Short and Long Run Maternal Labor Supply Responses to Publicly Provided Schooling for Children *

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Abstract

Over the past 70 years, female labor force participation has surged, yet gender disparities in employment persist, partly due to the disproportionate childrearing responsibilities women face. Publicly funded childcare may alleviate these constraints, influencing mothers' labor supply and long-term human capital investments. This study examines how access to public early childhood education in the U.S. impacts mothers' labor supply decisions in the short and long term. Using a Regression Discontinuity design based on children's kindergarten eligibility cutoffs, we analyze administrative data on maternal employment from the early 2000s to 2014. Results show a modest employment increase of 0.23 percentage points for mothers with early kindergarten access, lasting two years before diminishing. Effects are strongest for highly educated mothers and those with no younger children. Additionally, employment responses are greater in regions with traditional gender norms and longer school days, highlighting the importance of program design in shaping outcomes.

Keywords: Maternal labor supply, human capital investments, public provision of childcare

JEL Codes: H75, I28, J13, J16, J22

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1 Introduction

Parenthood is related to large and long-term reductions in women's employment and earnings. A large literature documenting this "child penalty" demonstrates that the transition to motherhood is typified by permanently altered employment trajectories for women, with drops in participation, hours, and wages that never fully recover (Kleven, Landais and Leite-Mariante, 2024; Kleven et al., 2019). At the same time, the transition to fatherhood often does not disrupt men's labor supply trajectories. In the United States, a large fraction of this gap can be attributed to differences in extensive margin participation (Kleven, 2023). Exploiting adoptions, Andresen and Nix (2022) show that gender gaps are not due to comparative advantages or biological differences between mothers and fathers, but are likely due to differences in preferences, gender norms, or gender-based discrimination. These gendered patterns can explain initial differences in labor market behavior of men and women after transitioning to parenthood, but given mothers' broad, underlying interest in work,[1] these initial patterns must interact with alternate explanations to yield persistent child penalties.

One plausible explanation is the amount of time spent out of the labor market to focus on childcare and family needs. This could lead to weaker labor market attachment at both the extensive and intensive margins. Many point to returns to experience (Mincer and Polachek, 1974; Polachek, 1981) and compensating differentials related to job flexibility/hours (Flabbi and Moro, 2012; Goldin, 2014) to explain the persistence of gender gaps. But more time spent out of the labor market could also contribute to persistent, dynamic effects if human capital depreciates (Anderson et al., 2002), if it changes preferences, or if there are adjustment costs associated with shifting from home production to market work. At the heart of these explanations is the recognition that because of prevailing gender norms, mothers often experience time and resource constraints related to child rearing that affect their ability to dedicate time to the labor force in a way than fathers do not. Because of the salience of

[1] In a 2007, Pew Research Center study, 70 percent of mothers with children under 18 said that either working part-time or full-time would be ideal for them (Taylor et al., 2007).

the tradeoffs between child investments and career investments, mothers with young children may be particularly responsive to policies that reduce immediate and long-term tension between work and family and facilitate labor market re-entry. Policies, such as publicly subsidized childcare, that speed up labor market re-entry might ameliorate the effects of labor market absence.

In this paper, we exploit kindergarten eligibility cutoffs to understand how gaining access to publicly subsidized early childhood education affects mothers' labor market experience (and other forms of human capital investment) in both the short- and long-run. Publicly provided education provides a form of subsidized childcare, which can relax maternal time constraints and facilitate re-entry. In this setting we can document the short- and long-run consequences of gaining access to subsidized childcare one year earlier, allowing us to better understand the role of time out of the labor market on gender gaps and child penalties.

We estimate these relationships by linking several US Census Bureau surveys and administrative datasets. From the Census Household Composition Key (CHCK) we link nearly all children born in the US since 1996 to their mothers. Combined with the Numident and Master Address File, we identify mothers with children born in close proximity to their state-specific kindergarten cutoff date. We then use Personal Identification Keys (PIKs) to link these women to administrative earnings from the Longitudinal Employer-Household Dynamics (LEHD) between 2000 and 2014, resulting in a multi-year employment panel for nearly 7.5 million mothers. We use this novel dataset in a regression discontinuity design to compare employment trajectories for mothers whose children gain access to kindergarten one year earlier relative to mothers whose children barely miss the kindergarten cutoff deadline. By also linking to the American Community Survey (ACS), we document the first stage effect of eligibility on school attendance and explore other potential human capital investment responses among mothers, such as going back to school.

Our results show that barely gaining access to kindergarten changes the counterfactual care setting of children. Children born just before their state's cutoff are 41 percentage

points more likely to be enrolled in kindergarten and 10.5 percentage points more likely to be enrolled in any schooling relative to children born just after a cutoff. In the LEHD, we find that access to kindergarten one year earlier increases annual maternal employment by 0.23 percentage points. If we scale these reduced form estimates by the first stage impact on any school enrollment (10.5 percent) we find that having a child attend school one year earlier increases annual maternal employment by 2.2 percentage points. Despite the fact that counterfactual children, born just after the cutoff, gain access to school the next year, we find that annual employment rates remain significantly elevated for two years after the relevant kindergarten deadline (second grade for the eligible children) before fading out. Even though untreated mothers received the same benefit one year later, the increased ability to enter the labor market one year earlier has effects that persist beyond the kindergarten year. This suggests that factors with downstream impacts beyond immediate time constraints are relevant for mothers' labor supply participation. We estimate a similar pattern of effects on the inverse hyperbolic sine of earnings, but observe no significant effect on earnings, suggesting that in this context the labor market effects of having a child attend school one year earlier operate through the extensive margin. We do not see evidence of running variable manipulation or discontinuous changes in demographics at the threshold, consistent with the regression discontinuity's causal assumptions.

We next explore heterogeneity to document the set of mothers and situations where access to earlier childcare matters. Using a linked LEHD sample for multiple cohorts of children, we explore dimensions of heterogeneity that previous work using similar methods could not.[2] We examine heterogeneity by household characteristics as well as variation related to both policy generosity and local social norms to shed light on why subsidized childcare increases labor force attachment (at least for several years) and how time out of the labor force affects labor force participation in the long run.

[2]For example, (Fitzpatrick, 2012) uses the 2000 full count census to explore the contemporaneous effect of kindergarten access on maternal employment. Her aggregate samples include fewer than 340,000 mothers, or less than five percent of our sample.

Mothers with different characteristics or family settings might face additional constraints or prefer to stay home. We find that employment effects are concentrated among mothers whose youngest children enter kindergarten, which is consistent with a central finding in related papers on maternal labor supply (Cascio, 2009; Fitzpatrick, 2012; Gelbach, 2002). Perhaps surprisingly, mothers in more advantaged households are the most responsive to kindergarten eligibility. Effect sizes increase with maternal education and point estimates are larger if a child's father is present. The social context also seems to matter. Employment effect point estimates are considerably larger when children gain access to kindergarten in states with more stereotypical gender norms, as captured by the General Social Survey (Kleven, 2023), suggesting that local norms and expectations interact with family policies.

The data clearly show that policy structure and generosity are important factors relating to mothers' labor supply responses, and mothers' employment is most responsive in places where children have access to full-day kindergarten. This finding is consistent with emerging research suggesting that program structure and program hours likely shape mothers' responses to having access to early childhood education for their children (Dhuey et al., 2021; Gibbs et al., 2024; Wikle and Wilson, 2023).

Employment effects for mothers of youngest children and children in full-day kindergarten access states also show stronger patterns of persistence into the future, with suggestive evidence that effects persist past two years in states providing full-day kindergarten access. For both mothers of youngest children and mothers in full-day kindergarten access states, employment effects begin to appear before the kindergarten year. This is likely because women in these settings make care arrangements earlier, or have access to public education earlier in a way that relaxes time constraints and facilitates earlier labor market re-entry. These patterns are consistent with notions that time out of the labor market has persistent effects on maternal labor force attachment that last for at least several years. We note that persistence of employment responses is limited, and we find no evidence that gaining access to public school one year earlier has long-lasting impacts on labor market attachment.

Kindergarten access also has no effect on employment or earnings of fathers. As such, earlier provision of public schooling leads to small, but only transitory, decreases in child penalties in the United States.

Importantly, the temporary persistence is not driven by changes in mothers' human capital. Using the ACS, we do not observe contemporaneous or longer-term changes in maternal human capital investments after children gain access to kindergarten. Mothers on average are not more likely to return to school or obtain more education. Kindergarten access also does not change family settings in ways that could facilitate more labor market attachment. There is no change in the probability of marriage or divorce or the number of children they have.

Using the Current Population Survey, we provide additional, descriptive insight into why relaxing childcare constraints earlier does not lead to persistent changes in labor market attachment or close gender gaps. For new parents, childcare responsibilities lead to significant gender gaps in labor market attachment. Mothers with infants and toddlers are much more likely to not be looking for work, absent from work, or working part time because of childcare constraints. As parents' youngest children age into school these gaps close. However, the presence of other family obligations (not including childcare) continues to drive a wedge in labor market attachment between mothers and fathers. These patterns are consistent with initial allocations of household management between mothers and fathers when mothers reduced labor supply at childbirth persisting even after children are school eligible.

Our paper contributes to several strands of literature. Most directly, this study expands a growing literature which explores the impact of publicly provided universal early childhood education on maternal labor supply in the United States during the kindergarten year (Cascio, 2009; Fitzpatrick, 2012; Gelbach, 2002; Gibbs et al., 2024) or at slightly younger ages (Cascio and Schanzenbach, 2013; Fitzpatrick, 2010; Humphries et al., 2024). This literature primarily focuses on labor supply responses in the short run, finding mixed evidence.

Extant literature has primarily focused on contemporaneous employment outcomes and

has not evaluated adjustments and returns to career investments over time. The body of research focused on short-run responses to publicly provided early childhood education does not engage with the fact that it may take time for women to adjust employment trajectories and human capital accumulation. Labor supply effects of childcare access might accrue over time if it takes time to reenter the labor market or if mothers put off education and other human capital investments when a child is born (Kuka and Shenhav, 2024). We suspect that data constraints explain the dearth of research on long-run impacts of early childhood education for mothers. Recent research is beginning to move in the direction of exploring long-run implications for mothers with children in early childhood education. A new study evaluating universal preschool in New Haven, Connecticut finds that providing families with early childhood education has persistent positive impacts for maternal labor supply (Humphries et al., 2024). There are also recent studies that evaluate the long-run impacts of universal childcare subsidies, which are closely related to universal ECE. Two studies using data from the United States find increased labor supply attachment in the long-run (Erceg, 2023; Herbst, 2017).

Our research is also related to a literature studying labor supply impacts of targeted means-tested early childhood education programs (Sabol and Chase-Lansdale, 2015; Wikle and Wilson, 2023). While the underlying research goals of these papers are similar to our study, our universal kindergarten context differs from these studies in key areas. For one, these past studies evaluate children who are younger and in a pre-school context compared to our evaluation of a kindergarten context. These studies leverage provision of early childhood education among a targeted population that experiences particular labor market access and outcomes, leaving open questions about how other families might respond. Finally, our longitudinal study has large enough samples to support an evaluation of the persistence of labor-supply impacts of access to early childhood education on different groups of mothers, which provides added insights into mechanisms that may be driving responses.

Our research adds context to the evaluation of child penalties, especially in the United

States. As Kleven, Landais and Leite-Mariante (2024) show, child birth leads to a persistent decline in female labor force participation and earnings, in a way that does not affect men. These child penalties vary across the United States and are positively correlated with stereotypical gender norms (Kleven, 2023). We find that gaining access to public school earlier induces small, transitory changes in maternal employment with no effect on paternal employment. This would suggest that public schooling leads to slightly smaller child penalties for a short period of time, but consistent with Kleven, Landais, Posch, Steinhauer and Zweimuller (2024), this subsidized childcare does not affect long-run child penalties in a meaningful way. However, this paper does highlight the role of time out of the labor market when considering gender differences that persist in labor force attachment after child birth.

The paper proceeds as follows. Section 2 discusses motivations for studying this research question and situates this research in a broader related literature. Section 3 details the data sources used in the study and how they were linked for our applications. Section 4 documents our empirical strategy. In Section 5, we summarize the results of the impacts of early childhood education on maternal labor supply, and in Section 6 we discuss implications and conclude.

2 Motivation

Over the past 70 years, as the labor market has become more accessible to women and as mothers have simultaneously shifted toward more intentional parenting paradigms (Bianchi et al., 2006; Sani and Treas, 2016), more mothers and potential mothers face binding constraints when facing joint decisions about work and family. For these reasons, a persistent child penalty continues to be the primary driver of broader gender gaps in employment outcomes (Kleven, Landais and Leite-Mariante, 2024). In the context of the trade offs between work and family faced by mothers with young children, policies that reduce immediate and long-term tension between work and family may be helpful for families. Publicly provided early education programs for children may relax mothers' time and monetary constraints.

These policies may facilitate changes in the way mothers immediately allocate time and resources, suggesting short-run consequences for families. Additionally, these policies may also have indirect longer-term consequences for families if providing access to early childhood education supports mothers' career trajectories.

Short-run time out of the labor market to care for children can lead to long-term labor market differences, even if mothers want to eventually return to work. Mothers may experience non-linear decay in skills over time, suggesting the length of time a mother remains out of the labor market may impact her return to reentering the labor market. Alternatively, mothers' time out of the labor market might lead families to build routines and allocate home production to mothers in a way that are costly to adjust if she were to re-enter the labor market. For example, if stay-at-home mothers disproportionately take on responsibilities for child transportation, school interactions (Buzard et al., 2024), and home production, the family might face large adjustment costs (in both time and money) if the mothers returns to work. It could also be that time out of the labor market leads people to change or update their preferences towards work. Consider the simple, conceptual model of a mother's decision to renter the labor market at time t. Mothers' get benefits from work which are a function of wages $w(e_t, o_t)$ and from other features γ_t, potentially including non-pecuniary benefits of work. Wages are a function of experience (e_t) and time out of the labor market (o_t). However, working is costly, and these costs are potentially driven by time out of the labor market (o_t), childcare costs associated with work (λ_t), and tastes towards work and time use (ϕ_t). A mother will decide to work if

$$U(w(e_t, o_t), \gamma_t) \geq c(o_t, \lambda_t, \phi_t) \tag{1}$$

Time out of the labor market might directly affect both the cost and benefit side of this decision, and also indirectly affect the costs of work by changing preferences. Subsidizing childcare costs (λ_t) by gaining access to public early childhood education increase the benefits of work, relative to costs, but the marginal benefit depends on time out of the labor market.

So all else equal, mothers may be more likely to reenter the labor market if their time out of the labor market is shorter. Once a mother reenters the labor market, time out of the labor market becomes immaterial, leading to persistent changes in labor market attachments beyond the initial year of early childhood education access. We aim to test these hypotheses by exploiting a one-year difference in access to public kindergarten, which relies on birthdate cutoffs to determine eligibility.

To date there is growing body of evidence that demonstrates the impact of early childhood education not just for children, but for parents as well. Research to date includes short-run evaluations of early childhood education and maternal labor supply, contributing to more understanding about how the early childhood education landscape in the United States contributes to mothers' employment (see review by Morrissey (2017)). The evidence coming from these studies is mixed, due to differences in policy settings, cultural contexts, time periods, and sample compositions. Our study most closely compares with Fitzpatrick (2012). Like us, her study uses a regression discontinuity strategy in the kindergarten year but focuses on an earlier time period by using the 1980 and 2000 Censuses. Her study, as well as other studies based in a universal kindergarten or preschool settings find labor supply responses among single mothers whose youngest child is entering early childhood education (Cascio, 2009; Cascio and Schanzenbach, 2013; Fitzpatrick, 2010, 2012; Gelbach, 2002), and responses among other mothers are less consistent. In general, this literature demonstrates that maternal labor supply elasticities are getting smaller over time, suggesting marginal mothers have changed as more and more mothers have entered the labor market over the past few decades. Even with this body of research, open questions remain about which mothers are most responsive and why, questions that our study provides insight into.

Much less is known about the long-run implications of early childhood education for mothers. One study evaluates long-run implications of returns to universal pre-kindergarten in New Haven, Connecticut (Humphries et al., 2024). Using an admissions lottery, this paper finds that access to early childhood education elevates employment hours and earnings of

mothers, with persistence for at least six years after pre-kindergarten. Their sample is composed of a low-income majority-minority school district with children who are younger than children in our study. Our paper complements this work as we evaluate the United States as a whole during the kindergarten year in a quasi-experimental setting. Relatedly, research on the long-run implications of providing families with childcare subsidies point toward persistence in labor supply beyond the initial treatment (Erceg, 2023; Herbst, 2017).

Program structure in terms of how many hours of early childhood education are offered to children is a form of program generosity that varies within the universal kindergarten context of the United States. The primary motivation for expanding classroom hours in kindergarten remains focused on children's development. Even so, program hours may also be relevant for parents (Dhuey et al., 2021; Gibbs et al., 2024; Humphries et al., 2024; Wikle and Wilson, 2023). Half-day programming is less conducive to employment for parents, because it often involves mid-day transportation and arranging additional care, and it might not provide enough time to be sustainably employed (Gibbs et al., 2024). We might expect then that program hours shape mothers' responses to having access to early childhood education for their children.

Even as policy support for women's employment has increased over the past several decades, traditional gender norms and cultural beliefs about a mother's role in children's development remain strong. Conceptually, cultural norms may transmit information or social expectations. If women get utility from aligning with cultural norms or if cultural norms transmit information about family's long-term well being, women's employment may seem lower than what would be expected when simply considering pecuniary aspects of labor supply (Cavapozzi et al., 2021). Women living in areas with stronger gender attitudes typically work less than mothers living in areas with more egalitarian attitudes (Cavapozzi et al., 2021; Ruppanner et al., 2021) and face larger child penalties (Kleven, 2023). Research on the interplay of childcare policy and gender attitudes suggests that maternal employment is sensitive to childcare costs only in areas with strong gender norms, whereas in more egali-

tarian areas, the costs of childcare is less salient to their employment decisions (Ruppanner et al., 2021). Taken together, these studies suggest that giving families an implicit childcare subsidy by providing early childhood education is likely to correlate with the largest family-level responses in areas with strong gender norms.

Labor supply responses to early childhood education access often differ based on micro-level demographic and characteristics of mothers. Conceptually we might expect more advantaged mothers to have the highest labor supply elasticities for several reasons. For one, baseline employment levels differ, implying that marginal mothers are at different parts of the employment distribution. Advantaged mothers have more resources to draw on as they balance work and family, which may mean that employment is less critical for family financial stability. These mothers may also differ in their approach to parenting (Kalil et al., 2012). A higher elasticity among advantaged mothers would suggests that married mothers and mothers with higher levels of education would be most responsive to changes in the implicit cost of childcare. Beyond family demographics, mothers' constraints related to the need to care for children may also be salient. Empirically, maternal labor supply effects have been substantially larger in families where there are no younger children in the home (Cascio, 2009; Fitzpatrick, 2012). To summarize, the literature on early childhood education and childcare subsidies indicates that maternal labor supply is responsive in the short- and long-run, and those responses are influenced by micro-level, cultural, and policy contexts facing families.

The study complements and extends existing literature in key ways. First, this study is supported by a large and recent sample, making it the most comprehensive evaluation of long-run maternal labor supply responses to public early childhood education access that we know of. Second, the novel data links and large sample facilitate an important analysis of subgroups that informs past research on mechanisms driving labor supply responses. This is crucial to understand, considering that the nature of maternal responses in labor markets is a relevant factor in policy conversations about the full extent of the social impacts of

providing children with early childhood education.

3 Data

Our analysis takes advantage of data links between several large data sources. Estimating the long-run and heterogeneous effects of school access on maternal labor supply required the use of children's exact date of birth, information on kindergarten age-eligibility rules for families, parent to child linkages, and maternal labor force information over time. The only U.S.-based datasets that include all of these elements are small surveys, such as the Panel Study of Income Dynamics (PSID) or the National Longitudinal Survey of Youth (NLSY). These surveys only contain thousands of usable observations. Using linked, administrative Census Bureau and Social Security Administration (SSA) data as well as a compliation of school age-eligibility rules, we construct a dataset that allows us to follow millions of mothers as their children age into elementary school and beyond. We outline each component of this linked data.

3.1 Census Household Composition Key (CHCK)

The Census Household Composition Key (CHCK) is a restricted-use Census Bureau data product that links parents to children. Using the SSA Numident, which records exact birth date, and census records, the CHCK is a crosswalk between child Personal Identification Keys (PIKs) and mother and father PIKs (Genadek et al., 2021). PIKs are scrambled unique identifiers, that are consistent across a subset of Census surveys and data sources.[3] The CHCK was first constructed in 2016, and captures births going back to 1997 (Genadek et al., 2021). Each year the process is repeated to capture all new births, and any additional parent-child linkages that could not be made before. We start with the 2016 CHCK, and add any additional children who were not linked from the 2017-2019 CHCK. Children are

[3]Although the PIK is meant to be unique, it is probabilistically assigned so there are a few cases where the PIK is not unique. In these cases we keep the first observation.

linked independently to their mothers and fathers. As such, we observe more mother-child linkages than father-child linkages.

The CHCK is linked to the SSA numident, allowing us to observe each child's exact date of birth. We use the Numident date of birth to identify each child's birthdate relative to the kindergarten cutoff in the approppriate state. From this, we construct our main analysis samples: children that are born within 90 days of their corresponding state kindergarten cutoff date and mothers of children born within 90 days of their appropriate state cutoff date.

3.2 Master Address File

Although the CHCK contains parent-child linkages and child exact date of birth, it does not contain geographic information. A child's state of residence is needed to determine when they were born relative to the applicable state kindergarten eligibility cutoff. The Master Address File (MAF) uses address information to link individuals to addresses (ResearchDataGov, 2022). To conduct the Decennial Census and census surveys, such as the American Community Survey (ACS) the U.S. Census Bureau maintains a database of residential addresses in the United States using U.S. Postal Service change of address databases and Demographic Area Address Listing Files (Uhl, 2011).

Using the MAF, we identify the state a child lives in in the year they turn 5. This allows us to calculate the child's date of birth relative to the applicable kindergarten eligiblity cutoff. For example, the kindergarten eligiblity cutoff in California is Sept. 1st. If we identify a child born on Sept. 15th and living in California when they turn age five, we record them as being 14 days from the applicable kindergarten cutoff. We also use the MAF to identify if a child is living at the same residence as their mother and their father.

3.3 LEHD

We link the analysis sample from the CHCK to the Linked Employer-Household Dynamics (LEHD) employer file. The LEHD is a panel of firm-employee level-quarterly earnings constructed from state unemployment insurance earning records. The LEHD also contains individual PIKs, allowing us to collapse to the worker-level and observe total annual earnings for each individual and link this worker employment panel to our CHCK analysis sample. We were granted access to data from 19 states across the country. We used the 2014 LEHD extract, meaning we can follow workers from the year the state started sharing data with the Census Bureau (typically the early 2000s) through the first quarter of 2015.

Using the LEHD we construct three main measures. First, we construct total earnings during the school year. Because we are interested in the effects of kindergarten eligiblity, we measure maternal employment to correspond to the school calendar as close as possible. We construct annual earnings from the third quarter of the calendar year to the second quarter of the following calendar year. This allows us to observe employment from July to June. In most states, kindergarten starts in either August or September and continues through May or June. Second, we construct a binary measure that equals one if the individual had any positive earnings during the school year.[4] Final, we take an inverse hyperbolic sine transformation of annual earnings, to facilitate a percent change interpretation, but still include zeros.

3.4 American Community Survey (ACS)

Although the LEHD provides a detailed panel of employment, it does not allow us to observe other decisions or investment behaviors of mothers. To capture potential changes in these behavior we use the American Community Survey (ACS). THe ACS is a random sampling survey of nearly 1 million households conducted each year by the U.S. Census Bureau. We use the ACS between 2001 and 2019. The ACS replaces the long form of the Decennial

[4]Results are similar if we impose an earnings threshold above zero.

Census and asks participants a range of questions about employment, earnings, education, fertility, and family formation. The ACS is also PIK'ed allowing us to link individuals in our analysis sample to ACS observations. Because the ACS is a survey sample, we do not observe a panel, but we are able to capture outcomes for a random subset of individuals at different points in time relative to the kindergarten event.

We focus on four types of outcomes for mothers in the ACS. First, we construct analogous employment and earnings measures as used in the LEHD analysis. Second, we construct an indicator that equals one if the student is currently enrolled in school as well as a set of educational attainment dummies that indicate if the individual has reached a specific level of educational attainment (e.g., high school graduate, college graduate, advanced degree). Third, we examine the number of own children the individual has in their household. This allows us to estimate if kindergarten eligiblity affects fertility behavior. Finally, we construct an indicator that equals one if the mother is married, to estimate if the kindergarten cutoff affects family formation and marriage.

We also use the ACS to examine the first stage relationship between the kindergarten eligiblity cutoff and school enrollment. First, we link children in the ACS to the CHCK analysis sample. We then use the school enrollment measures to see if the child is enrolled in school, and what level of school they are enrolled in. This measure will allow us to determine the fraction families whose school enrollment decision is affected by the state mandated kindergarten enrollment cutoff. We show results for enrollment in kindergarten, but to better understand the counterfacutal care setting we are more interested in enrollment in any school. This measure will allow us to capture the share of children who shift from non-school childcare to kindergarten schooling.

3.5 Kindergarten Cutoff Dates Data

We link these administrative data to a database of state-level kindergarten age-eligibility policies to identify treatment status. School age eligibility cutoffs are determined at the

state level. Some states further relinquish this determination to the local education authority (school district). As such, there is a patchwork of public preschool and kindergarten eligibility deadlines that vary across states but also over time within states. Agencies, like the National Center for Education Statistics, provide publicly available information on school eligibility cutoff deadlines for kindergarten in each state for a point in time. Using these snapshots as a starting point, we examine each state's education code to determine the kindergarten eligibility birthdate deadline for each state in each year from 1999 to 2020. We use these school-eligibility cutoff deadlines to determine when a focal child was eligible to begin public school. During this time period 8 states deferred to local education authorities to determine the kindergarten eligiblity cutoff.[5] Between 1999 and 2020, there are kindergarten cutoffs ranging from June 1 to January 1, with September 1st the most common cutoff date, followed by September 30, August 1, and August 31. These four dates account for approximately two thirds of the state-year birthdate cutoffs.

3.6 Linked Analysis Samples

We combine these data sets to constructed our linked analysis samples. First, we link individuals using PIKs from the CHCK to the Numident. Using a child's birthday recorded in the Numident, we identify children's birthdate relative to the school age-eligibility cutoff in their state in the year that they turn 5.[6] We limit the sample to children born within 90 days of the relevant state cutoff and use the PIK to identify these children in the ACS to observe their school-related outcomes around the kindergarten cutoff. This yields our sample of approximately 279,000 focal children, observed between 2001 and 2019.

Next, we use the CHCK parent-child linkages to identify the mothers of focal children. Using PIKs we link focal mothers to their observations in the ACS and the LEHD. Using the employment history in the LEHD we examine the effect of gaining kindergarten eligibility

[5]This includes Colorado, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Vermont, and Washington for part of the sample from 1999 to 2004.

[6]For children born in the first quarter of the year, we make this comparison in the previous year, as this is the relevant kindergarten year.

on mothers' employment and earnings over time. Using the ACS we measure education and family structure, in addition to employment outcomes. The kindergarten year ACS sample includes approximately 246,000 mothers.[7] The ACS is an annual survey that goes out to approximately one percent of households each year, as such, many mother-child relationship recorded in the CHCK do not link to the ACS, because they were never interviewed. The LEHD is constructed from administrative records, rather than survey samples, which means that unlike the ACS, in the LEHD we have the universe of employment records for 19 states, so we are able to link significantly more mothers to their employment histories. The kindergarten year LEHD sample of mothers includes approximately 7,496,000 mothers who had children born within 90 days of the relevant state kindergarten cutoff. This large sample allows us to estimate effects with more precision and explore dimensions of heterogeneity with more statistical precision than has been used previously. We then follow this focal sample of mothers forward and backward in time to determine how access to early childhood schooling due to age-eligibility affects short-, medium-, and long-run employment outcomes for mothers.

4 Empirical Approach

In each state kindergarten eligibility is determined by rigid age-eligibility cutoffs.[8] For example, to be eligible for kindergarten in many states, a child must have turned five years old before September 1st. As such, a mother that has a child that turns 5 on August 31st and a mother that has a child that turns 5 on September 2nd might appear to have similar life circumstances but face very different childcare and education options during the next year. Since eligibility dates vary across states and over time, parents cannot perfectly manipulate their child's date of birth relative to the school eligibility cutoff. Families who fall on one

[7]The ACS sample of children and mothers are not the same because we restrict the ACS sample of mothers to mothers currently residing with the child. About 12 percent of the ACS sample children are not living with their mother, but with only their father or another relative.

[8]In 8 states cutoffs are determined by the local education authority, but there are still age-eligibility cutoffs.

side of the cutoff are likely to be similar to those that fall just on the other side of the cutoff, except that one group will experience the associated benefit of increased childcare and education options.

We estimate the effects of public early education access on outcomes by comparing outcomes for mothers with a child just old enough for the school cutoff deadline relative to mothers with children who just missed the school cutoff deadline using a regression discontinuity design. This strategy has been used previously to examine the impact of public preschool and kindergarten access on concurrent maternal employment (Fitzpatrick, 2010, 2012). Building on previous work, we are able to follow mothers over time to explore time dynamics, explore patterns of heterogeneity that previous work was unable to examine, and evaluate human capital investments and other decisions –in addition to employment– that could be adjusting simultaneously.

4.1 Kindergarten Cutoff Date and Kindergarten Enrollment

We first show that the kindergarten eligibility cutoff does in fact change a child's school setting. In Figure 1 we show the first stage effect of meeting the kindergarten eligibility cutoff on the probability of being enrolled in kindergarten (top panel) and on the probability of being enrolled in any school (bottom panel). We plot the share of children in school in ten day bins.[9] As seen in the top panel, being born just before the kindergarten eligibility cutoff date increases the probability of being in kindergarten by 41.4 percentage points. This is a large and statistically significant increase. In the bottom panel we see that begin born just before the applicable kindergarten eligibility cutoff date increases the probability of being enrolled in any school by a similarly precise, but much smaller 10.5 percentage points. This helps inform us about the counterfactual care setting for children during this time period. Although the kindergarten cutoff does shift many children in to kindergarten at the margin, about three quarters of these complier children would have been in an alternative

[9]The last bin includes 11 days as it includes birthdays that are 80 to 90 (inclusive) days after the kindergarten cutoff.

schooling arrangement, such as pre-school. Because the kindergarten cutoff shifts children from both school and non-school care setting, we will use the any school attendance estimates to interpret the magnitude of the maternal labor supply effects as this better captures the families that experienced a shift in parental care demands.

4.2 Maternal Labor Supply Specification

To understand how a child gaining access to kindergarten affects a mother's labor supply we estimate the following reduced form regression

$$Y_i = \beta_0 + \beta_1 BornBefore_i + \beta_2(Birthdate - Cutoff)_i + \beta_3(Birthdate - Cutoff)_i * BornBefore_i + X_i'\Gamma + \varepsilon_i \quad (2)$$

The primary outcomes of interest mother-level annual employment and earnings, obtained from the LEHD. This is estimated on the LEHD focal mother sample. We explore additional outcomes to explore mechanisms in the ACS focal mother sample. $BornBefore_i$ is a binary variable that equals one if the child was born before the relevant kindergarten eligibility cutoff in their state of residence. The variable $(Birthdate - Cutoff)_i$ is a continuous variable that measures the number of days between the child's birth and the kindergarten eligibility cutoff. The matrix X_i represents individual and household controls, and geographic fixed effects (e.g., state or commuting zone). The model includes standard errors clustered at the state-by-days relative to the cutoff level. Throughout, we restrict the sample to children and mothers of children born within 90 days of the school eligibility cutoff, giving a three month bandwidth. However, as seen in Table 4, our estimates are robust to reducing the bandwidth to one month on each side of the cutoff. For consistency we also estimate the first stage effects on child-level school attendance, corresponding to Figure 1.

The coefficient of interest is β_1, which captures the effect of gaining eligibility to attend kindergarten on maternal labor supply. Unfortunately, the child-level outcomes used to

estimate the first stage are only available in the ACS sample. As such, we are unable to estimate the second stage relationship between child school attendance and maternal labor supply in the LEHD focal mothers sample. Instead, we estimate the first stage and reduced form relationships separately, and evaluate the corresponding Wald estimator, analogous to a two-sample, two-stage least squares.

We use this specification to estimate both contemporaneous and long-term effects. We estimate effects for years, relative to the focal kindergarten eligibility year, separately to understand the dynamic effects of gaining access to school one year earlier. We also estimate effects for subgroups to understand which mothers are affects and if there are particular settings that influence mother's responsiveness to gaining access.

4.3 Evaluating the Identifying Assumption

With this regression discontinuity design, our key identifying assumption is that the expected potential outcomes are smooth through the kindergarten eligibility cutoff. This will be the case if children born just before and just after the applicable kindergarten eligibility date have the same potential outcomes on average. In other words, if timing of birth relative to the cutoff is as good as random. We test the implications of this assumption in two ways.

First, we show that the distribution of births evolves smoothly through the cutoff and does not spike before or around the applicable eligibility date. It would be problematic if parents precisely manipulated the timing of their children's births to change their children's access to kindergarten. Then unobservable characteristics might differ across the threshold leading to differences in potential outcomes. This is a concern other research exploiting birth timing regression discontinuities in federal tax credits around the new year have raised, largely showing that birth timing is not sensitive to incentives around January first (Barr et al., 2022; LaLumia et al., 2015). Unlike federal tax credits, the kindergarten eligibility cutoff varies from state to state, with 12 separate dates in the 2020-2021 school year. Cutoff dates within states have also changed over time. For example, in California the kindergarten

cutoff date prior to 2012 was December 2nd. It then changed to November 1st in 2012, October 1st in 2013, and September 1st in 2014. Given interstate migration, and the fact that parent would have to predict the applicable kindergarten eligibility cutoff five years in advance, the ability to precisely manipulate is even less likely. As seen in Figure 2, we do not see evidence of birth date manipulation in our data. In both the ACS focal child sample and the LEHD focal mother sample we see that the density of birthdates is mostly smooth through the cutoff.

Average observable characteristics are similar on either side of the cutoff. If there was strategic manipulation in ways that were correlated with our outcomes of interest, we might expect there to be differences in average observable characteristics on either side of the eligibility cutoff. Using specification (2), we estimate how crossing the kindergarten eligibility threshold affects average observable baseline characteristics of mothers in the LEHD focal mother sample. In Figure 3 we plot the β_1 coefficient when the outcome is the mother's race/ethnicity, immigration status, educational attainment, presence of father, and age at birth of the child. We find that all of the estimates are small in magnitude. Out of the 14 characteristics, only one (being Non-Hispanic White) is statistically significant at the five percent level. Overall, we find little evidence of sorting across the cutoff, consistent with our identifying assumption.

5 Results

5.1 Contemporaneous Maternal Employment Effects

We estimate the effect of gaining access to kindergarten on maternal employment in Figure 4 and Table 1. Mothers with children born before the cutoff have higher levels of employment relative to those past the cutoff. At the cutoff, we observe a 0.23 percentage point increase in the probability of being employed during the child's kindergarten year if they became eligible and attended. As seen in Table 1 this increase is statistically significant. This increase is

small in aggregate, but as noted above, the kindergarten eligibility cutoff only shifted 10.5 percent of kindergarten-aged children into school from alternative care arrangements. This would suggest that having a child enroll in school increases annual maternal employment by 2.2 percentage points. We see no significant change in earnings at the threshold, but when we examine the inverse hyperbolic sine of earnings we observe a marginally significant 1.7 percent increase in earnings. As there is no level change in earnings, this is likely driven by changes in employment at the extensive margin. These estimates are similar in magnitude to the IV scaled estimates from Fitzpatrick (2012), exploring the effect of kindergarten enrollment on maternal labor supply in the 2000 decennial census, but because of our sample size we are able to statistically detect differences around the cutoff.

As in Fitzpatrick (2012), we also explore heterogeneity by maternal characteristics. Once again, because of our sample size we are able to explore potential differences across groups but maintain statistical precision. We re-estimate equation (2), but restrict the sample based on the mother's race/ethnicity, education, the presence of the father (to capture single parents), the presence of younger children, whether or not the state mandates districts to offer full-day kindergarten, and whether the state has relatively more conservative or liberal gender norms. The treatment effect coefficients are plotted in Figure 5. Gaining access to kindergarten significantly increases annual employment for Non-Hispanic White mothers by 0.32 percentage points. The effects for Non-Hispanic Black, Hispanic, and Non-Hispanic Other mothers are smaller and not statistically different from zero. However, they are also not statistically distinguishable from the effects for Non-Hispanic White mothers.

The effect of gaining kindergarten access is increasing in maternal education. The point estimate is small and negative for mothers with less than high school, 0.2 percentage points for high school educated mothers, 0.21 and statistically significant at the ten percent level for mothers with some college, but no degree, and 0.48 percentage points and significant for college educated mothers. This is more than twice as large as the aggregate estimate, and based on the first stage effect on school attendance would suggest that having a child enroll

in kindergarten increases maternal employment by about five percentage points.

The kindergarten year employment effect is larger for mothers who reside with the father than for single mothers, but the point estimates are not statistically different. Whether or not the mother has additional younger children beyond the focal child yields the largest difference in causal treatment effects. Mothers without younger children increase their annual labor supply by 0.54 percentage points when their youngest gains access to kindergarten, while we see no effect for mothers with younger children. This effect is statistically significant for these groups.

We next explore heterogeneity by variation in the generosity of childcare being provided through kindergarten. Many states offer half day programming. However, as this only provides between 2 and 3 hours of childcare a day, it likely has to be paired with additional childcare to facilitate work. As Gibbs et al. (2024) show, the secular shift to full-day kindergarten in the US has led to increases in maternal labor supply. We separate LEHD mothers of focal children into states that mandate school districts to offer full-day kindergarten and states that do not mandate full-day offerings to capture variation in the length of childcare time associated with kindergarten. We find the largest treatment effect across all groups for mothers in states that mandate full-day kindergarten offerings. Gaining access to kindergarten with full-day options increases maternal annual labor supply by 0.72 percentage points. If we scale by the first stage estimate this would suggest that labor supply increased by as much as 7 percent when children enroll in full-day kindergarten.[10] Meanwhile the effect in states without full-day kindergarten is small and insignificant.

Another potentially interesting dimension of heterogeneity is variation in prevailing gender norms. Andresen and Nix (2022) find that the child penalty is driven by differences in preferences, gender norms, or discrimination. As Kleven (2023) shows, the child penalty in employment and earnings experienced by women after child birth is larger in states with more conservative gender norms. As such, it seems plausible that gaining access to sub-

[10]In the ACS we cannot differentiate between full-day or part-day kindergarten, so we cannot estimate the first stage relationship of the cutoff on enrolling in full-day kindergarten.

sidized childcare through kindergarten eligibility might affect mothers differently in states with different gender norms. The direction of this relationship is theoretically ambiguous. If more women in states with more conservative gender norms are inherently less attached to the labor market, we might see no effect of gaining access to additional childcare. Alternatively, if women in states with more liberal gender norms are already in the labor force, the additional access to subsidized childcare might be inframarginal. Although we cannot statistically distinguish the effects in states with stronger and weaker gender norms, the effect is four times larger in strong gender norm states than in weak gender norm states. This would suggest that gaining access to early childhood education translates into more maternal labor supply when the prevailing norms discourage mothers from working. If public school is viewed as a socially acceptable setting to place children into, subsidizing other care settings such as childcare may not elicit the same response.

5.2 Maternal Employment Effects Over Time

We next explore whether or not access to kindergarten has a persistent effect on maternal labor force attachment. If the depreciation of human capital is non-linear, the ability to enter the labor market one year earlier might have effects that last beyond the first year. Using the linked LEHD mothers, we are able to explore how barely gaining access to kindergarten affects maternal labor force attachment relative to mothers that had to wait an additional year.

To do this we re-estimate equation (2), but replace the outcome with annual employment from different years relative to the applicable kindergarten cutoff year. We plot estimates from two years prior to the kindergarten year (when the child is approaching their third birthday) to 4 years after the kindergarten year, when children born before the cutoff would be entering fourth grade. These coefficients are plotted in Figure 6, with 90- and 95-percent confidence intervals.

Prior to the kindergarten year we see small, insignificant differences in annual employ-

ment between mothers with children who will eventually be eligible for kindergarten relative to mothers with children who will barely miss the cutoff and only be eligible the next year. Consistent with estimates in Figure 4 and Table 1, we see a statistically significant increase in the rate of employment among mothers who gain access to kindergarten in the kindergarten year, and despite the one-year nature of treatment, we estimate a similarly large and statistically significant effect one year later. The effect persists through the second grade year, although it declines and is only statistically significant at the ten percent level. After the second grade year the estimate returns to zero, suggesting no permanent differences in labor force attachment associated with gaining access to kindergarten one year earlier.

5.3 Heterogeneous Maternal Employment Effects Over Time

Based on the heterogeneity patterns observed in Figure 5, we re-estimate our employment effects over time for various demographic groups. In particular, we focus on differences by the age of the youngest child, the availability of full-day kindergarten, and the strength of state gender norms to better understand the mechanisms driving the persistence of effects.

In Figure 7 we plot the RD effect of gaining kindergarten access on maternal employment surrounding the kindergarten event separately for mothers whose focal child is the youngest and for mothers who have younger children. Among mothers with younger children we see no changes in employment surrounding the kindergarten eligibility event. Consistent with Fitzpatrick (2012), gaining access to subsidized childcare for one child does not significantly affect maternal labor supply if there are additional young children in the home. However, among mothers with out younger children we observe large, significant, and persistent differences in labor force attachment. Having a child born prior to the kindergarten eligibility threshold increases annual employment during the year children born before the cutoff date would be in kindergarten, first grade, and second grade. The point estimates decline gradually, and are still relatively large in the third and fourth grade year, but they are no longer statistically significant. Interestingly, the effect in the year before kindergarten is also large

and statistically significant. There are two possible mechanisms. First, eligibility dates for preschool programs often align with local kindergarten eligibility dates. As such, mothers whose child was eligible for kindergarten was also likely eligible to enter preschool in the prior year. These programs are typically less time-intensive than kindergarten, which can help explain the smaller effect in the preschool year than in later years. Second, mothers might preemptively adjust labor supply and other care settings prior to their youngest child's kindergarten eligibility.

We explore the role of program hours generosity further in Figure 8. Over time the share of children enrolled in full-day kindergarten has increased, and this has led to an increase in maternal labor supply (Gibbs et al., 2024). Access to full-day schooling might relax more time constraints and provide mothers with more flexibility to work than a part day program. Some states mandate that school districts provide a full-day kindergarten option to their students. In Figure 8 we estimate effects over time for mothers in states that required districts to offer full-day kindergarten in the relevant kindergarten year and for mothers in other states. We estimate smaller, marginally significant increases in annual employment associated with kindergarten access in states that do not require full-day access during the kindergarten and first grade years, but by second grade these effect are no longer statistically distinguishable and eventually fade out. However, among mothers in states that do mandate full-day kindergarten access, gaining access to kindergarten is associated with large, persistent gains in annual employment, significant in all years through the fourth grade year except for the third grade year. However, as observed among mothers without younger children, estimated effects prior to the kindergarten year are large and marginally significant. States that support full-day kindergarten also likely have more robust preschool programs, which could help to explain these preemptive effects.

Finally, given prior work documenting differences in the child penalty by local gender norms, we separately estimate the effects over time of earlier kindergarten eligibility in

states with more progressive or more conservative gender norms.[11] Gaining kindergarten access has a small, statistically insignificant effect on annual employment of mothers in states with gender progressive norms. However, in states with conservative gender norms there is a large, statistically significant increase in mother's annual employment associated with earlier kindergarten access in the kindergarten and first grade year.

5.4 Effects on Maternal Human Capital Investments and Fathers

Research on mothers' responses to early childhood education access for their children has focused on employment, when in reality labor supply decisions, human capital investment decisions, and fertility and childrearing decisions are jointly made through a process of intrahousehold bargaining. This points to the potential for additional indirect channels to emerge. Table 3 confirms that these indirect channels are not mediating long-run labor supply responses as it demonstrates that children's access to early childhood education does not alter mothers' education, mothers' marital status and family structure, or mothers' fertility decisions.

Unlike mothers, we see no immediate or persistent effects for fathers (Figure 10). This is consistent with other work finding that maternal labor supply is sensitive to the provision of kindergarten while paternal labor supply is not (Gibbs et al., 2024). We also find that the contemporaneous estimated effects on employment and earnings for mother are robust to using a 30 day bandwidth on either side of the cutoff rather than a 90 day bandwidth (see Table 4).

6 The Role of Childcare vs. Other Family Obligations

If the accumulation of time spent out of the labor market does affect employment decisions, we might expect to see more persistent effects. However, we find very little evidence that

[11] We use the state gender norm measures constructed by Kleven (2023) using the General Social Survey (GSS), and split states at the median by gender norm progressivity.

gaining access to childcare one year earlier has long-run effects on maternal labor force attachment. Using the monthly Current Population Survey (CPS) we provide descriptive evidence of why this might be. The monthly CPS asks respondent detailed questions about work arrangements and non-work, including asking why workers were absent from work, were not working full time, or were not looking for work (even if they want to be working). Using these measures, we document the relative importance of childcare as an employment friction for mothers and fathers. Across three dimensions (absent from work last week, worked part time last week, not looking for work in the previous three weeks despite wanting to be employed) we plot the fraction of mothers and fathers who report that childcare is the reason for reduced labor market engagement *by the age of their youngest child* in Figure 11. We also plot the fraction of parents who report other family obligations as the main reason. Family obligations do not include problems with childcare. Across all three dimensions we see that concerns about childcare are relatively more important for mothers with infants and toddlers than for fathers with young children. However, as the youngest child ages into school years, the preventative role of childcare for mothers converges to that of fathers.

The same is not true for other family obligations. Across all three dimensions and at all child ages family obligations are cited more often than childcare concerns as a obstacle to increased labor market engagement. Mothers are more likely than fathers to report family obligations as the relevant obstacle to employment, and unlike childcare these gaps do not close as the child ages. Although the levels do fall some for mothers with young children, family obligations drive a persistent wedge between mothers and fathers in the likelihood that they are absent from work, work part time, or do not look for work, even when they want to be employed. These patterns are consistent with initial allocations of household management between mothers and fathers determined when children enter the home persisting even after children are school eligible. As families allocate household management tasks across parents, many of these assignments are sticky even when time constraints for mothers are relaxed by the provision of childcare. This is consistent with

recent work showing that mothers bear additional household management tasks beyond just watching children that affect labor supply behavior (Buzard et al., 2024). Although access to school one year earlier has contemporaneous effects, there are not persistent effects in part because these other household management duties remain among mothers.

7 Discussion

Our study of kindergarten access reveals that publicly provided early childhood education has a significant effect on short-run employment outcomes of mothers with a five-year-old child. During the kindergarten year, employment increases by 0.23 percentage points relative to similar mothers whose children are not eligible for kindergarten. Wages also increase by 11 percent. Importantly, we find evidence that employment responses persist beyond the kindergarten year, especially among mothers who have the strongest short-run responses. Persistence in labor market attachment is most pronounced in areas with full-day kindergarten mandates; mothers who get access to kindergarten one year later still have not caught up in their labor force participation five years later. It takes time for mothers who get access to kindergarten one year later to catch up in the labor market. This suggests that one additional year of work is impactful for mothers' employment trajectories and prompts questions about what channels of influence—such as returns to work experience or compensating differentials—are at play.

Our research highlights important areas of heterogeneity in the responses to access to kindergarten. Consistent with past research on early childhood education and maternal employment, we found no effects among mothers who had younger children at home and all effects loaded on mothers whose youngest child was kindergarten aged (Cascio, 2009; Cascio and Schanzenbach, 2013; Fitzpatrick, 2010, 2012; Gelbach, 2002). This suggests that caring for younger children remains an important motivator to not work, even as early childhood education is offered to older children. Responses were stronger among more educated mothers. The reasons for this may simply be that the opportunity cost of not working is higher for

more educated mothers, which may disproportionately pull them toward employment when children gain access to school. This pattern may also be the result of known education gradients in how mothers approach motherhood and investments in their children (Kalil et al., 2012).

Despite short-run responses, mothers do not experience permanent changes in career trajectories from an extra year of childcare. While providing child care improves the feasibility of employment contemporaneously, it does not seem to be a policy channel that disrupts the persistence of the child penalty. Mothers continue to face constraints related to family obligations that remain, even when childcare is provided, limiting the long-term efficacy of childcare policy in reducing child penalties.

This research sheds light on a broader question about the policy impact of universal early childhood education on the parents of children served by school access. Our findings suggest that providing early childhood education for children remains an important policy lever to support maternal employment. This is especially true in areas with more traditional gendered cultural beliefs and norms. Additionally, early childhood education program generosity in terms of the length of the school day elicits stronger employment responses that persist until at least fourth grade, a finding that aligns with an emerging literature (Cowan et al., 2023; Dhuey et al., 2021; Duchini and Van Effenterre, 2022; Graves, 2013; Wasserman, 2023; Wikle and Wilson, 2023). Children's care is a primary consideration for mothers, and mothers often sacrifice earnings growth and make fewer career investments when children need a flexible and available caregiver (Adams-Prassl, 2023; Goldin, 2014; Mas and Pallais, 2017). In this context, program length of day is salient to mothers as they evaluate employment feasibility. Understanding the implications of program structure on families is helpful for program designers so that going forward, early childhood education programs will have the largest social value when designed with the needs of children as well as parents in mind.

References

Adams-Prassl, A. (2023), 'The gender wage gap in an online labour market: The cost of interruptions', *Review of Economics and Statistics* .

Anderson, D. J., Binder, M. and Krause, K. (2002), 'The motherhood wage penalty: Which mothers pay it and why?', *American Economic Review* pp. 354–358.

Andresen, M. E. and Nix, E. (2022), 'What causes the child penalty? evidence from adopting and same-sex couples', *Journal of Labor Economics* . https://doi.org/10.1086/718565.

Barr, A., Eggleston, J. and Smith, A. A. (2022), 'Investing in infants: the lasting effects of cash transfers to new families', *Quarterly Journal of Economics* **137**, 2539–2583.

Bianchi, S. M., Robinson, J. P. and Milkie, M. A. (2006), *Changing rhythms of American family life*, Russell Sage Foundation, New York.

Buzard, K., Gee, L. and Stoddard, O. (2024), 'Who you gonna call? gender inequality in external demands for parental involvement', *SSRN Electronic Journal* .
URL: *https://ssrn.com/abstract=4456100*

Cascio, E. U. (2009), 'Maternal labor supply and the introduction of kindergartens into american public schools', *Journal of Human Resources* **44**(1), 140–170.

Cascio, E. U. and Schanzenbach, D. W. (2013), 'The impacts of expanding access to high-quality preschool education', *Brookings Papers on Economic Activity* **Fall 2013**, 127–178.

Cavapozzi, D., Francesconi, M. and Nicoletti, C. (2021), 'The impact of gender role norms on mothers' labor supply', *Journal of Economic Behavior and Organization* **186**, 113–134.

Cowan, B. W., Jones, T. R. and Swigert, J. M. (2023), 'Parental and student time use around the academic year', *NBER Working Paper* **Paper No. 31177**.

Dhuey, E., Lamontagne, J. and Zhang, T. (2021), 'Full-day kindergarten: Effects on maternal labor supply', *Education Finance and Policy* **16**(4), 533–557.

Duchini, E. and Van Effenterre, C. (2022), 'School schedule and the gender pay gap', *Journal of Human Resources* .

Erceg, A. (2023), 'The long-run effects of childcare subsidies on maternal labor market outcomes'.

Fitzpatrick, M. D. (2010), 'Preschoolers enrolled and mothers at work? the effects of universal prekindergarten', *Journal of Labor Economics* **28**(1), 51–85.

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

Flabbi, L. and Moro, A. (2012), 'The effect of job flexibility on female labor market outcomes: Estimates from a search and bargaining model', *Journal of Econometrics* **168**, 81–95.

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

Genadek, K. R., Sanders, J. and Stevenson, A. J. (2021), Measuring u.s. fertility using administrative data from the census bureau, Technical Report 2021-02, U. S. Census Bureau.

Gibbs, C. R., Wikle, J. and Wilson, R. (2024), A matter of time? measuring effects of public schooling expansions on families, Technical Report 24-987, Annenberg Institute for School Reform at Brown University, Providence, RI.

Goldin, C. (2014), 'A grand gender convergence: Its last chapter', *American Economic Review* **104**(4), 1091–1119.

Graves, J. (2013), 'School calendars, child care availability and maternal employment', *Journal of Urban Economics* **78**, 57–70.

Herbst, C. (2017), 'Universal child care, maternal employment, and children's long-run outcomes: Evidence from the us lanham act of 1940', *Journal of Labor Economics* **35**.

Humphries, J. E., Neilson, C., Ye, X. and Zimmerman, S. D. (2024), Parents' earnings and the returns to universal pre-kindergarten, Technical Report 33038, National Bureau of Economic Research, Cambridge, MA.

Kalil, A., Ryan, R. and Corey, M. (2012), 'Diverging destinies: Maternal education and the developmental gradient in time with children', *Demography* **49**, 1361–1383.

Kleven, H. (2023), 'The geography of child penalties and gender norms: A pseudo-event study approach', *NBER Working Paper* **Paper No. 30176**.

Kleven, H., Landais, C. and Leite-Mariante, G. (2024), 'The child penalty atlas', *Review of Economic Studies* . https://doi.org/10.1093/restud/rdae104.

Kleven, H., Landais, C., Posch, J., Steinhauer, A. and Zweimuller, J. (2024), 'Do family policies reduce gender inequality? evidence from 60 years of policy experimentation', *American Economic Journal: Economic Policy* **16**(2), 110–49.
URL: *https://www.aeaweb.org/articles?id=10.1257/pol.20210346*

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.
URL: *https://www.aeaweb.org/articles?id=10.1257/app.20180010*

Kuka, E. and Shenhav, N. (2024), 'Long-run effects of incentivizing work after childbirth', *American Economic Review* **114**, 1692–1722.

LaLumia, S., Sallee, J. M. and Turner, N. (2015), 'New evidence on taxes and the timing of birth', *American Economic Journal: Economic Policy* **7**, 258–293.

Mas, A. and Pallais, A. (2017), 'Valuing alternative work arrangements', *American Economic Review* **107**(12), 3722–3759.

Mincer, J. and Polachek, S. (1974), 'Family investments in human capital: Earnings of women', *Journal of Political Economy* **82**, S76–108.

Morrissey, T. W. (2017), 'Child care and parent labor force participation: a review of the research literature', *Review of Economics of the Household* **15**, 1–24.

Polachek, S. W. (1981), 'Occupational self-selection: A human capital approach to sex differences in occupational structure', *Review of Economics and Statistics* **63**, 60–69.

ResearchDataGov (2022), 'Boc master address file auxiliary reference file'. https://www.researchdatagov.org/product/720.

Ruppanner, L., Collins, C., Landivar, L. C. and Scarborough, W. J. (2021), 'How do gender norms and childcare costs affect maternal employment across us states', *Gender and Society* **35**, 910–939.

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**, 136–161.

Sani, G. M. D. and Treas, J. (2016), 'Educational gradients in parents' child-care time across countries, 1965–2012', *Journal of Marriage and Family* **78**, 1083–1096.

Taylor, P., Funk, C. and Clark, A. (2007), 'From 1997 to 2007: Fewer mothers prefer full-time work'.
URL: *http://pewresearch.org*

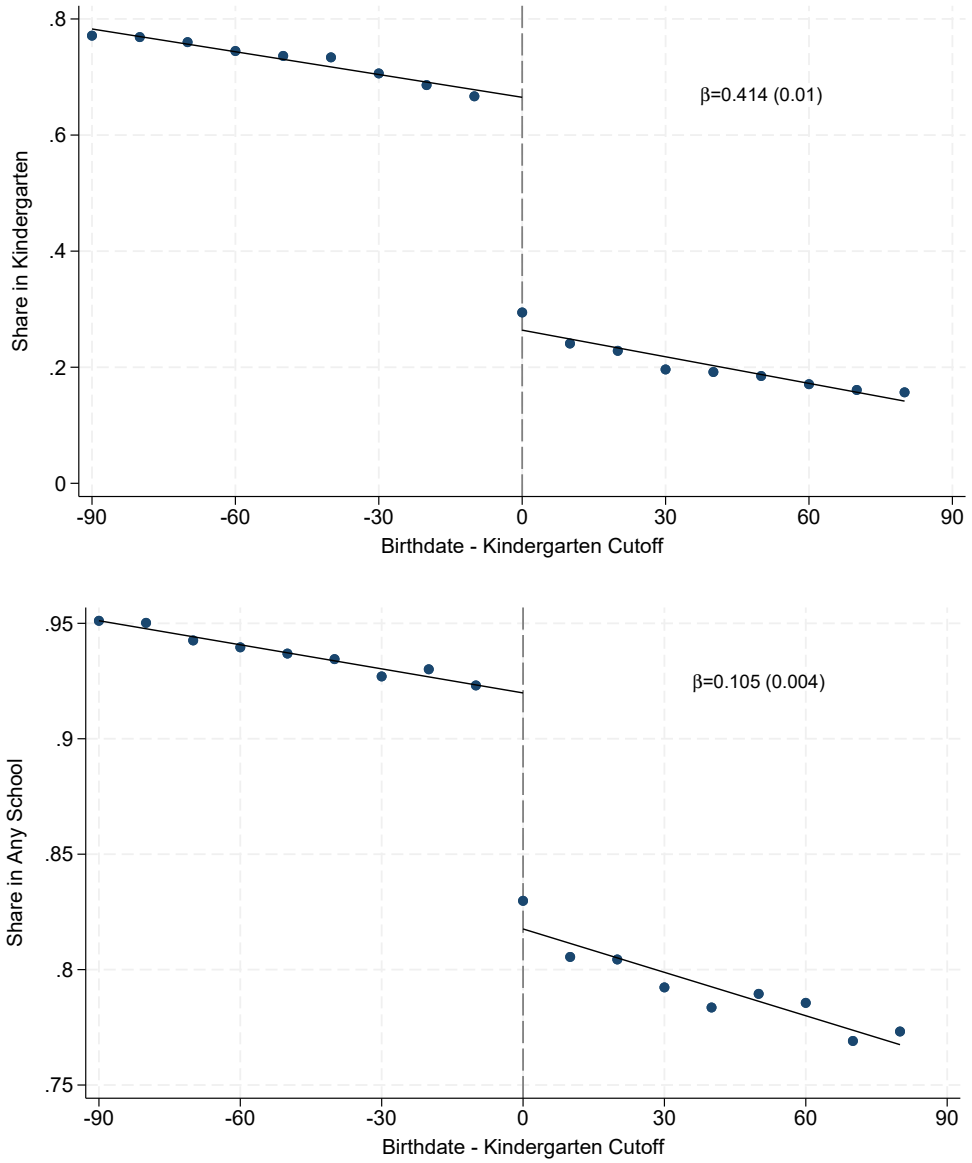
Uhl, S. (2011), Building and maintaining the master address file. https://www2.census.gov/geo/pdfs/education/Uhl_CAS_2011.pdf.

Wasserman, M. (2023), 'Hours constraints, occupational choice, and gender: Evidence from medical residents', *Review of Economic Studies* **90**, 1535–1568.

Wikle, J. and Wilson, R. (2023), 'Access to head start and maternal labor supply: Experimental and quasi-experimental evidence', *Journal of Labor Economics* **41**(4), 453–487. https://doi.org/10.1086/720980.

8 Tables and Figures

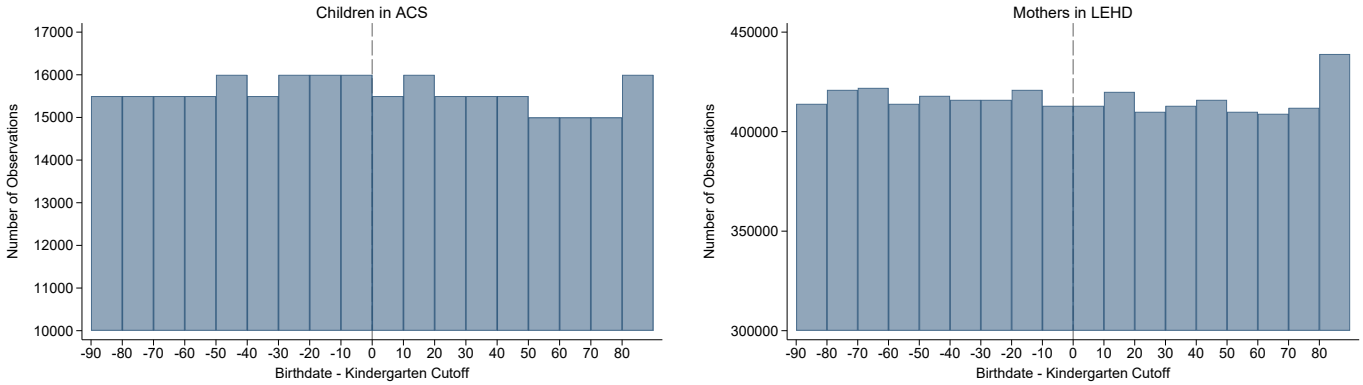
Figure 1: Effect of School Birth Date Eligibility Cutoff on Kindergarten Enrollment



NOTE: Sample restricted to children in the 2001-2019 ACS whose birthday was within 90 days of the state school eligibility cutoff. The average rate of enrollment in kindergarten is plotted in 10 day date-of-birth bins, except for the last bin which includes births 80–90 days after the applicable school eligibility cutoff.

SOURCE: Author's own calculations using the 2001–2019 ACS microdata, linked to the Numident for exact date of birth. Disclosure number CBDRB-FY24-P2706-R11598.

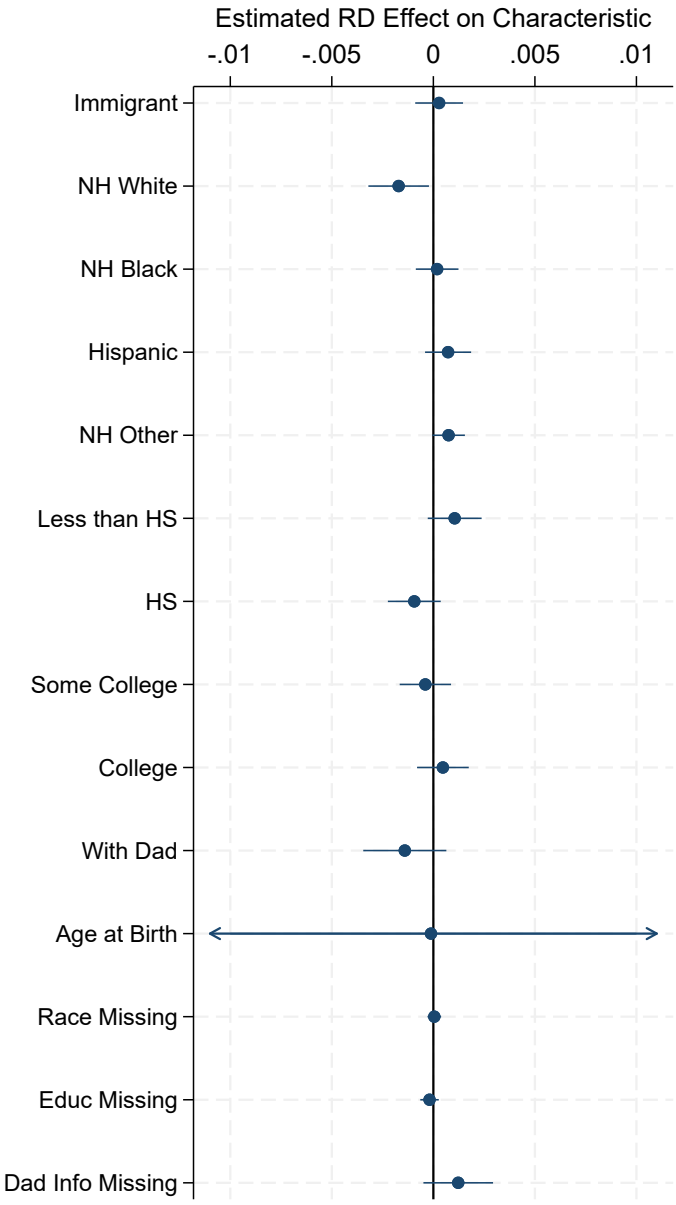
Figure 2: Distribution of Children and Mothers Around School Birth Date Eligibility Cutoff



NOTE: In the left panel sample restricted to children in the 2001-2019 ACS whose birthday was within 90 days of the state school eligibility cutoff. The number of children is plotted in 10 day date-of-birth bins, except for the last bin which includes births 80–90 days after the applicable school eligibility cutoff. In the right panel sample restricted to mothers in the 2014 LEHD who had a child whose birthday was within 90 days of the state school eligibility cutoff. The number of children is plotted in 10 day date-of-birth bins, except for the last bin which includes births 80–90 days after the applicable school eligibility cutoff.

SOURCE: Author's own calculations using 2001–2019 ACS microdata, and 2014 LEHD, linked to the Numident for exact date of birth. Disclosure number CBDRB-FY24-P2706-R11598.

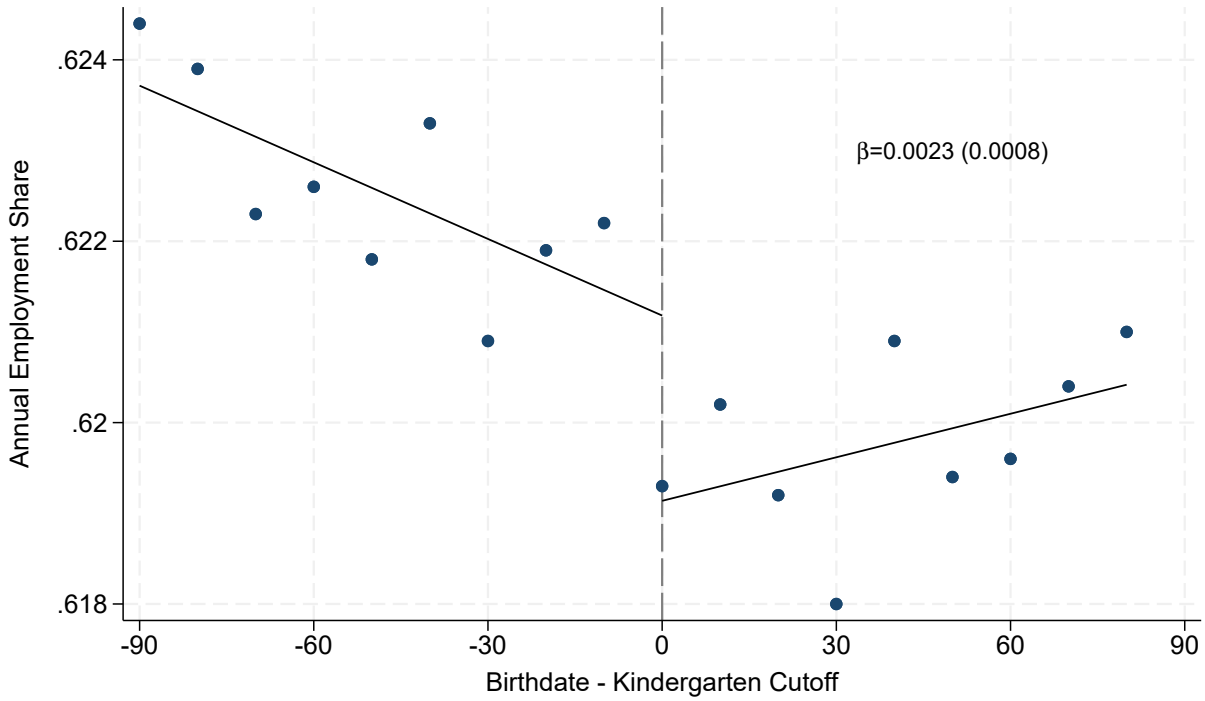
Figure 3: Estimated Effect of School Birth Date Eligibility Cutoff on Baseline Characteristics



NOTE: The sample is restricted to mothers in the 2014 LEHD who had a child whose birthday was within 90 days of the state school eligibility cutoff. Days between birthdate and kindergarten cutoff are controlled for linearly and allowed to vary on either side of the cutoff. Standard errors are clustered at the days relative to the cutoff level.

SOURCE: Author's own calculations using 2014 LEHD, linked to the Census Household Composition Key and Numident for focal child's exact date of birth. Disclosure number CBDRB-FY24-P2706-R11598.

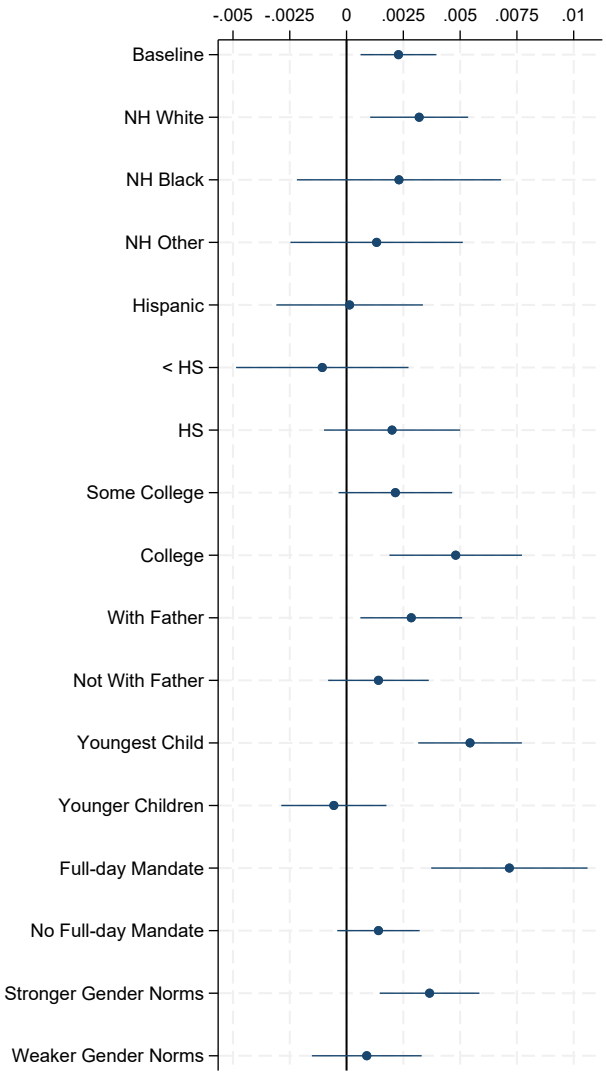
Figure 4: Effect of School Birth Date Eligibility Cutoff on Annual Employment of Mothers



NOTE: Sample restricted to mothers in the 2014 LEHD who had a child whose birthday was within 90 days of the state school eligibility cutoff. The number of children is plotted in 10 day date-of-birth bins, except for the last bin which includes births 80–90 days after the applicable school eligibility cutoff.

SOURCE: Author's own calculations using 2014 LEHD, linked to the Census Household Composition Key and Numident for focal child's exact date of birth. Disclosure number CBDRB-FY24-P2706-R11598.

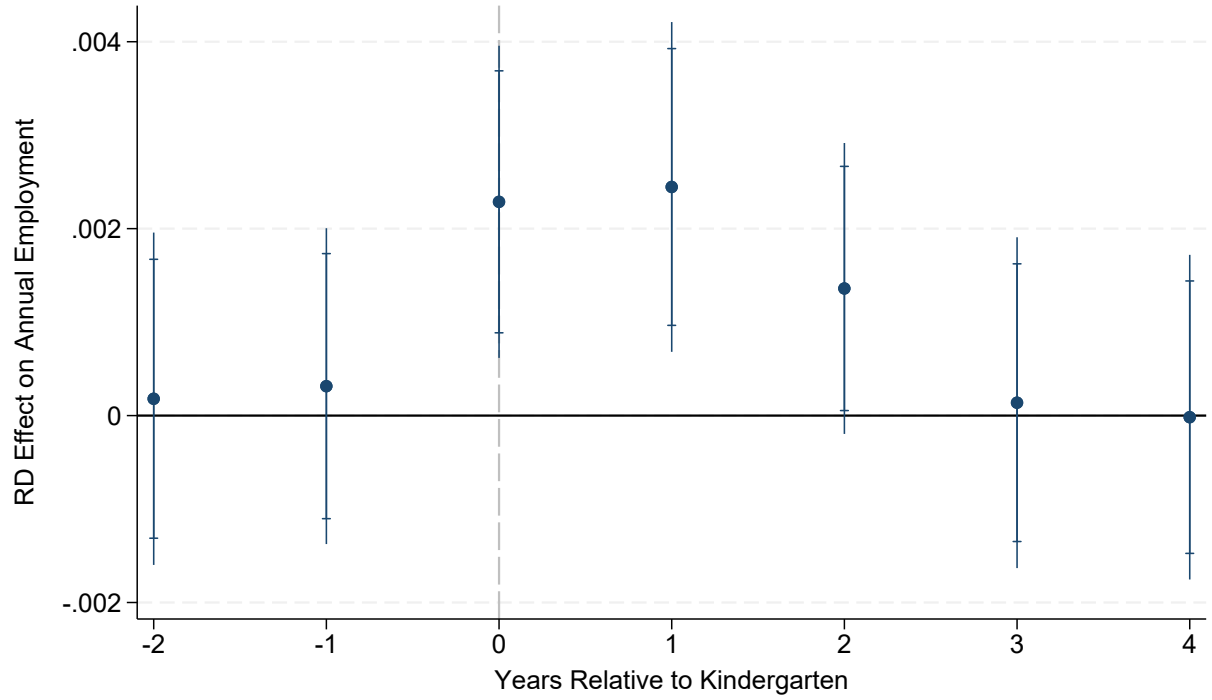
Figure 5: Heterogeneous Effects of School Birth Date Eligibility Cutoff on Annual Maternal Employment



NOTE: Sample restricted to mothers in the 2014 LEHD who had a child whose birthday was within 90 days of the state school eligibility cutoff. The effect is estimated separately for each year. Days between birthdate and kindergarten cutoff are controlled for linearly and allowed to vary on either side of the cutoff. Standard errors corrected for clusterin at the day from the cutoff level. 95-percent confidence intervals are included.

SOURCE: Author's own calculations using 2014 LEHD, linked to the Census Household Composition Key and Numident for focal child's exact date of birth. Disclosure number CBDRB-FY24-P2706-R11598.

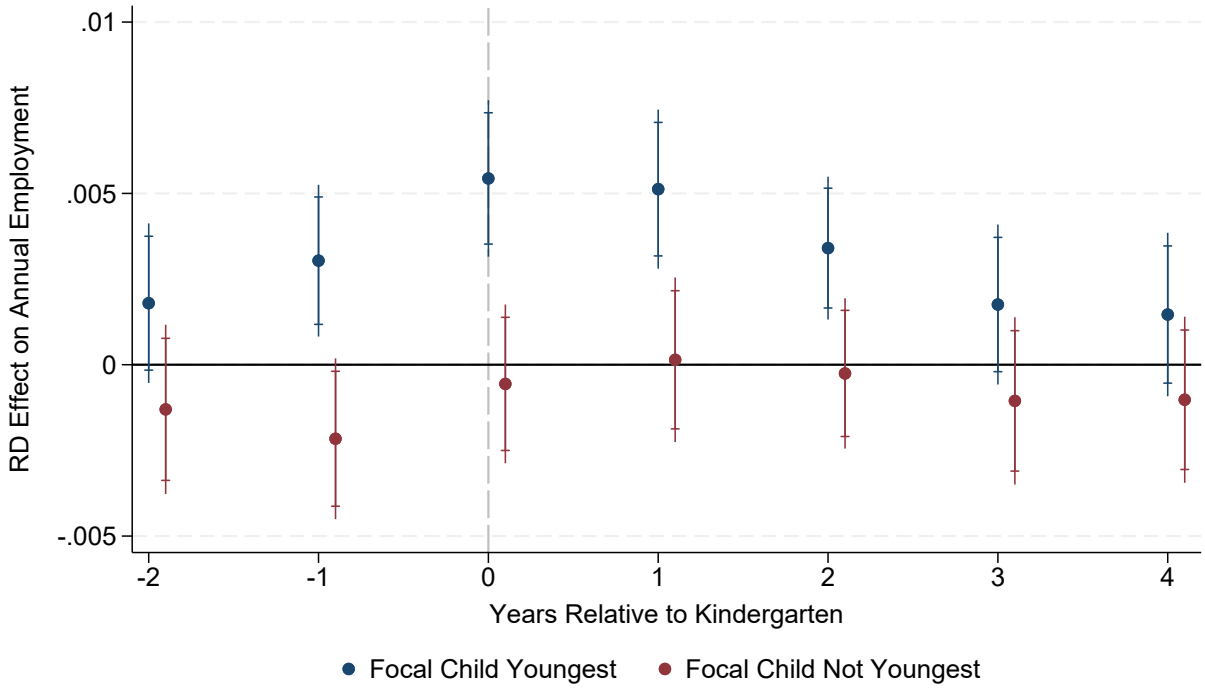
Figure 6: Effect of School Birth Date Eligibility Cutoff on Employment of Mothers Over Time



NOTE: Sample restricted to mothers in the 2014 LEHD who had a child whose birthday was within 90 days of the state school eligibility cutoff. These mothers are then followed each year from two years prior to the relevant kindergarten eligibility cutoff to four years after, when the eligible children would have entered fourth grade. The effect is estimated separately for each year. Days between birthdate and kindergarten cutoff are controlled for linearly and allowed to vary on either side of the cutoff.

SOURCE: Author's own calculations using 2014 LEHD, linked to the Census Household Composition Key and Numident for focal child's exact date of birth. Disclosure number CBDRB-FY24-P2706-R11598.

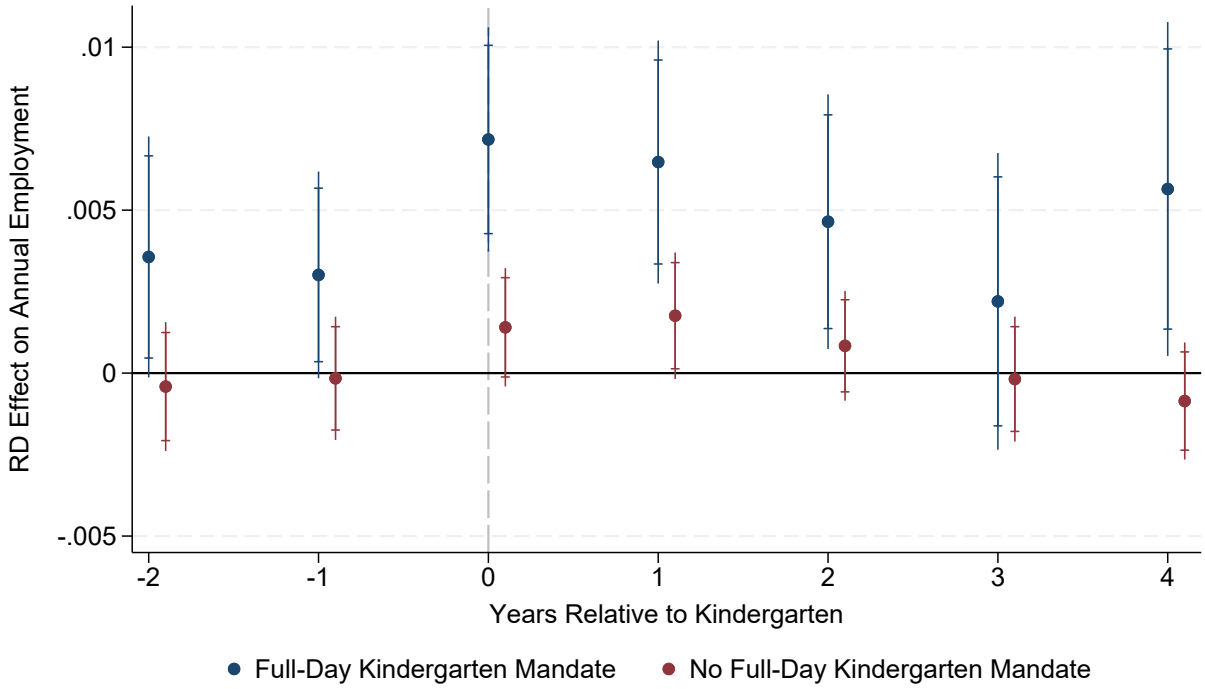
Figure 7: Heterogeneity by Presence of Younger Children: Effect of School Birth Date Eligibility Cutoff on Employment of Mothers Over Time



NOTE: Sample restricted to mothers in the 2014 LEHD who had a child whose birthday was within 90 days of the state school eligibility cutoff. These mothers are then followed each year from two years prior to the relevant kindergarten eligibility cutoff to four years after, when the eligible children would have entered fourth grade. The effect is estimated separately for each year. Days between birthdate and kindergarten cutoff are controlled for linearly and allowed to vary on either side of the cutoff.

SOURCE: Author's own calculations using 2014 LEHD, linked to the Census Household Composition Key and Numident for focal child's exact date of birth. Disclosure number CBDRB-FY24-P2706-R11598.

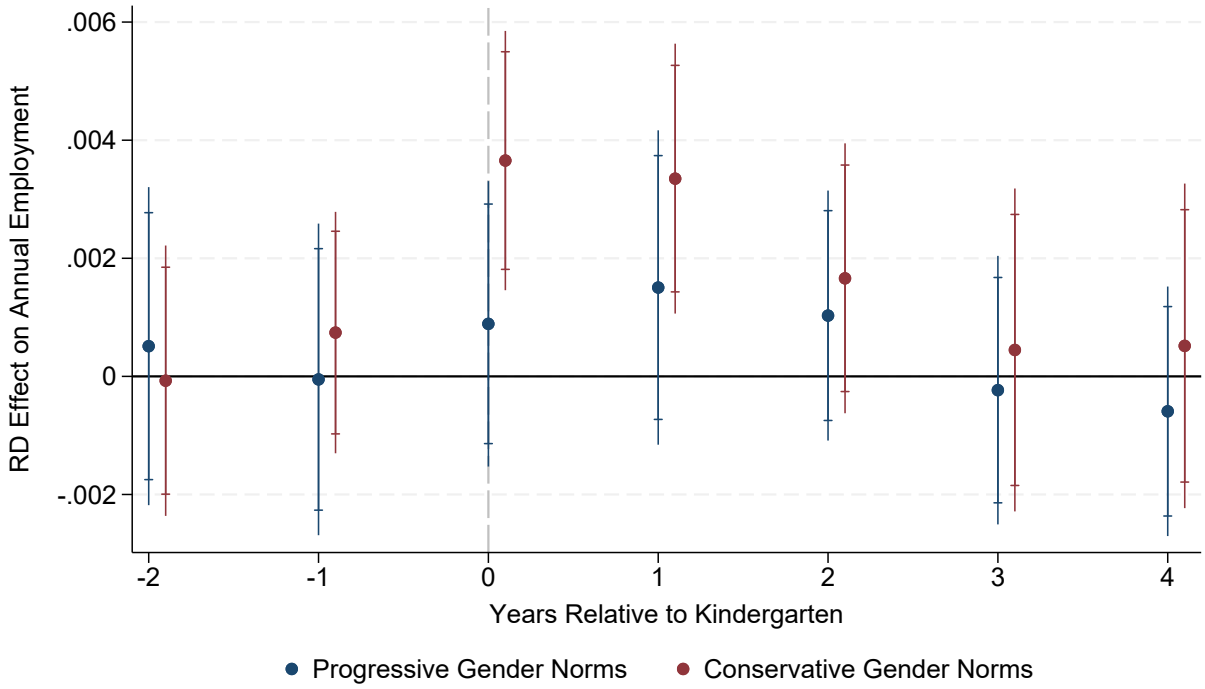
Figure 8: Heterogeneity by Length of Kindergarten: Effect of School Birth Date Eligibility Cutoff on Employment of Mothers Over Time



NOTE: Sample restricted to mothers in the 2014 LEHD who had a child whose birthday was within 90 days of the state school eligibility cutoff. These mothers are then followed each year from two years prior to the relevant kindergarten eligibility cutoff to four years after, when the eligible children would have entered fourth grade. The effect is estimated separately for each year. Days between birthdate and kindergarten cutoff are controlled for linearly and allowed to vary on either side of the cutoff.

SOURCE: Author's own calculations using 2014 LEHD, linked to the Census Household Composition Key and Numident for focal child's exact date of birth. Disclosure number CBDRB-FY24-P2706-R11598.

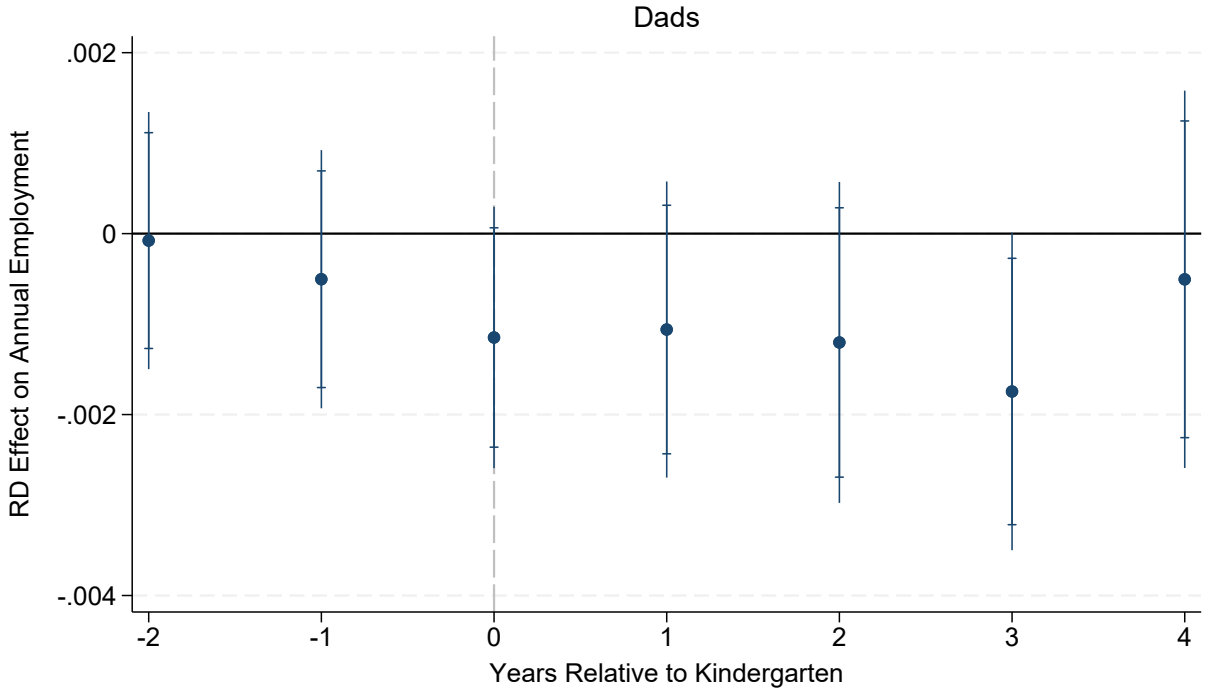
Figure 9: Heterogeneity by Gender Norms: Effect of School Birth Date Eligibility Cutoff on Employment of Mothers Over Time



NOTE: Sample restricted to mothers in the 2014 LEHD who had a child whose birthday was within 90 days of the state school eligibility cutoff. These mothers are then followed each year from two years prior to the relevant kindergarten eligibility cutoff to four years after, when the eligible children would have entered fourth grade. The effect is estimated separately for each year. Days between birthdate and kindergarten cutoff are controlled for linearly and allowed to vary on either side of the cutoff.

SOURCE: Author's own calculations using 2014 LEHD, linked to the Census Household Composition Key and Numident for focal child's exact date of birth. Disclosure number CBDRB-FY24-P2706-R11598.

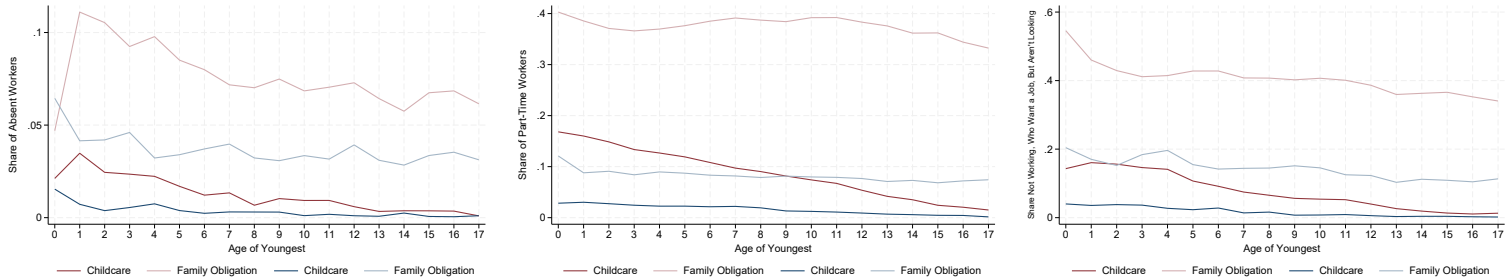
Figure 10: Fathers: Effect of School Birth Date Eligibility Cutoff on Employment of Fathers Over Time



NOTE: Sample restricted to fathers in the 2014 LEHD who had a child whose birthday was within 90 days of the state school eligibility cutoff. These fathers are then followed each year from two years prior to the relevant kindergarten eligibility cutoff to four years after, when the eligible children would have entered fourth grade. The effect is estimated separately for each year. Days between birthdate and kindergarten cutoff are controlled for linearly and allowed to vary on either side of the cutoff.

SOURCE: Author's own calculations using 2014 LEHD, linked to the Census Household Composition Key and Numident for focal child's exact date of birth. Disclosure number CBDRB-FY24-P2706-R11598.

Figure 11: Reasons for Reduced Labor Market Engagement in the CPS



NOTE: Sample restricted to mothers and fathers in the monthly CPS between 2000 and 2019. The red lines are for mothers the blue lines are for fathers. In the panel on the right the sample is restricted to individuals who reported being absent from work last week. In the middle panel the sample is restricted to individuals who reported working part-time last week. In the right panel the sample is restricted to individuals who reported that they did not look for work in the past four weeks, but had said that they wanted a job. The share of people that listed childcare or family obligations as the reason for not being more engaged in the labor market (either absent, working part-time, or not looking for work). These groups are mutually exclusive.

SOURCE: Author's own calculations using 2000-2019 monthly CPS.

Table 1: Effect of School Birth Date Eligibility Cutoff on School Enrollment and Annual Employment of Mothers

	Children		Mothers		
	In Kindergarten (1)	In School (2)	Employed (3)	Earnings (4)	IHS Earnings (5)
Birthday<Cutoff	0.4135***	0.1049***	0.002287***	-9.308	0.01701*
	(0.009970)	(0.003683)	(0.000852)	(95.24)	(0.009177)
Data Set	ACS	ACS	LEHD	LEHD	LEHD
Observations	279,000	279,000	7,496,000	7,496,000	7,496,000

NOTE: In columns (1) and (2) the sample is restricted to children in the 2001-2019 ACS whose birthday was within 90 days of the state school eligibility cutoff. In columns (3)–(5) the sample is restricted to mothers in the 2014 LEHD who had a child whose birthday was within 90 days of the state school eligibility cutoff. Days between birthdate and kindergarten cutoff are controlled for linearly and allowed to vary on either side of the cutoff. Standard errors are clustered at the days relative to the cutoff level. $p < 0.01$ ***, $p < 0.05$ **, $p < 0.1$ *. Disclosure number CBDRB-FY24-P2706-R11598.

Table 2: Changes in Mothers Characteristics Around the School Birth Date Eligibility Cutoff

	Immigrant (1)	NH White (2)	NH Black (3)	Hispanic (4)	NH Other (5)	Less than HS (6)	HS (7)	Some College (8)	College (9)	With Father (10)	Mother's Age at Birth (11)	Race Missing (12)	Education Missing (13)	Father's Info Missing (14)
Birthday<Cutoff	0.000284	-0.001709**	0.000186	0.000725	0.000751*	0.001050	-0.000938	-0.000394	0.000470	-0.001406	-0.000116	0.000047	-0.000188	0.001225
	(0.000601)	(0.000761)	(0.000536)	(0.000579)	(0.000409)	(0.000677)	(0.000664)	(0.000645)	(0.000649)	(0.001044)	(0.01264)	(0.000171)	(0.000232)	(0.000875)
Observations	7,496,000	7,496,000	7,496,000	7,496,000	7,496,000	7,496,000	7,496,000	7,496,000	7,496,000	7,496,000	7,496,000	7,496,000	7,496,000	7,496,000

NOTE: The sample is restricted to mothers in the 2014 LEHD who had a child whose birthday was within 90 days of the state school eligibility cutoff. Days between birthdate and kindergarten cutoff are controlled for linearly and allowed to vary on either side of the cutoff. Standard errors are clustered at the days relative to the cutoff level. $p < 0.01$ ***, $p < 0.05$ **, $p < 0.1$ *. Disclosure number CBDRB-FY24-P2706-R11598.

Table 3: Effect of School Birth Date Eligibility Cutoff on Alternative Human Capital Decisions of Mothers

	Employed (1)	Wage Income (2)	IHS Wage Income (3)	In School (4)	Has HS Degree (5)	Has 4-year Degree (6)	Has Advanced Degree (7)	Number of Children (8)	Married (9)	Divorced or Separated (10)
					Kindergarten Year ACS					
Birthday<Cutoff	0.009227**	147.8	0.1127***	-0.000755	0.000251	-0.003362	0.002595	-0.001129	-0.003424	-0.001497
	(0.003593)	(313.3)	(0.03832)	(0.002378)	(0.002302)	(0.003907)	(0.002862)	(0.009778)	(0.003472)	(0.002433)
Observations	246,000	246,000	246,000	246,000	246,000	246,000	246,000	246,000	246,000	246,000
					First through Third Grade Year ACS					
Birthday<Cutoff	-0.000296	-79.62	0.01818	-0.002014	0.001481	-0.002057	0.000923	-0.000983	-0.002085	0.001365
	(0.002326)	(185.)	(0.02474)	(0.001420)	(0.001382)	(0.002113)	(0.001555)	(0.006398)	(0.002072)	(0.001499)
Observations	698,000	698,000	698,000	698,000	698,000	698,000	698,000	698,000	698,000	698,000

NOTE: In the top panel, the sample is restricted to mothers in the 2001-2019 ACS who had a child whose birthday was within 90 days of the applicable state kindergarten school eligibility cutoff. In the bottom panel, the sample is restricted to mothers in the 2001-2019 ACS who had a child whose birthday was within 90 days of the applicable state kindergarten school eligibility cutoff, but the mother is observed one to three years later (when the child would be on the margin of entering first through third grade). Days between birthdate and kindergarten cutoff are controlled for linearly and allowed to vary on either side of the cutoff. Standard errors are clustered at the days relative to the cutoff level. $p < 0.01$ ***, $p < 0.05$ **, $p < 0.1$ *. Disclosure number CBDRB-FY24-P2706-R11598.

Table 4: Robustness to Bandwidth: Effect of School Birth Date Eligibility Cutoff on Annual Employment of Mothers

	Employed (1)	Earnings (2)	IHS Earnings (3)
Birthday<Cutoff	0.002847**	33.35	0.02184*
	(0.001224)	(149.7)	(0.01315)
(Birthday<Cutoff)*Days from Cutoff	0.000021	2.114	0.000040
	(0.000069)	(6.608)	(0.000742)
Days from Cutoff	0.000009	-1.842	0.000038
	(0.000049)	(4.94)	(0.000504)
Observations	2,532,000	2,532,000	2,532,000

NOTE: Sample is restricted to mothers in the 2014 LEHD who had a child whose birthday was within 30 days of the state school eligibility cutoff. This shortens the bandwidth from 90 days to 30 days. Days between birthdate and kindergarten cutoff are controlled for linearly and allowed to vary on either side of the cutoff. Standard errors are clustered at the days relative to the cutoff level. $p < 0.01$ ***, $p < 0.05$ **, $p < 0.1$ *. Disclosure number CBDRB-FY24-P2706-R11598.