publications Sage CA: Thousand Oaks, CA.

Havnes, T. and Mogstad, M. (2011). Money for nothing? Universal child care and maternal employment. *Journal of Public Economics*, 95(11-12):1455–1465. Publisher: Elsevier.

Heim, B. T. (2007). The incredible shrinking elasticities married female labor supply, 1978–2002. *Journal of Human resources*, 42(4):881–918. Publisher: University of Wisconsin Press.

Hipple, S. F. (2016). Labor force participation: what has happened since the peak. *Monthly Lab. Rev.*, 139:1.

Kleven, H., Landais, C., and Søgaard, J. E. (2019). Children and gender inequality: Evidence from Denmark. *American Economic Journal: Applied Economics*, 11(4):181–209.

Lefebvre, P. and Merrigan, P. (2005). Low-fee ($5/day/child) regulated childcare policy and the labor supply of mothers with young children: A natural experiment from Canada. *CIRPÉE Research Paper*, (05-08).

Malik, R. (2018). The effects of universal preschool in Washington, DC: Children's learning and mothers' earnings. *Washington, DC: Center for American Progress. Accessed June*, 25:2019.

Meyers, M. K., Heintze, T., and Wolf, D. A. (2002). Child care subsidies and the employment of welfare recipients. *Demography*, 39(1):165–179. Publisher: Springer.

Morrissey, T. W. (2017). Child care and parent labor force participation: a review of the research literature. *Review of Economics of the Household*, 15(1):1–24.

OECD (2017). *The Pursuit of Gender Equality-An Uphill Battle*. OECD publishing.

Russo, A. (2017). A head start for the whole family: Assessing the labor supply response of mothers of Head Start participants. *Senior thesis, Yale University, New Haven, CT*.

Sabol, T. J. and Chase-Lansdale, P. L. (2015). The influence of low-income children's participation in Head Start on their parents' education and employment. *Journal of Policy Analysis and Management*, 34(1):136–161. Publisher: Wiley Online Library.

Sall, S. P. (2014). Maternal Labor Supply and the Availability of Public Pre-K: Evidence from the Introduction of Prekindergarten into American Public Schools. *Economic Inquiry*, 52(1):17–34. Publisher: Wiley Online Library.

Schlosser, A. (2005). Public preschool and the labor supply of Arab mothers: Evidence from a natural experiment. *Manuscript, The Hebrew University of Jerusalem*.

Waldfogel, J. (1997). The effect of children on women's wages. *American sociological review*, pages 209–217. Publisher: JSTOR.

Appendix A - Separating Programs for 3- and 4-year-olds

In our baseline estimations of Equation 1, we do not distinguish between programs for three- and four-year-olds and instead pool both age groups together. However, potentially, there might be a difference in the maternal labor force participation responses to these programs. For example, the longer the mother is out of the labor force, the less likely she is to come back to the labor force. To explore this potential difference further, we run regressions separately for three-year-olds and for four-year-olds. In the first case we look at families who live in states with programs for three-year-olds, but whose children are not yet age-eligible for four-year-old programs. In the second case, we look at states without the Pre-K program for three-year-olds. Results are provided in Table A1.

We observe a strong overall effect of eligibility to Pre-K programs for three-year-olds on maternal labor force participation. Pre-K programs for three-year-olds increase LFP of married mothers, mothers with college education, those who live in metropolitan areas, and those with high income. We observe an effect of free Pre-K on mothers with four-year-olds among those that are college educated and mothers with low- and high- income. Overall, these results are consistent with the results of the baseline specification. However, limited sample size puts constraints on our ability to make statistical inferences for these samples.

Table A1: Estimated Effects of the Access to Free Pre-K on the Maternal LFP. Separating Programs for 3- and 4-year-olds.

Demographic Group	**Comparing 2- and 3- year olds**		**Comparing 3- and 4- year olds**	
	Sample Size	**Coefficient on Pre-K (Standard Error)**	**Sample Size**	**Coefficient on Pre-K (Standard Error)**
All	18,578	0.036***	15,748	0.010
		(0.017)		(0.015)
Not Married	4,231	-0.022	3,868	-0.004
		(0.035)		(0.028)
Married	14,347	0.057***	11,880	0.013
		(0.021)		(0.018)
Education Level: Less than College	9,320	0.011	8,232	-0.013
		(0.019)		(0.020)
Education Level: College +	9,258	0.049***	7,516	0.037**
		(0.021)		(0.020)
White, non-Hispanic	12,626	0.032	10,494	0.018
		(0.023)		(0.018)
Black, non-Hispanic	1,576	-0.026	1,444	-0.098
		(0.051)		(0.078)
Other, non-Hispanic	1,965	0.099	1,662	0.023
		(0.062)		(0.041)
Hispanic	2,411	0.048	2,148	0.037
		(0.030)		(0.048)
Residence: Metropolitan	15,251	0.039**	12,914	0.016
		(0.018)		(0.018)
Residence: Nonmetropolitan	3,202	0.013	2,711	-0.0006
		(0.058)		(0.032)
Income: <200% FPL	4,023	0.022	3,697	0.075**
		(0.035)		(0.032)
Income: b/w 200% and 400% FPL	6,251	0.040	5,247	-0.050
		(0.034)		(0.042)
Income: >400% FPL	8,304	0.044*	6,804	0.015
		(0.022)		(0.021)

Note: *,**,*** indicate statistical significance at 10%, 5%, and 1% respectively

Standard errors are clustered at the state level

Appendix B - Controlling for Effects of Income

One potential concern with our results is the potential interaction between family's income and their decision to send children to pre-K. Richer and poorer families might respond differently to their child aging regardless of whether pre-K is available. One way to account for it is to run the baseline regression 1 only on households with incomes below some threshold. We select 150 percent of the FPL as a threshold because it ensures that nearly all the sample would be eligible in all states with Pre-K. Results are reported in Table B1.

Sample restrictions greatly decreases the number of observations and hinders our ability to get precise estimates. However, consistent with the baseline results we fin the significant positive effect of pre-K availability on the labor force participation of married mothers and those who live in metropolitan area.

The second way to account for the potential interaction between family's income and their decision to send children to pre-K, without losing most of the sample, is to include interaction term between age of the child and income into the regression. We rerun the baseline regression 1 by including this interaction term. Table B2 presents the results.

Overall effect of the access to Pre-K on the maternal labor force participation is positive and significant and similar in magnitude to the baseline results reported in Table 4. Effect is significant in a similar set of demographic groups: married mothers, mothers with college degree, those who live in metropolitan area, and those with low and high family income.

Table B1: Estimated Effects of Access to Free Pre-K on Maternal LFP. Families with Income Below 150% of FPL

Demographic Group	**Sample Size**	**Coefficient on Pre-K (Standard Error)**
All	3,138	0.041
		(0.032)
Not Married	1,715	0.005
		(0.053)
Married	1,423	0.082*
		(0.042)
Education Level: Less than College	2,676	0.019
		(0.031)
Education Level: College +	462	0.143
		(0.101)
White, non-Hispanic	1,581	-0.012
		(0.058)
Black, non-Hispanic	458	0.016
		(0.065)
Other, non-Hispanic	252	-0.02
		(0.124)
Hispanic	847	0.144
		(0.042)
Residence: Metropolitan	2,428	0.082*
		(0.043)
Residence: Nonmetropolitan	673	-0.069
		(0.059)

Note: *,**,*** indicate statistical significance at 10%, 5%, and 1% respectively

Standard errors are clustered at the state level

Table B2: Estimated Effects of Access to Free Pre-K on Maternal LFP. Including the Interaction Term b/w Age of Children and Income

Demographic Group	**Sample Size**	**Coefficient on Pre-K (Standard Error)**
All	21,496	0.023*
		(0.013)
Not Married	4,648	0.0003
		(0.022)
Married	16,848	0.029*
		(0.016)
Education Level: Less than College	10,769	0.006
		(0.016)
Education Level: College +	10,727	0.038*
		(0.019)
White, non-Hispanic	14,408	0.026
		(0.016)
Black, non-Hispanic	1,938	-0.061
		(0.057)
Other, non-Hispanic	2,278	0.057
		(0.042)
Hispanic	2,872	0.026
		(0.030)
Residence: Metropolitan	17,642	0.026*
		(0.015)
Residence: Nonmetropolitan	3,690	0.018
		(0.028)
Income: <200% FPL	5,471	0.049**
		(0.022)
Income: b/w 200% and 400% FPL	7,565	-0.022
		(0.024)
Income: >400% FPL	8,460	0.043*
		(0.020)

Note: *,**,*** indicate statistical significance at 10%, 5%, and 1% respectively

Standard errors are clustered at the state level