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Abstract

Public pre-kindergarten (pre-K) is primarily designed as an educational policy for young children but has attracted attention as a potential lever to support maternal employment. This study provides national evidence on the maternal labor market effects of state pre-K funding, exploiting variation in public investment across states and over time (academic years 2002-2024). Using a triple-difference design that compares mothers of pre-K-age children to mothers of slightly older children across states and years, we find consistent evidence across two independent national surveys: a $1,000 increase in per-child pre-K funding is associated with a robust 0.3–0.6 percentage-point increase in maternal employment, with some evidence of an increase in weekly work hours and in annual earnings. Subgroup-specific estimates are largely consistent in magnitude but reveal larger employment responses among mothers with young children and among socioeconomically advantaged mothers (partnered, college-educated, higher-income). Together, the findings suggest that public investments in early education can yield modest but robust labor market benefits for mothers.

Keywords: Public preschool, maternal employment, early child care, early education policy

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1. Introduction

The limited supply and high cost of high-quality child care in the United States are often cited as structural constraints that depress mothers' labor force participation (Landivar et al., 2021; Ruppanner et al., 2019; 2021). Most research on public pre-kindergarten (pre-K), a policy that subsidizes preschool enrollment and has been expanded primarily by states and cities, has focused on estimating effects on child outcomes (see Phillips et al., 2017). Increasingly, however, it has also attracted attention as a potential lever for improving families' economic well-being, largely by supporting mothers' labor market participation (Burchinal et al., 2022; Jackson et al., 2025; Humphries et al., 2024).

Over the past two decades, public pre-K has expanded substantially by most measures, including state investments and enrollment rates (Moran et al., 2026; Friedman-Krauss et al., 2025). Yet it is unclear how increases in state-supported child care and early education have affected family life (Burchinal et al., 2022; Jenkins & Duncan, 2023). The impact of public pre-K on families has both economic and developmental concerns. Subsidizing the care of 4-year-olds could affect women's employment and earnings, with downstream effects on children's development through increased household resources (Duncan et al., 2011).

A growing literature has examined the labor market effects of pre-K policies, yet important gaps remain (Morrissey, 2017). Current studies with credible claims to internal validity have been conducted on a small number of city- or state-level programs, with a disproportionate emphasis on universal pre-K initiatives that determine eligibility based solely on children's age and achieve relatively high participation across the income distribution. Yet half of the states have pre-K programs that target children from lower-income families (Moran et al., 2026). In turn, far less is known about the employment effects among these programs, many of which continue to serve substantial shares of children nationwide.

In addition, inconsistencies among reported estimates from local-level studies further complicate our understanding of the extent to which pre-K expansion can generally support mothers' workforce participation. Some evaluations have reported null effects (Fitzpatrick, 2010; Li, 2020), suggesting a minimal labor supply response among recent cohorts of mothers due to a stronger labor force attachment than earlier cohorts (Blau & Kahn, 2007; Byker, 2016; Fitzpatrick, 2012). Other studies of modern universal pre-K programs report positive impacts on maternal employment (Cha, 2025; Humphries et al., 2024; Jackson et al., 2025; Malik, 2018), with a wide range of effect sizes.

Finally, few studies explore the intensity of public investment in pre-K programs. Most prior studies focus on the presence or availability of pre-K programs—often measured through policy adoption or program eligibility. In today's policy landscape, however, nearly all states (45 states and the District of Columbia) invest in pre-K to some degree, and expansions have often occurred incrementally over time (Friedman-Krauss et al., 2025; Karch, 2014; Moran et al., 2026; Rose, 2010). As a result, the relevant policy margin is no longer whether to adopt pre-K, but whether to invest more. Estimating the marginal effects of additional public investment provides policy-relevant parameters that are more directly informative for cost-benefit considerations, particularly for policymakers weighing incremental funding increases against competing budget priorities.

This study addresses these gaps by examining the national relationship between state pre-K funding and maternal labor supply. We pose two primary research questions:
(1) Does state pre-K funding increase mothers' employment, work hours, and earnings?

(2) Do these effects vary by family characteristics and key program designs (i.e., universal eligibility, full-school-day [or full-day] requirements)?

To answer these questions, we utilize State Pre-K Expenditures: A National Dataset (SPEND) – a newly constructed state-by-year dataset that includes a host of state-level outcomes alongside data on pre-K funding from the National Institute for Early Education Research (NIEER). We combine the SPEND study with individual-level labor market outcomes from two nationally representative surveys: the Current Population Survey (CPS) and the American Community Survey (ACS). Separately analyzing both mother samples allows us to assess the robustness of the findings across distinct data sources with different sampling strategies and measurement structures.

We estimate the effects of state pre-K funding using a triple-difference design that exploits variation across states, years, and children's age groups. Specifically, we compare mothers of pre-K-age children (ages 4-5) with mothers of slightly older children (ages 6–7). Both groups of mothers are exposed to the same state-level economic, policy, and social norm conditions, but pre-K funding changes should only affect the mothers with age-eligible children. This design helps account for unobserved, state-specific time-varying factors that may jointly influence public spending and maternal employment (Gibbs et al., 2025).

The results from the CPS and ACS samples indicate that higher state pre-K funding is associated with modest, but robust, increases in mothers' employment, with some evidence of small gains in weekly work hours and annual earnings. Subgroup analyses reveal employment gains typically ranging from 0.2 to 0.6 percentage points, work hours gains of 0 to 14 minutes per week, and annual earnings gains of $0 to $600. We find evidence of larger labor supply gains among mothers with both a pre-K-aged child and a younger child, partnered mothers, mothers with at least some college education, and mothers from higher-income families (185% of FPL or above). However, the effects of pre-K funding on maternal employment did not differ meaningfully by income-based eligibility rules or full-day requirements.

This study contributes to the literature in several ways. First, it highlights the broader role of early education policy in shaping mothers' employment decisions. Moving beyond single-site evaluations, we provide the first national-level estimate of the association between state pre-K spending and maternal labor market participation by leveraging variation in funding across states and over time. In other words, we provide evidence on the labor market consequences of the national expansion of state public pre-K. Second, focusing on the post-2000 policy environment, the study shows that modern public investments in preschool can have positive effects on employment, but the effects are quite modest. Third, subgroup analyses reveal no clear differences in maternal responses to incremental pre-K expansions across program design features.

The remainder of the paper proceeds as follows. Section 2 describes the landscape of state pre-K programs in the United States. Section 3 reviews the existing evidence. Sections 4 through 6 describe the data, measures, and identification strategy. Section 7 presents the results, including subgroup analyses. Section 8 discusses the findings, and Section 9 concludes.

2. State Pre-K Programs in the U.S.

In the United States, pre-kindergarten (pre-K) policy has been within the purview of state and local governments, resulting in substantial variation across the nation in program features (Friedman-Krauss et al., 2025; Karch, 2014). For example, eligibility criteria differ widely: some states offer universal access based on children's age, while others restrict eligibility to children

deemed at risk of poor academic outcomes. Program structures also vary, with some states mandating full-day schedules and others offering only part-day options. As a result of this institutional diversity, findings from evaluations of individual state or local programs may not readily generalize to the national context (Jenkins, 2016).

Despite this variation, state pre-K programs share a common objective: to provide one or two years of formal early education before kindergarten entry to support children's school readiness. Relative to other early childhood policies—such as Head Start or child care subsidy programs—state pre-K initiatives are more explicitly oriented toward educational goals than toward income support or employment promotion (Rose, 2010; Phillips et al., 2017). Nevertheless, features that are central to educational quality—such as program hours, staffing levels, classroom resources, and the reliability of care—can also directly affect parents' ability to engage in paid work (Gibbs et al., 2025). As a result, even when not designed explicitly as work-support policies, pre-K programs may influence maternal labor supply by altering the affordability, stability, and usability of non-parental child care.

Over the past two decades, an increasing number of states have adopted or expanded pre-K programs and substantially increased public investments in them (Cascio, 2021). During this period, inflation-adjusted funding per age-eligible child has roughly doubled, and the share of four-year-olds enrolled in state pre-K programs increased from approximately 15 percent in the early 2000s to more than 30 percent by the 2023–2024 academic year (Friedman-Krauss et al., 2025).

This growth was achieved through diverse expansion paths across states. Moran and colleagues (2026) document how states have followed remarkably distinct trajectories in expanding pre-K funding over the past two decades. Relying on the same pre-K funding data used in our study, their analysis shows that increases in state pre-K spending have primarily been directed toward expanding access to more children rather than toward increasing spending per slot (i.e., program quality). In contrast with the research on pre-K program adoption (e.g., Cohen-Vogel et al., 2022), they did not find consistent predictors of pre-K expansion trajectories.

This cross-state heterogeneity in pre-K expansion patterns over time generates meaningful variation in access to publicly funded pre-K options across states and years. This study leverages such policy-driven variation to assess the labor market effects of state investments in pre-K.

3. Literature Review

From a "linked lives" perspective in human development theory, which emphasizes the interdependence of individuals' life-course trajectories, changes in children's educational opportunities and daily schedules induced by pre-K expansion may alter parents' employment decisions (Elder & Shanahan, 2006). Standard economic models of labor supply offer a complementary but theoretically ambiguous prediction (Blau, 2001). Two competing mechanisms – the substitution effect and the income effect – generate opposing predictions, and which dominates depends on the mother's counterfactual employment situation. The substitution effect operates when subsidized care lowers the effective price of child care, raising the relative return to paid work and incentivizing mothers to shift time from caregiving to employment. The income effect operates when the subsidized care raises household purchasing power, potentially reducing mothers' need to work.

To illustrate a situation where substitution effects may be dominant, consider a mother who is the primary caregiver for a child and faces prohibitive costs to enroll their child in private

child care. If public pre-K lowers the cost of care, the mother may then seek employment rather than serve as the child's primary caregiver during work hours. By contrast, the income effect may be more dominant for a mother who is already working and paying for private child care. Publicly-supported pre-K may function as an indirect income transfer, enabling some mothers to scale back their work hours or leave the workforce altogether. Should income effects dominate, we should expect to see increases in public pre-K investment associated with decreases in maternal employment. Conversely, should substitution effects prevail, we would expect to find that increases in state pre-K investments predict increases in maternal employment.

Consistent with these competing theoretical predictions, empirical evidence on the labor market effects of pre-K policies is mixed. Table 1 summarizes existing U.S.-based studies examining the effects of pre-K programs on maternal employment and labor force participation. Some early evaluations of the first universal pre-K programs in Georgia and Oklahoma found null effects on maternal employment (Fitzpatrick, 2010; Li, 2020). Others estimated positive effects only among key subgroups, such as mothers with a high school degree or less, but not for their counterparts with a college education (Cascio & Schanzenbach, 2013). More recent studies of universal pre-K expansions in Washington, D.C. (Malik, 2018), New Haven, Connecticut (Humphries et al., 2024), New York City (Cha, 2025), and a multi-site sample of nine states and cities (Jackson et al., 2025) report economically meaningful increases in maternal employment or labor force participation, ranging from 1.4 to 10 percentage points, associated with program rollout (intent-to-treat) or program attendance (treatment-on-treated). Two additional studies that incorporate both targeted and universal pre-K programs also document positive effects of program access on maternal labor supply outcomes (Ilin et al., 2022; Sall, 2014).

Although the weight of evidence suggests positive effects, the existing literature leaves several important questions unresolved. First, as shown in Table 1, most studies (seven out of eight) focus on specific state or local programs, with a heavy emphasis on universal pre-K initiatives. While these studies provide valuable evidence on program-specific impacts, they do not fully incorporate the diverse policy designs and investment levels that characterize state pre-K systems nationwide. Of particular relevance, Ilin et al. (2022) is the only study to examine the full landscape of state pre-K programs across 45 states and the District of Columbia. Exploiting variation in eligibility rules—based on program presence, child age, and income thresholds—they estimate that mothers with a preschool-age child likely eligible for state pre-K are 2.3 percentage points more likely to participate in the labor force than comparable mothers without access.

Our study builds on this approach but shifts attention from eligibility to the intensity of public investment. Whereas eligibility rules determine who qualifies for public pre-K, the access may still be limited in practice due to the lack of resources to fund the slots. Instead, funding levels may alter the effective availability of programs (Moran et al., 2026). By examining variation in state pre-K funding per four-year-old in a given population, we obtain a comprehensive proxy for the overall scale of pre-K expansion across states. This allows us to assess whether marginal increases in public investment translate into changes in maternal employment.

Second, evidence on heterogeneity in employment effects is difficult to reconcile across local studies. Whether pre-K expansions raise or reduce labor supply likely depends on mothers' baseline employment constraints and resources. Theoretically, substitution effects, where lowered child care costs raise the return to paid work, are most likely among mothers for whom child care costs represent a significant barrier to workforce entry: typically lower-income or less-

educated mothers, or those with multiple young children. Income effects, where the subsidized care reduces out-of-pocket child care expenditure, lowering the financial pressure to work, are more relevant for mothers already employed who may use pre-K as an implicit subsidy.

These predicted patterns in subgroup heterogeneity are not consistently borne out by studies. Some analyses find larger responses among socioeconomically disadvantaged mothers, typically defined by lower educational attainment (Cascio & Schanzenbach, 2013), while others report stronger effects among more advantaged mothers, such as those with a college degree (Sall, 2014; Ilin et al., 2022). Patterns by family income are similarly mixed: some studies document non-linear relationships, with employment gains concentrated at both the lower and upper ends of the income distribution (Malik, 2018; Sall, 2014; Ilin et al., 2022), while others find effects concentrated among middle-income families (Humphries et al., 2024). Moreover, partnered mothers have access to a secondary earner as a buffer, generating competing predictions. They face less economic pressure to work, suggesting income effects may dominate, yet they also have more resources and flexibility to enter the workforce when child care is subsidized, suggesting substitution effects. Empirically, while studies from Washington, D.C. identify significant gains among unmarried mothers (Malik, 2018), analyses from New York City and multi-state samples find larger effects among married or partnered mothers (Cha, 2025; Ilin et al., 2022; Sall, 2014).

Together, these patterns motivate a more comprehensive examination of how pre-K policies shape maternal labor supply. In this paper, we address this gap by exploiting variation in state pre-K investments across all 50 U.S. states over the period from 2002 to 2024. Focusing on mothers of four- and five-year-old children, we examine the average association between state pre-K funding and maternal employment, as well as heterogeneity by family characteristics and program design features, including income eligibility and mandates for full-day programs. This study provides new evidence on the labor market implications of national state pre-K expansions.

4. Data and Measurement

Data

We use data from two nationally representative surveys conducted by the U.S. Census Bureau: the Current Population Survey (CPS) and the American Community Survey (ACS), covering survey years 2001–2023. Both datasets are accessed through the Integrated Public Use Microdata Series (IPUMS; Flood et al., 2025; Ruggles et al., 2025). The CPS is the primary source of official U.S. labor force statistics for the civilian noninstitutionalized population and provides high-frequency, reliable measures of employment and work hours. The core data on labor force information is collected and reported monthly. Prior to 2014, the CPS sampling frame was based on the decennial census; since 2014, samples have been drawn annually from the Census Bureau's Master Address File, which is continuously updated using information from the U.S. Postal Service.

In the CPS, information on children's preschool enrollment and household income is obtained through supplemental surveys. In particular, the October CPS Education Supplement provides detailed measures of preschool or pre-K enrollment for children aged three and older, including whether enrollment is in a public or private program and whether it is full-day or part-day. The Annual Social and Economic Supplement (ASEC), administered between February and April, collects detailed information on household income sources and serves as the official data source for national poverty estimates.

The ACS is the largest ongoing household survey in the United States and is designed to provide detailed demographic, social, and economic information at fine geographic levels. Similar to the CPS, the ACS collects information on school enrollment for children aged three and older, including whether enrollment is in a public or private preschool, though it does not distinguish between full-day and part-day programs. The ACS also measures individuals' annual income from multiple sources, albeit with less detail than the CPS ASEC. Although the ACS survey collects data monthly, it is only reported annually in the public-use file. Like the CPS, the ACS draws its sample from the Census Bureau's Master Address File, and the two datasets cover a comparable sampling frame (Census Bureau, 2023). In this study, we leverage both samples to assess the robustness of our results to data source and measurement differences.

We use State Pre-K Expenditures: A National Dataset (SPEND), a new state-level panel of state pre-K programs that are collected by the National Institute for Early Education Research (NIEER) for academic years 2001–2002 through 2023–2024 (hereafter referred to as 2002–2024, based on the year of the spring semester) (Moran et al., 2026). This data provides state-by-academic-year information on total pre-K funding and enrollment for all 50 states and the District of Columbia, along with key program characteristics, such as income eligibility and mandated operating hours.

Outcomes

Our primary labor market outcomes are: (1) maternal employment, measured as a binary indicator for whether the mother worked for pay in the previous week, (2) weekly work hours, measured as hours mothers worked in the previous week in the CPS and usual hours worked per week in the previous 12 months in the ACS, and (3) annual wage and salary income, defined as mothers' total annual earnings from paid employment. Both the weekly hours and annual earnings include zeros from non-working individuals.[1] We also present results for work hours conditioned on the working-mother sample and for log annual earnings.

We do not restrict the main analytic sample to mothers with non-missing values for all three outcomes; thus, sample sizes vary by outcome. Annual wage and salary income is drawn from the CPS ASEC rather than the CPS Monthly survey, resulting in a considerably smaller sample for that outcome. Our main findings are robust to a balanced sample restricted to mothers with non-missing values across all three outcomes (Appendix Table A1).

It is important to note that the reference periods for the annual earnings data from the CPS ASEC and ACS capture only a fraction of the window in which pre-K funding would have occurred. The CPS ASEC measures earnings during the prior calendar year. For example, the annual earnings reported in the 2003 CPS ASEC reflect labor market activity during January-December 2002 and overlap only with the fall 2002 to 2003 academic year, excluding the following spring semester. In the ACS, annual earnings refer to the prior 12 months from the survey, but the interview month is unavailable in the public-use data, preventing precise assignment of the relevant exposure window. Accordingly, earnings estimates in both surveys should be interpreted as reflecting average associations with partially overlapping exposure periods, with greater timing uncertainty in the ACS, rather than accumulated effects for the entire academic year. The CPS and ACS data are available through IPUMS (Flood et al., 2025; Ruggles et al., 2025). The SPEND dataset and replication code supporting the findings of this study will be made openly available upon publication.

[1] For non-employed individuals, we coded work hours as zero; for individuals with missing employment status, we coded work hours as missing.

State Pre-K Funding

Our primary analyses focus on state pre-K funding from state sources only (i.e., for programs funded and administered by the state), excluding local and federal contributions, as reported by state administrators.[2] To ensure comparability across states, total state pre-K funding is adjusted by the population of four-year-old children. The resulting measure captures the intensity of state investment in pre-K to which families with age-eligible children are exposed. Funding amounts are inflation-adjusted to 2024 dollars and scaled such that one unit corresponds to $1,000 in spending per four-year-old. Figure 1 provides a distributional summary of this measure. In 2002, the median level of spending (Iowa) was $267 (inflation-adjusted 2024 dollars). Almost all states saw substantial expansion in state pre-K funding, although growth rates varied. By 2024, the median spending level was $1,837 in Arkansas.

For the primary analysis, we exclude the District of Columbia because it is not a state and its pre-K spending levels are extreme relative to all other states over the study period.[3] Based on our analysis of NIEER data from 2002-2024, the District of Columbia spent, on average, more than $16,000 per four-year-old annually, compared to approximately $4,600 in the next highest-spending state, New Jersey.

Because state pre-K funding is reported by academic year while labor market outcomes are measured by calendar year, we align funding exposure to individual observations differently across the CPS and ACS, reflecting differences in the availability of survey months. In the CPS, information on the month and year of interview is available, allowing us to directly map each observation to the academic year that was underway. For example, a mother interviewed between January and August 2005 is assigned to academic year 2004/2005, whereas a mother interviewed between September and December 2005 is assigned to academic year 2005/2006.

In contrast, the public-use ACS does not report the interview month to minimize the risk of re-identification of the respondent. We therefore align ACS calendar-year observations to the subsequent spring academic year as an approximation to the academic year most likely to influence children's preschool enrollment during that survey year. For instance, a mother interviewed in 2005 is assigned to academic year 2005/2006. To reduce potential misclassification, we exclude mothers of four- and five-year-old children who are reported as attending kindergarten in the ACS. This approach, however, introduces some measurement error in the timing of policy exposure because ACS interviews occur throughout the year, and some respondents interviewed early in the calendar year may correspond to the current rather than the subsequent academic year. While this misalignment is likely to attenuate estimated effects, our estimates are highly robust to an alternative approach, assigning observations to the current academic year rather than the subsequent academic year (Appendix Table A2).

For our identification strategy, a key assumption is that within-state changes in pre-K funding are not systematically driven by time-varying factors that simultaneously affect maternal labor supply in ways that differentially influence mothers of 4–5-year-old children relative to those with slightly older children. To assess this possibility, we examine whether changes in state pre-K funding are associated with a broad set of time-varying state characteristics. Specifically, we consider demographic factors (racial and ethnic composition [percent White, Hispanic, Black, Asian and AIAN], the share of the foreign-born, share of 3-4-year-olds), economic factors (state unemployment rate, state poverty rate, gross state product [GSP] per capita), labor and social

[2] Findings are robust to alternative definition of state pre-K funding that includes all sources of funding (Appendix Tables A12, A14, A16).

[3] The estimates are robust to the alternative sample including D.C. (Appendix Table A12, A14, A16).

safety net policy contexts (state minimum wage, state Earned Income Tax Credit [EITC] rate expressed as percentage of federal credit, mean index of social welfare receipt rate [average receipt rate of Social Security Income {SSI}, Supplemental Nutrition Assistance Program {SNAP}, Temporary Assistance for Needy Families, Medicaid, and Special SNAP for Women, Infants, and Children {WIC}]), early childhood policy (Paid Family Leave adoption, Head Start enrollment rate for 4 year old children, CCDF participation rate for 4 year old children), education policy (National School Lunch Program [NSLP] participation rate, School Breakfast Program [SBP] participation rate, K–12 per-pupil spending), and the governor's party affiliation. These measures were compiled from the University of Kentucky Center for Poverty Research (UKCPR), ACS, Urban Institute Welfare Rules Database, Center for American Women and Politics (CAWP), Prenatal-to-Three Policy Impact Center Policy Tracking System (PTS), Administration for Children and Family Child Care and Development Fund Statistics, and the Kids Count Data.

Appendix Table A3 reports estimates from regressions of state pre-K spending per 4-year-old (in 2024 dollars) on these covariates, controlling for state and year fixed effects. Of the 19 covariates examined, higher average welfare receipt rates, a higher state EITC rate, and a higher SBP participation rate are statistically significantly associated with pre-K funding, while a lower share of Black residents, lower NSLP participation, and a higher K-12 per-pupil spending show marginal associations.

While this exercise cannot rule out all potential confounders, it suggests that changes in funding are not strongly driven by economic and demographic factors that shape broader labor market conditions, but it does co-move with some social safety net policy (e.g., welfare receipt rates, state EITC rate). To isolate the effects of pre-K funding, our triple-difference design compares mothers with 4–5-year-old children to mothers with 6–7-year-old children within the same state and year, thereby differencing out common state-year shocks and age-specific trends in maternal employment.

[Figure 1 placed here]

5. Identification Strategy

We estimate the effects of state pre-K funding on maternal workforce participation by exploiting variation in funding exposure across states, years, and children's age groups. We begin by estimating a two-way fixed-effects (TWFE) ordinary least squares (OLS) model that relates state pre-K funding to labor market outcomes among mothers with pre-K-age children (ages 4–5), who are eligible for state pre-K programs:

$$Y_{ist} = \beta_0 + \beta_1 PKfunding_{st} + \beta'_2 X_{ist} + \beta'_3 Z_{st} + \nu_s + \lambda_t + \epsilon_{ist}, \quad (1)$$

where Y_{ist} denotes the labor market outcome of mother i in state s and year t. $PKfunding_{st}$ measures state pre-K spending per four-year-old child. The vector X_{ist} includes individual-level characteristics: mother's race and ethnicity, age, highest educational attainment, nativity, partnered status, and the number of children under age 13 in the household. The vector Z_{st} includes time-varying state-level characteristics capturing demographic composition, economic conditions, and policy context, which are listed above in Section 4. State fixed effects (ν_s) absorb time-invariant differences across states, while year fixed effects (λ_t) control for national shocks common to all states.

The coefficient $\beta_1$captures the within-state association between changes in pre-K funding and maternal labor outcomes, net of observed covariates and national time trends. However, estimates from equation (1) may be biased if changes in pre-K funding are correlated with unobserved, time-varying state factors or if states adjust pre-K spending in response to shifts in maternal employment.[4]

To address these concerns, our preferred specification employs a generalized triple-difference (difference-in-difference-in-differences; DDD) design (Gruber, 1994; Olden & Møen, 2022) that uses mothers with slightly older children (ages 6–7) as a comparison group. Mothers of 6–7-year-olds are exposed to the same state-level economic, normative, policy environment as mothers of 4–5-year-olds. However, mothers of 6-7-year-olds should not be directly affected by changes in pre-K funding, as their children have aged out of pre-K eligibility.[5] Following prior work (e.g., Gibbs et al., 2025; Wikle & Wilson, 2022), we estimate the following model:

$$Y_{ista} = \beta_0 + \beta_1(PKfunding_{st} \times Treat) + \beta_2' X_{ista} + \nu_{s \times t} + \lambda_{s \times a} + \epsilon_{ista} \quad (2)$$

where $Treat$ is an indicator equal to one if the mother is in the treated group (has a child aged 4–5) and zero if she is in the comparison group (has children aged 6–7 but no child aged 4–5). Just as in *Equation 1* above, the vector X_{ista} includes individual-level characteristics. Importantly, this model includes $\nu_{s \times t}$, which represents a set of fixed effects that capture the *interactions* between state and year (i.e., state-by-year fixed effects), which absorb all state-specific shocks. The state-by-age group fixed effect, $\lambda_{s \times a}$, controls for any time-invariant differences between mothers of children ages 4-5 and 6-7 in a given state. Here, the effect of pre-K funding is identified from whether the within state-year-difference net of time-invariant state-specific age-related difference in maternal outcomes vary with funding levels, which is captured in the interaction term, $PKfunding_{st} \times Treat$. Unlike the TWFE model (*Equation 1*), our primary DDD model does not include time-varying state covariates, as state-by-year fixed effects absorb any state-year level characteristics, including the main effect of funding estimated in *Equation 1*.

Mothers of young school-age children are the preferred comparison group as opposed to mothers of infants and toddlers for two reasons. First, mothers of younger children can adjust their behavior responding to pre-K expansion that their children will soon be eligible for (Erceg et al., 2024). Such anticipatory responses could attenuate the contrast between treated and comparison groups and complicate interpretation of the estimates. In contrast, mothers of 6–7-year-olds have already passed the pre-K eligibility window and therefore are unlikely to adjust their labor supply decisions in response to changes in pre-K funding.

Second, the child care and early education for infants and toddlers might be more heterogeneous than the kindergarten and public schooling context. Care for very young children relies on a mix of informal arrangements, home-based care, and private providers, and is less

[4] As a check on reverse causality, we regress state pre-K funding per four-year-old on maternal employment rates lagged by one and two years, controlling for state and year fixed effects and time-varying state covariates (Appendix Table A4). The estimated associations are small: in the ACS, a one-percentage-point increase in lagged maternal employment predicts about a $1 increase in funding per four-year-old; in the CPS, the corresponding estimate is about $1 for the one-year lag and $11 for the two-year lag, with only the latter statistically significant. These magnitudes are very small relative to the $1,000 funding increment used in the main models, suggesting limited scope for reverse causality to explain the estimates from TWFE models.

[5] We tested sensitivity of findings to alternative comparison groups: mothers with 4-5-year-olds vs. mothers with 8-9-year-olds, mothers with only 4-year-olds vs. 6-7-year-olds, mothers with 4-5-year-olds vs. mothers with 0-3-year-olds (Appendix Tables A11, A13, A15).

directly connected to the public education system (Hanson et al., 2024). By contrast, children ages 4–7 are typically engaged in more standardized institutional settings tied to the public school system. Using mothers of 6–7-year-olds as the comparison group therefore helps ensure that both groups face a more comparable institutional context while differing primarily in their exposure to pre-K funding.

The identifying assumption is that absent changes in pre-K funding, labor market outcomes for mothers of 4–5-year-olds and 6–7-year-olds would have followed parallel trends within states. Under the assumption, the coefficient β_1 identifies the causal effect of state pre-K funding on maternal labor supply. We assess the plausibility of the parallel-trends assumption by examining trends in maternal employment across age groups and by conducting several placebo tests.

Prior to estimating the effects of funding on maternal labor market outcomes, we estimate the association between state pre-K funding and preschool enrollment among four-year-olds using equation (1). We begin by examining the share of four-year-olds enrolled in state pre-K programs, using enrollment data collected by NIEER from state ECE administrators. This measure captures program-specific participation and allows us to assess whether increases in funding translate into a larger share of children enrolled in publicly funded pre-K slots.

Along with this administratively-reported measure, we also examine household-reported preschool participation using the CPS October Supplement and the ACS. Specifically, we analyze the share of 4-year-olds enrolled in (1) any preschool, (2) public preschool, and (3) full-day preschool. These survey-based measures allow us to assess whether increased state pre-K funding expands overall preschool participation (extensive margin), shifts children across care arrangements (e.g., from private to public programs), or increases hours in preschool in full-day programs.

6. Results

Descriptive Patterns

Figure 2 plots trends in average state spending on pre-K per four-year-old child in the population. This figure does not represent spending per enrolled child, but rather, the investment in the four-year-old population. State investments increased substantially over the study period, roughly doubling from approximately $1,000 in 2002 to over $2,000 by 2024 (all dollar figures have been inflation-adjusted to 2024 USD), with two notable declines following the Great Recession and the COVID-19 pandemic.

Figure 3 presents trends in preschool enrollment among four-year-olds using data from the CPS October Supplement and the ACS. Year-to-year estimates are noisier in the CPS due to smaller sample sizes, but the patterns are comparable across the two samples. Overall, enrollment in any preschool among four-year-olds appears largely stagnant. Public preschool enrollment modestly increased prior to the COVID-19 pandemic. In addition, the CPS sample—which uniquely identifies full-day enrollment—shows a steady increase in participation in full-day preschool programs throughout the 2010s.

Figure 4 illustrates trends in maternal employment, weekly work hours, and annual earnings for mothers with young children, drawing from the CPS and ACS. Maternal employment increased steadily over time, interrupted by declines during the Great Recession and the COVID-19 recession. Although levels are consistently higher for mothers of six- and seven-year-old children than for mothers of four- and five-year-old children, trends for the two groups

move closely in parallel. This pattern supports our identifying assumption underlying our triple-difference design that these groups are similarly affected by common temporal shocks.

Table 2 reports summary statistics for mothers of four- and five-year-old children and mothers of six- and seven-year-old children using CPS and ACS samples. The two groups are highly comparable in terms of race and ethnicity, educational attainment, nativity, and household composition. As expected, mothers with older children exhibit higher employment rates, longer work hours, and higher annual earnings, reflecting well-documented life-cycle patterns in mothers' labor force participation (Goldin et al., 2024).

[Figure 2 placed here]
[Figure 3 placed here]
[Figure 4 placed here]
[Table 2 placed here]

Effects of Pre-K Funding on Preschool Enrollment

We begin by examining the relation between state pre-K funding and children's preschool enrollment to assess whether increased funding translates to greater access to early education—an important channel through which maternal employment may respond. Table 3 reports estimates from the TWFE model with full state covariates.

Using administrators' reports of pre-K enrollment from NIEER, we find that a $1,000 increase in state pre-K funding per four-year-old is associated with an 11-percentage-point increase in the share of four-year-olds enrolled in state-funded pre-K programs. This sizable relation suggests that funding increases are strongly associated with greater participation in state-funded pre-K programs.

Survey-based state-year-level estimates from the CPS and ACS, however, suggest modest changes in the extensive margin of preschool attendance associated with a $1,000 increase in state pre-K funding. Both samples indicate approximately 1-percentage-point increase in the share of four-year-olds attending *any* preschool. Public preschool enrollment rate increases by nearly 2 percentage points. At the same time, we observe reductions in private preschool enrollment rate of nearly 1 percentage point, consistent with partial substitution from private to public settings (Bassok et al., 2014). We also observe nearly a 2 percentage points increase in the full-day ECE enrollment rate. Individual-level estimates of the association between pre-K funding and preschool enrollment are presented in Appendix Table A5 and show patterns like those from the state-level analysis.[6] We note a considerable discrepancy between the enrollment effect estimated from NIEER administrative data (11 percentage points) and those from CPS and ACS survey data (2 percentage points), estimates are directionally consistent. The gap likely reflects differences in measurement scope: NIEER tracks enrollment in state-funded pre-K program directly, where the funding variation operates, whereas CPS and ACS capture a broader mix of public preschool settings, including Head Start, locally funded programs, and early special education, diluting the treatment signal. Survey measures may also introduce classification error, as parents may have difficulty distinguishing program types given overlapping funding structures. The discrepancy in enrollment rates from NIEER and ACS is discussed in Moran et al. (2026).

[6] Individual-level estimates indicate little statistically significant association with enrollment in any ECE, a roughly 1-percentage-point increase in the likelihood of enrolling in public preschool, a 1-percentage-point decrease in private preschool enrollment, and a 1-percentage-point increase in full-day preschool enrollment.

Taken together, the findings indicate that increases in state pre-K funding substantially expand state-funded pre-K participation but generate only modest changes in overall preschool attendance. This pattern suggests that funding may operate primarily by shifting children across types of early care and education—particularly toward publicly funded programs and full-day programs—rather than dramatically expanding the overall pool of preschool participants. Consequently, the effects on maternal employment are likely to reflect changes in the intensity or type of care arrangements rather than large increases in the extensive margin of formal ECE use.

[Table 3 placed here]

Effects of Pre-K Funding on Maternal Labor Supply

Before estimating our preferred DDD model, we first assess whether simpler two-way fixed-effects (TWFE) models capture policy exposure or broader state-level trends. Table 4 reports the results with and without time-varying covariates, separately for mothers of four- and five-year-old children and mothers of six- and seven-year-old children. Among mothers with pre-K-age children, TWFE models without time-varying covariates suggest positive associations between pre-K funding and maternal labor supply. However, these associations are sensitive to specification: once state-level and individual-level covariates are included, the estimated relations become substantially smaller, directionally inconsistent, and statistically insignificant. Moreover, positive associations appear as well among mothers of six- and seven-year-old children in TWFE models and similarly disappear once covariates are included.

Because most six- and seven-year-olds are already enrolled in kindergarten or elementary school, their mothers should not be directly affected by contemporaneous changes in pre-K funding. One might attribute these associations among mothers with school-age children to spillover effects operating through broader labor market conditions (Jackson et al., 2025) or persistence of employment responses from earlier exposure to pre-K when children were age-eligible. However, given mixed evidence on persistence in employment gains in prior work[7] (Humphries et al., 2024; Cha, 2025) and the absence of clear lagged effects in our own analyses using funding lagged by two years (Appendix Table A6), we adopt the conservative interpretation that these TWFE associations primarily reflect residual confounding. Together, these patterns suggest TWFE models may conflate policy exposure with broader state labor market trends, motivating our preferred triple-difference specification.

We estimate the association between state pre-K funding and maternal labor supply using a DDD specification that compares mothers of four- and five-year-old children with mothers of six- and seven-year-old children within the same state and year (Table 5). Results indicate small but statistically significant increases in maternal employment associated with state pre-K funding. Across the CPS and ACS samples, a $1,000 increase in funding is associated with a 0.3 (CPS; $p < .05$) to 0.6 (ACS; $p < .001$) percentage-point increase in maternal employment. With a sample including both mothers who work and who do not (i.e., zero work hours and zero earnings), estimates for weekly work hours range from 0.1 hours (CPS; not significant) to 0.2 hours (ACS; $p < .001$)—equivalent to approximately 6 to 15 additional minutes per week. Estimates for annual earnings were noisier, ranging from –$98 (CPS; not significant) to $663 (ACS; $p < .001$). To assess whether funding affects the intensive margin among those working, we restrict the sample to employed mothers and report log annual earnings (which excludes

[7] Among existing evidence on persistent labor supply effects of pre-K programs in the U.S. context, for employment outcome, Humphries et al. (2024) and Cha (2025) do not find that short-term increase in employment during pre-K year sustained, but Humphries et al. (2024) found a lasting effects of increased parental earnings up to 6 years.

zeros). We find similar patterns: a $1,000 increase in state pre-K funding is associated with a -0.4 hours (CPS; not significant) to 0.1 hours (ACS; $p < .001$) increase in weekly work hours and a 0.01 log-point increase in annual earnings (approximately 1 percent). Taken together, these results suggest that marginal increases in state pre-K funding are associated with modest but consistent gains in maternal employment, with some evidence of null-to-modest effects on hours and earnings.

[Table 4 placed here]
[Table 5 placed here]

Effects of Pre-K Funding on Fathers and Grandmothers

We also examine potential labor supply responses among fathers. As with mothers, trends in employment, work hours, and annual earnings among fathers of 4-5-year-olds and fathers of 6-7-year-olds track closely over time (Appendix Figure A2). As shown in Appendix Table A7, we find no measurable effects of pre-K funding on fathers' labor supply in either sample.

Grandparents, especially grandmothers, increasingly play important roles in addressing young children's child care needs (Kwon, 2023; Pilkauskas et al., 2020) and their labor supply might potentially be affected by pre-K expansions. However, the data do not support the parallel trends assumption for co-residing grandmothers by child age groups (Appendix Figure A3), and triple-difference estimates are inconsistent in sign and magnitude across the CPS and ACS samples, precluding reliable inference about pre-K funding effects on grandmothers' labor supply. In summary, we find no compelling evidence of pre-K funding effects on the labor supply of other household members besides mothers.

Effects of Pre-K Funding on Family Income and Food Insecurity

Lastly, we extend the analysis beyond maternal labor supply to assess whether employment gains associated with pre-K funding translate into improvements in families' economic well-being. Although we document modest increases in employment among mothers of pre-K-age children, it remains an open question whether these changes are large enough to meaningfully reduce the poverty level or material hardship of the family.

We examine associations between state pre-K funding and families' income-to-needs ratio, measured by both the Official Poverty Measure (OPM) and the Supplemental Poverty Measure (SPM), which adjust for taxes, transfers, and non-cash benefits, along with regional variation in cost-of-living and work-related necessity costs, and thus provides a broader accounting of disposable material resources. The OPM and SPM measures are available in the CPS ASEC. We also analyze food insecurity using the CPS Food Security Supplement (FSS), a standard measure of whether households had adequate access to food in the past 30 days. Across these measures, we find no statistically significant associations between pre-K funding and income-to-needs ratios, poverty status, or food insecurity (Table 6).[8]

[Table 6 placed here]

Heterogeneity in Effect by Subgroups

[8] Households with children ages 4-5 and 6-7 showed comparable trends in income-to-needs and the experience of food insecurity in the past month (Appendix Figure A1). We also examined the effects of state pre-K funding on child care expenses, using the annual household child care expenses surveyed in CPS ASEC (2010 to 2024). The triple-difference estimate suggest a modest increase in child care expenses of $214, but we do not report the result since the trends in child care expenses are not parallel for households with children ages 4-5 and 6-7.

Figures 5, 6, and 7 present subgroup estimates for maternal employment, weekly work hours, and annual earnings, respectively. We examine heterogeneity across demographic and household characteristics, including the presence of a child under age four in the household in addition to the pre-K-eligible child, partnered status (whether cohabiting with a spouse or a partner), educational attainment (whether attained some college or more), household income relative to 185 percent of the federal poverty line, race and ethnicity (non-Hispanic White, non-Hispanic Black, and Hispanic), and nativity (whether born in the U.S.). We test the equality of coefficients across subgroups using post hoc Z-tests.

We also assess heterogeneity by key pre-K program features. Specifically, we classify state-years as operating a universal pre-K (UPK) program if at least one program offers universal eligibility, and as targeted otherwise. Similarly, we classify state-years as full-day if the largest state pre-K program requires a minimum of six hours of operation per day, and as part-day otherwise. State-years without any pre-K program are excluded from these analyses because they do not map meaningfully onto either program category. Importantly, these estimates capture the marginal effect of funding only among states operating a pre-K program with a specific feature, not the effect of feature adoption itself.

Across most subgroups, point estimates for employment are modestly positive, ranging from approximately 0.2 to 0.6 percentage points. Estimated effects on weekly work hours in the CPS are generally small and not statistically distinguishable from zero, with the exception of mothers with a younger child, who experience an increase of approximately 14 minutes per week. In contrast, ACS estimates are more precisely estimated and range from roughly 10 to 14 minutes per week across most subgroups. Similarly, estimated effects on annual earnings from the CPS are imprecise for most subgroups, with one exception for mothers with a high school degree or less who exhibit a decline of $1,338. In the ACS, all point estimates are positive and generally range from $100 to $600.

In statistically testing the equivalence of the coefficients across subgroups, in the CPS, pre-K funding effects are larger among mothers with younger children than those whose pre-K-age child is the youngest, in all three labor supply outcomes. In the ACS, larger effects are found for mothers with younger children in work hours. These patterns align with the theoretical prediction that mothers who face greater child care cost constraints would show dominant substitution effects, thereby showing larger gains in employment.

In contrast, in the CPS, mothers with higher education showed a significantly larger increase in all labor supply outcomes, and a larger increase in earnings in the ACS. Similarly, in the ACS sample, partnered mothers and mothers of higher-income families showed a larger increase in employment, work hours, and annual earnings than single and lower-income counterparts, although the point estimates were similar in magnitude in the CPS. Although the larger labor supply responses among mothers with younger children are consistent with the standard economic model, the larger gains observed among more resourced are inconsistent with this framework. One possibility not accounted for in the standard economic model is that pre-K programs typically cover only partial work hours, making wraparound care arrangement necessary for workforce participation. Higher-educated and partnered mothers may be better positioned to purchase or arrange such supplemental care, lowering logistical barriers to labor supply adjustment even when financial relief from subsidized care is less binding for them.

Finally, we find no evidence that the marginal effect of pre-K funding differs by program characteristics. Estimates are similar across universal and targeted programs, as well as across

full-day and part-day programs, suggesting that the association between funding and maternal labor market outcomes does not vary systematically by these program features.

[Figure 5 placed here]
[Figure 6 placed here]
[Figure 7 placed here]

Placebo and Robustness Checks

We probe key identifying assumptions. First, future pre-K funding should not predict current employment outcomes. We test whether pre-K funding one year ahead differentially predicts employment outcomes between mothers of 4-5-year-olds and mothers of older children. The results from the CPS and the ACS both indicate that future funding has little additional predictive power over and above current funding levels (Appendix Table A8).

Second, the estimated effects should not capture spurious age-specific trends. In our model, we used two placebo treatment groups of mothers of younger children (ages 0-3, with comparison mothers of children ages 6-7) and mothers of older children (ages 6-7, with comparison mothers of children ages 8-9). In Appendix Table A9, we do not find statistically significant age-specific trends associated with pre-K funding in the CPS, whereas the ACS sample finds statistically significant positive associations for employment, particularly when mothers of younger children were used for the placebo treatment group. This finding could partially suggest mothers of younger children may adjust their labor supply in anticipation of pre-K availability, although we cannot fully rule out the possibility of residual confounds. This is consistent with our rationale for preferring older children as the comparison group rather than younger children and demonstrates potential problems with using mothers of younger children as a comparison in studies of state pre-K programs.

Lastly, pre-K funding should not change demographic outcomes that are unlikely to be causally affected by pre-K policy in the short-term, such as college degree obtainment, immigrant status, and whether the mother lives with a spouse or a partner. Across these placebo outcomes, we do not see any spurious compositional change associated with pre-K funding (Appendix Table A10).

Together, these falsification exercises assess whether our estimates reflect policy-specific responses among mothers of pre-K-age children to current pre-K funding, rather than pre-existing trends or correlation, general age-specific trends, or compositional changes.

We test robustness across four dimensions: alternative comparison groups, model specifications, sample restrictions, and pre-K funding measures. Full details are reported in Appendix Tables A1, and A11 to A16.

Estimates for employment and work hours are highly consistent across 10 of the 12 robustness checks: the estimated employment gains ranged from 0.2 to 0.7 percentage points from the CPS; the estimates ranged from 0.3 to 0.9 percentage points with the ACS (Appendix Tables A1; A11-A12). For work hours, CPS estimates ranged from 0.1 to 0.2 hours a week, while ACS estimates ranged from 0.2 hours to 0.3 hours (Appendix Tables A1; A13 – A14). For annual earnings, while the estimates were sensitive from the CPS, ranging from -$83 to $1,152, most of which are imprecisely estimated due to small sample size, the ACS estimates robustly ranged from $398 to $794 (Appendix Tables A1; A15-A16). The estimates become substantially smaller across all measures when we use mothers of younger children as an alternative comparison group and when we replaced pre-K funding per 4-year-olds to pre-K funding per enrollees.

7. Discussion

This study examined whether state investments in public pre-K programs shape mothers' labor supply, an outcome that matters both intrinsically—for women's opportunities to engage in paid work—and instrumentally, as a potential mechanism for improving the economic resources available to families with young children. Leveraging variation in state pre-K funding over more than two decades, we provide national evidence that increases in public spending on pre-K are, on average, associated with modest but robust gains in maternal employment.

Understanding our results requires contextualizing them within prior work exploring the effects of early education programs on maternal employment. Previous studies that found positive intent-to-treat employment impacts of pre-K availability generally report effects ranging from 1 percentage point to 4 percentage points (Cha, 2025; Ilin et al., 2022; Jackson et al., 2025; Sall, 2014), with estimates for earnings gains ranging from null (Cha, 2025; Fitzpatrick, 2010) to 5.5% (Jackson et al., 2025). In comparison, we find that a $1000 increase in state pre-K funding predicts modest increases across outcomes: approximately a 0.3 to 0.6 percentage-point increase in employment, a 5-minute (not significant) to 15-minute increase in weekly work hours, and a -$98 (not significant) to $663 (1.3%) increase in annual earnings.

Our estimated impacts on employment appear smaller than those reported in past work for several reasons. First, no past study used changes in state funding as the treatment. Rather, these papers typically exploit lottery-based variation in pre-K enrollment (Humphries et al., 2024), variation in pre-K eligibility (Fitzpatrick, 2010; Ilin et al., 2022), or variation in pre-K availability or rollout (Jackson et al., 2025; Sall, 2014). Second, unlike studies focused on a specific state or city, our estimates reflect an average impact across all 50 states over a relatively long panel. As in Ilin et al. (2022), this national scope likely averages over substantial heterogeneity across states, attenuating estimated effects relative to place-based evaluations.

Given these differences in treatment definitions and geographic scopes, direct comparisons of effect sizes across studies are challenging. As a heuristic benchmarking exercise rather than a direct causal comparison, we contextualize our findings by scaling maternal employment effects by corresponding impacts on pre-K enrollment. Our study finds that a $1000 increase in pre-K state funding predicts a 10.9 percentage point increase in the likelihood that four-year-olds are enrolled in state-funded pre-K slots. Jackson et al. (2025), which is the most recent multi-state UPK evaluation, found that UPK expansion in nine states and cities predicted a 14.5 percentage points increase in state-funded pre-K enrollment, using the same enrollment data from the NIEER as this paper, and a 1.4 percentage point increase in employment among young mothers (compared to men). Assuming a linear extrapolation, these results suggest a one percentage point increase in state-funded pre-K enrollment as a result of UPK expansion predicts a 0.1 percentage point increase in employment (effect on employment scaled by effect on enrollment = 1.4/14.5). Comparatively, our results suggest that a one percentage point increase in state pre-K enrollment predicts a 0.028-0.55 percentage point increase in employment (0.3-0.6/10.9). Although the treatments are not directly comparable, our scaled estimates still fall within the estimates reported by Jackson and colleagues (2025).

The magnitude of the estimated impact on maternal employment is comparable to that of other education policies affecting maternal employment. For example, Gibbs et al. (2025) examined the expansion of full-day kindergarten and found that a 10-percentage point increase in the proportion of children in full-day kindergarten predicted a 0.43 percentage point greater likelihood that mothers are employed. Under this comparison, the 0.3 to 0.6 percentage-point increase in employment associated with a $1000 increase in pre-K funding, which predicted

roughly a 10 percentage-point enrollment effect in our data, is roughly equivalent to the employment effects of a 10 percentage-point increase in full-day kindergarten enrollment.

To illustrate the practical implications of these estimates, we situate our findings within the pre-K spending distribution in the early 2000s. In 2002, Rhode Island had no state-funded pre-K program, Iowa was at the 50th percentile of per-child expenditure distribution ($399 per four-year old), and Wisconsin was at the 75th percentile ($1,411 per four-year-old). Applying our estimates, an increase from zero spending to Iowa's median level would be expected to raise the likelihood of employment among mothers by 0.1 to 0.2 percentage points (0.3-0.6/$1000 × $399 = 0.12-0.24) and change mothers' annual earnings by -$39 to $264. An increase from zero to Wisconsin's spending level would be associated with about a 0.4 to 0.8 percentage point increase in employment and a -$138 to $935 increase in annual earnings. In practice, Rhode Island increased per-child pre-K expenditure to $2,054 by 2024. Applying the same logic, this increase corresponds to an implied 0.6 to 1.2 percentage point change in the likelihood that mothers were employed and -$201 to $1,362 of higher annual earnings since 2002. It should be noted that these calculations assume mothers across states and years respond similarly to funding increases and ignore heterogeneity in labor market contexts. As noted, our study likely obscures substantial heterogeneity in the effects of funding on maternal employment outcomes. Thus, these examples should be interpreted as illustrative rather than predictive.

Finally, we can consider our results in the context of the cost of scale-up of UPK in one state. Florida implemented UPK in 2005. From 2002 to 2008, the per-child expenditure increased from $0 to $3,596. Applying our results to this funding change, our results suggest that Florida could have seen an increase in the maternal employment rate of about one to two percentage points (0.3-0.6 × 3.596) and a change in annual income of about -$352 to $2,384 with the introduction of UPK. Notably, Jackson et al. (2025) report a state-specific employment effect of 1.3 percentage points for Florida's UPK introduction, which falls within our estimated range.

Subgroup Heterogeneity

We found significantly larger effects among mothers who had additional children that were younger than the pre-K eligible child. Mothers of multiple young children face compounding child care costs—each child requiring paid care arrangements—making child care costs a particularly binding constraint on labor force participation. This heterogeneity aligns with the standard labor supply theory: when subsidized pre-K reduces child care costs and raises the net return to employment, the substitution effect is likely to dominate the income effect, producing larger employment gains among those most constrained by child care costs. At the same time, this finding appears contradictory to the assumption that mothers with younger children would be insensitive to pre-K because the additional need for child care for the younger children would dampen the incentive for returning to work. This assumption stems from earlier studies on public kindergarten that have documented that employment gains were sometimes (particularly for single mothers) limited to those mothers whose kindergarten-eligible child is the youngest child in the family (Cascio, 2009; Fitzpatrick, 2012; Gelbach, 2002). However, no prior pre-K evaluation has documented the same patterns (e.g., Cha, 2025; Fitzpatrick, 2010; Li, 2020), and our findings indicate that mothers with younger children might be more responsive to pre-K funding. Although speculative, this may reflect pre-K's distinct mixed delivery setting – often a mix of public schools and community-based child care centers – which may allow mothers to arrange care for younger siblings simultaneously, relaxing broader child care constraints in ways that school-based kindergarten cannot.

This pattern, however, sits in some tension with the subgroup findings by socioeconomic groups. If child care cost constraints are the primary mechanism, we would expect the largest gains among the most financially constrained mothers – yet the evidence points in opposite direction. We find some evidence that mothers with greater resources generally show larger increases in labor supply outcomes. This is counterintuitive to the expectation that pre-K should affect those who are most resource-constrained, but the pattern of evidence is somewhat consistent: In the ACS sample, partnered mothers and mothers of higher-income families showed a larger increase in employment, work hours, and annual earnings than their single and lower-income counterparts, although the point estimates among these groups were similar in magnitude in the CPS. Mothers with higher education showed a larger increase in all labor supply outcomes in the CPS and a larger increase in earnings in the ACS. These align with findings from New Haven, Connecticut, which documented larger effects among higher income groups (Humphries et al., 2024), and multi-state analyses, which found significant employment gains among partnered mothers and mothers with a college degree (Ilin et al., 2022; Sall, 2014).

These findings are consistent with the possibility that publicly-funded pre-K may more readily help mothers in the "squeezed middle," whose income is too high for programs targeting children in poverty but too low for private ECE, to increase their workforce participation (Kwon, 2022). Another story that could explain these findings is that mothers without a partner or sufficient wraparound care resources may face challenges leveraging pre-K to (re)enter the labor force or increase work hours. A recent study from Virginia found non-negligible share of low-income children in public pre-K programs received child care subsidies (Rothbart et al., 2026), indicating the need for additional support to address the mismatch between work schedules and pre-K program hours. Together, our work may suggest that pre-K expansions are most helpful for mothers who would be most sensitive to child care costs (i.e., mothers with younger children) and for those who have the resources to address the gap between pre-K hours and work schedules (mothers of higher income families and mothers with partners).

Lastly, across the two samples, we did not find statistically distinguishable heterogeneity in funding effects by key program designs in income eligibility and full-day program hours. While prior studies on pre-K's employment effects often focused on universal pre-K programs with full-day schedules (e.g., D.C., New York City, New Haven, and Georgia), our estimate for funding effects was similar between states with and without universal design and full-day mandates. Thus, our findings indicate that under the different program designs, the funding increase is similarly effective for supporting mothers' employment.

Downstream Effects on Income Poverty and Food Insecurity

We do not find evidence that increases in pre-K funding translate into improvements in broader measures of family economic well-being, including income-to-needs ratios or food insecurity. These results align with prior evidence from the New York City universal pre-K rollout (Cha, 2025), which documented increases in maternal employment without corresponding improvements in income-to-needs or domain-specific material hardship (e.g., food, housing, medical, bill, financial hardship), though overall material hardship declined moderately. Although we cannot examine the possibility that state pre-K may improve overall material hardship with our data, our findings suggest that the magnitude of employment and earnings gains associated with pre-K funding may be too small to generate detectable improvements in income poverty or food hardship.

Conclusions

Extending the literature on the role of public early education in supporting mothers' work (Fitzpatrick, 2010; Gelbach, 2002; Gibbs et al., 2025; Jackson et al., 2025), this study provides new evidence of modest gains in maternal labor supply from pre-K expansions across U.S. states over the first two decades of the 21st century. Although pre-K enrollment is not conditioned on parental employment and programs are primarily designed to benefit children's early learning, our findings indicate that greater public investment in pre-K can support mothers' labor market participation.

Several limitations warrant caution. Our triple-difference design employs mothers of school-age children as a comparison group, which assumes limited effects of pre-K on mothers' longer-term labor force attachment. To the extent that pre-K shapes longer-term employment trajectories, our estimates – particularly for earnings, where prior work documents lasting gains (Humphries et al., 2024) – would be downward biased. Additionally, while our design identifies average associations across diverse state contexts, it cannot speak to local variation in these associations.

Nevertheless, our findings suggest that state investments in pre-K — even absent explicit employment requirements — can modestly expand mothers' labor market participation, with potentially larger gains among mothers managing multiple child care demands. As states continue to expand pre-K access, flexibility in program scheduling and delivery settings, alongside high-quality wraparound care, may strengthen labor market returns for families facing the greatest child care constraints.

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Tables

Table 1. U.S. Evidence on the Effects of Pre-K Policies on Maternal Employment

	Where	Period	Child Age	Treatment unit	Total effect on employment	Subgroups with significant treatment effect
1	Georgia and Oklahoma	2000	Age 4	Program availability (Universal)	-0.9 p.p (1.1, Not significant)	None (examined by presence of younger children and marital status)
2	Georgia and Oklahoma	1977-2011	Age 4	Program availability (Universal)	Not available	Mothers with high school degree or less
3	Washington D.C.	2005-2016	Age 3-4	Program availability (Universal)	+10 p.p (Labor Force Participation)	Unmarried mothers, mothers with all education level (with larger gains for mothers with less than high school degree), low-income (<100% FPL) and high-income (>500% FPL) mothers, White and Black mothers.
4	New Haven, Connecticut	2003-2022	Age 3-4	Program attendance (Universal)	+5.7 p.p (2.6) (TOT)	Parents in neighborhoods of second and third income tertile, White, moms, dads, households with one parent, and two parents (for earnings outcome)
5	New York City	2017-2023	Age 3	Program availability (Universal)	+3.9 p.p (1.8)	Partnered mothers
6	9 states and cities*	1990-2022	Age 0-5	Program availability (Universal)	+1.4 p.p (0.9)	Not available
7	10 states*	1990, 2000, 2005, 2006	Age 4	Program availability (moving from 0% to 100% availability) (Universal and targeted)	+4.4 p.p (1.4)	Married mothers (for both with and without younger child), mothers with a college degree
8	All U.S. states	2010-2019	Age 3-4	Program eligibility (Universal and targeted)	+2.3 p.p (1.3) (Labor Force Participation)	Married mothers, Mothers with college degree, mothers in metropolitan cities, low-income (<200% FPL) and high-income (>400% FPL)

Note: Each row represents the following studies: 1. Fitzpatrick, 2010, 2. Cascio & Schanzenbach, 2013, 3. Malik, 2018, 4. Humphries et al., 2024, 5. Cha, 2025. 6.Jackson et al. (2025). 9 states and cities include Vermont, Georgia, Wisconsin, Oklahoma, Florida, Iowa, West Virginia, New York City, and District of Columbia. 7. Sall (2013). 10 states are Alabama, Florida, Georgia, Kentucky, Louisiana, Maryland, North Carolina, South Carolina, Tennessee, Virginia, which have county-based school districts. 8. Ilin et al. (2022). Otherwise noted, reported estimates are the ITT effects on maternal employment. Standard error of the point estimate is presented in parenthesis.

Table 2. Summary statistics for mothers with 4- and 6-year-old children

	CPS		ACS	
	Mother with 4–5-year-old	Mother with 6–7-year-old	Mother with 4–5-year-old	Mother with 6–7-year-old
Demographics				
Race and ethnicity				
White, NH	59%	57%	60%	57%
Black, NH	13%	13%	12%	12%
Asian/other, NH	7%	7%	9%	9%
Hispanic	21%	22%	20%	21%
Age	34.13	36.27	33.61	36.00
Number of children under age 13	2.29	2.08	2.29	2.06
Completed education				
Less than high school	12%	12%	12%	12%
High school degree	24%	25%	22%	22%
Some college or Associate's degree	28%	29%	31%	32%
Bachelor's degree or more	36%	34%	35%	33%
Immigrant	23%	24%	21%	23%
Number of parents				
One	19%	21%	18%	21%
Two	81%	79%	82%	79%
Labor Supply Outcomes				
Worked last week	61%	66%	64%	69%
Weekly hours worked*	21.00	22.90	24.82	26.91
Annual wage/salary income (2024$)	33,488	35,953	33,006	35,540
Number of observations				
Worked last week	739,717	566,764	818,255	868,529
Weekly hours worked	715,628	548,108	837,468	889,973
Annual wage/salary income (2024$)	110,128	84,790	835,802	888,451

Source: CPS Monthly, CPS ASEC, and ACS (academic year 2002-2024). *Note*: Observations are weighted using individual-level sampling weights. The number of observations varies by outcome due to missing values. Annual wage and salary income is available from CPS ASEC and not from the CPS Monthly survey, resulting in a substantially smaller sample for this outcome. See Section 4 (Data and Measurement), subsection Outcomes, for sample construction details. *Weekly work hours differ by data source: the CPS measures hours worked in the previous week, while the ACS captures respondents' usual weekly hours.

Table 3. Effects of state pre-K funding on state-level pre-K enrollment rates of 4-year-olds

Sample: NIEER	State-funded pre-K			
PK funding$_{st}$ ($1000)	**10.868*** **			
	(1.608)			
Outcome mean	22%			
State-year observations	946			
Sample: CPS	Any ECE	Public ECE	Private ECE	Full-day ECE
PK funding$_{st}$ ($1000)	0.879	1.598	-0.719	**2.113***
	(0.879)	(1.006)	(0.755)	(0.793)
Outcome mean	64%	35%	28%	31%
State-year observations	946	946	946	946
Sample: ACS	Any ECE	Public ECE	Private ECE	
PK funding$_{st}$ ($1000)	**1.397****	**2.031*****	**-0.634+**	
	(0.503)	(0.410)	(0.332)	
Outcome mean	57%	32%	25%	
State-year observations	946	946	946	

Source: CPS October Education Supplement survey and ACS (academic year 2002-2022). *Note*: PK funding is inflation-adjusted to 2024 dollars. The model includes state fixed effects, year fixed effects, and state-level covariates. Standard errors are clustered at the state level. States are not weighted based on population. Full-day program participation cannot be identified in the ACS, thus the cell is left empty. + p<.1, * p<.05, ** p<.01, *** p<.001

Table 4. Effects of state pre-K funding on mothers' labor market outcomes (TWFE)

Panel A	**Mothers with 4-5-year-olds**					
Sample: CPS	Employed	Hours worked	Annual wage	Employed	Hours worked	Annual wage
PK funding$_{st}$ ($1000)	**0.006****	0.116	**1657.179****	-0.003	-0.192	-646.789
	(0.002)	(0.092)	(609.948)	(0.002)	(0.131)	(468.663)
Outcome mean	0.61	21.03	33,461	0.61	21.03	33,461
Observations	739,717	715,628	110,128	619,169	599,193	92,250
State-year and individual covariates	No	No	No	Yes	Yes	Yes
Sample: ACS	Employed	Hours worked	Annual wage	Employed	Hours worked	Annual wage
PK funding$_{st}$ ($1000)	**0.007****	**0.284*****	**1545.509*****	0.000	0.062	250.693
	(0.002)	(0.080)	(416.551)	(0.003)	(0.118)	(279.678)
Outcome mean	0.64	24.82	32,984	0.64	24.82	32,984
Observations	818,255	837,468	835,802	706,295	723,442	720,116
State-year and individual covariates	No	No	No	Yes	Yes	Yes
Panel B	**Mothers with 6-7-year-olds**					
Sample: CPS	Employed	Hours worked	Annual wage	Employed	Hours worked	Annual wage
PK funding$_{st}$ ($1000)	**0.004****	0.038	**1281.025*****	**-0.006+**	-0.221	-226.538
	(0.001)	(0.073)	(346.612)	(0.003)	(0.148)	(507.950)
Outcome mean	0.65	22.92	35,918	0.65	22.92	35,918
Observations	566,764	548,108	84,790	472,682	457,235	70,716
State-year and individual covariates	No	No	No	Yes	Yes	Yes
Sample: ACS	Employed	Hours worked	Annual wage	Employed	Hours worked	Annual wage
PK funding$_{st}$ ($1000)	**0.003***	0.075	**914.760****	-0.001	-0.080	-150.729
	(0.002)	(0.066)	(268.051)	(0.002)	(0.091)	(279.533)
Outcome mean	0.69	26.90	35,520	0.69	26.90	35,520
Observations	868,529	889,973	888,451	748,810	767,960	764,647
State-year and individual covariates	No	No	No	Yes	Yes	Yes

Source: CPS monthly, CPS ASEC, and ACS (academic year 2002-2024). *Note*: PK funding and annual wage is inflation-adjusted to 2024 dollars. All models include state and year fixed effects. State-year covariates are listed in Section 4 (Data and Measurement), subsection State Pre-K Funding, and individual-level covariates are listed in Section 5 (Identification Strategy). Standard errors are clustered at the state level. Observations are weighted using individual-level sampling weights. The number of observations varies by outcome due to missing values. Missing values in state-year covariates also reduced sample size for models including time-varying covariates. + p<.1, * p<.05, ** p<.01, *** p<.001

Table 5. Effects of state pre-K funding on mothers' labor market outcomes (DDD)

	Mothers with 4-5-year-olds, relative to mothers with 6-7-year-olds				
Sample: CPS	Employed last week	Hours worked last week	Annual wage	Hours worked (conditional on employed)	log wage
Treat # PK funding$_{st}$ ($1000)	**0.003***	0.078	-98.443	-0.050	0.006
	(0.001)	(0.051)	(348.924)	(0.045)	(0.006)
Outcome mean	0.61	21.03	33,461	35.13	10.52
Observations	1,306,481	1,263,736	194,918	795,080	114,319
Sample: ACS	Employed last week	Usual weekly work hours	Annual wage	Hours worked (conditional on employed)	log wage
Treat # PK funding$_{st}$ ($1000)	**0.006*** **	**0.247*** **	**663.540*** **	**0.113*** **	**0.013*** **
	(0.001)	(0.035)	(172.068)	(0.029)	(0.002)
Outcome mean	0.64	24.82	32984.44	36.09	10.46
Observations	1,686,784	1,727,441	1,724,253	1,129,307	1,044,879

Source: CPS monthly, CPS ASEC, and ACS (academic year 2002-2024). *Note*: PK funding and annual wage are inflation-adjusted to 2024 dollars. The model includes state-by-year fixed effects, state-by-age fixed effects, and individual-level covariates (the mother's race and ethnicity, age, number of children under age 13 in the household, the highest level of education, immigrant status, and partnered status). Standard errors are clustered at the state level. Observations are weighted using individual-level sampling weights. The number of observations varies by outcome due to missing values. See Section 4 (Data and Measurement), subsection Outcomes, for sample construction details. Findings are robust to a balanced sample restricted to mothers with non-missing values across three outcomes (Appendix Table A1). + p<.1, * p<.05, ** p<.01, *** p<.001

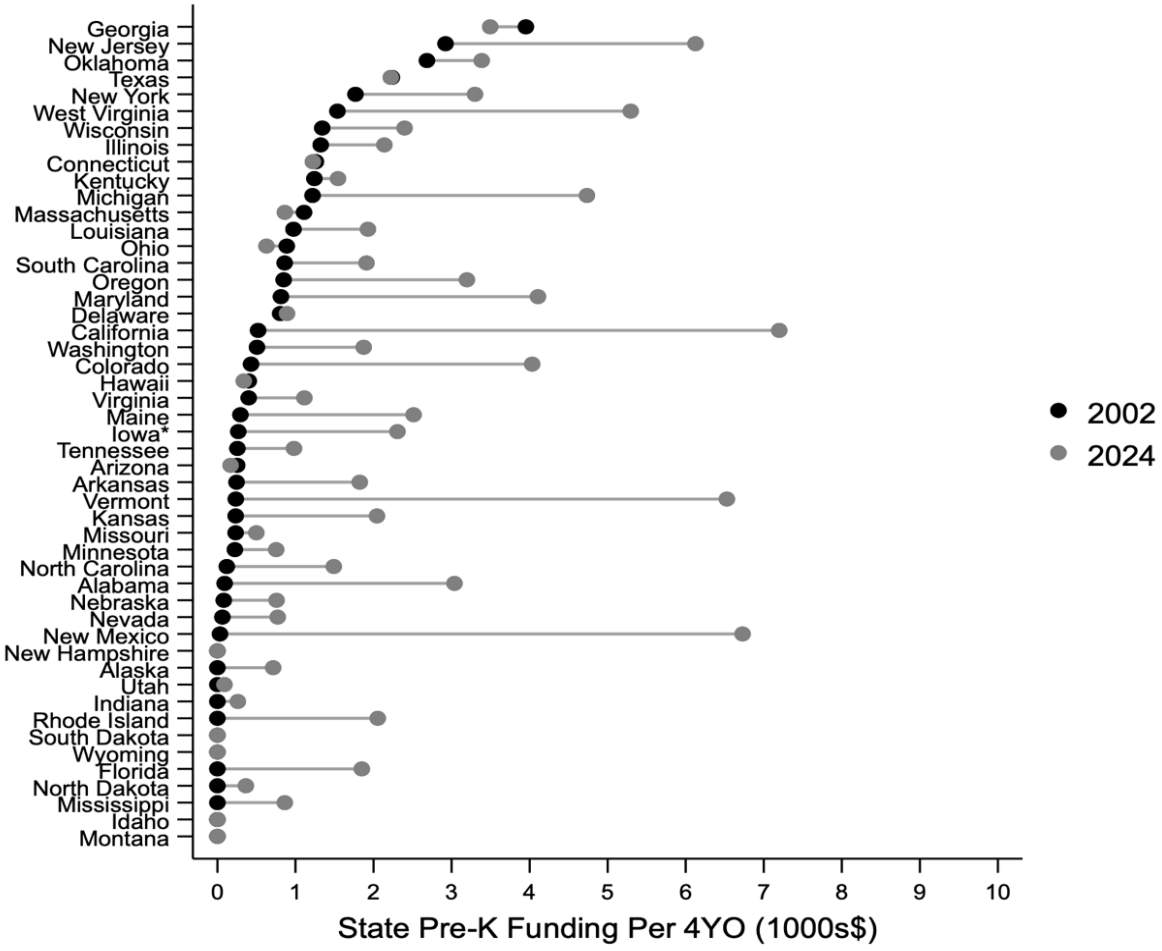
Table 6. Effects of state pre-K funding on household income-to-needs, child care expenses, and food insecurity

	Households with 4-5-year-olds, relative to households with 6-7-year-olds		
Sample: CPS	Income-to-needs (OPM)	Income-to-needs (SPM)	Food insecurity (past month)
Treat # PK funding$_{st}$ ($1000)	0.010	-0.002	0.002
	(0.021)	(0.018)	(0.005)
Outcome mean	3.54	2.46	0.10
Observations	194,918	115,139	72,413

Source: CPS ASEC (academic year 2002-2024 for OPM; 2010-2024 for SPM) and CPS FSS for food insecurity (academic year 2005-2024). *Note*: PK funding is inflation-adjusted to 2024 dollars. The model includes state-by-year fixed effects, state-by-age fixed effects, and the individual-level covariates. The number of observations for the SPM is smaller than for OPM, because the CPS ASEC began collecting SPM since 2009 calendar year. Trends in the income-to-needs and food insecurity outcomes are presented Appendix Figure A1. Standard errors are clustered at state level. Observations are weighted using household-level sampling weights. + p<.1, * p<.05, ** p<.01

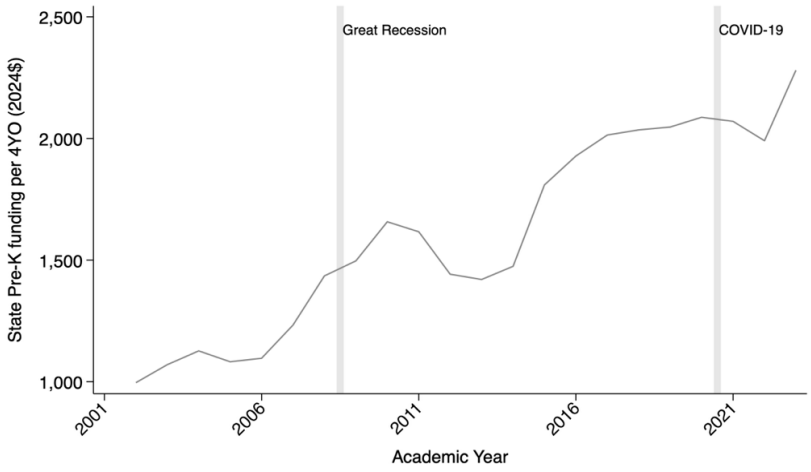
Figures

Figure 1. State Spending on Pre-K Programs in 2002 and 2024



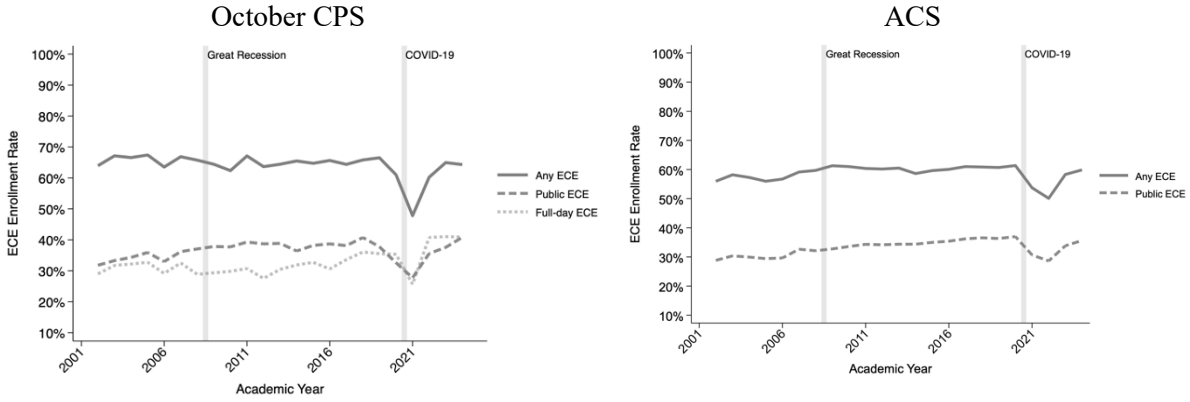
Source: NIEER State Pre-K Funding data, 2002 and 2024 academic years. Data points reflect state spending on pre-K programs per 4-year-old population, in inflation-adjusted 2024 dollars. * = median spending in 2002

Figure 2. Trend in average state spending in state pre-K per 4-year-old (2024 dollars)



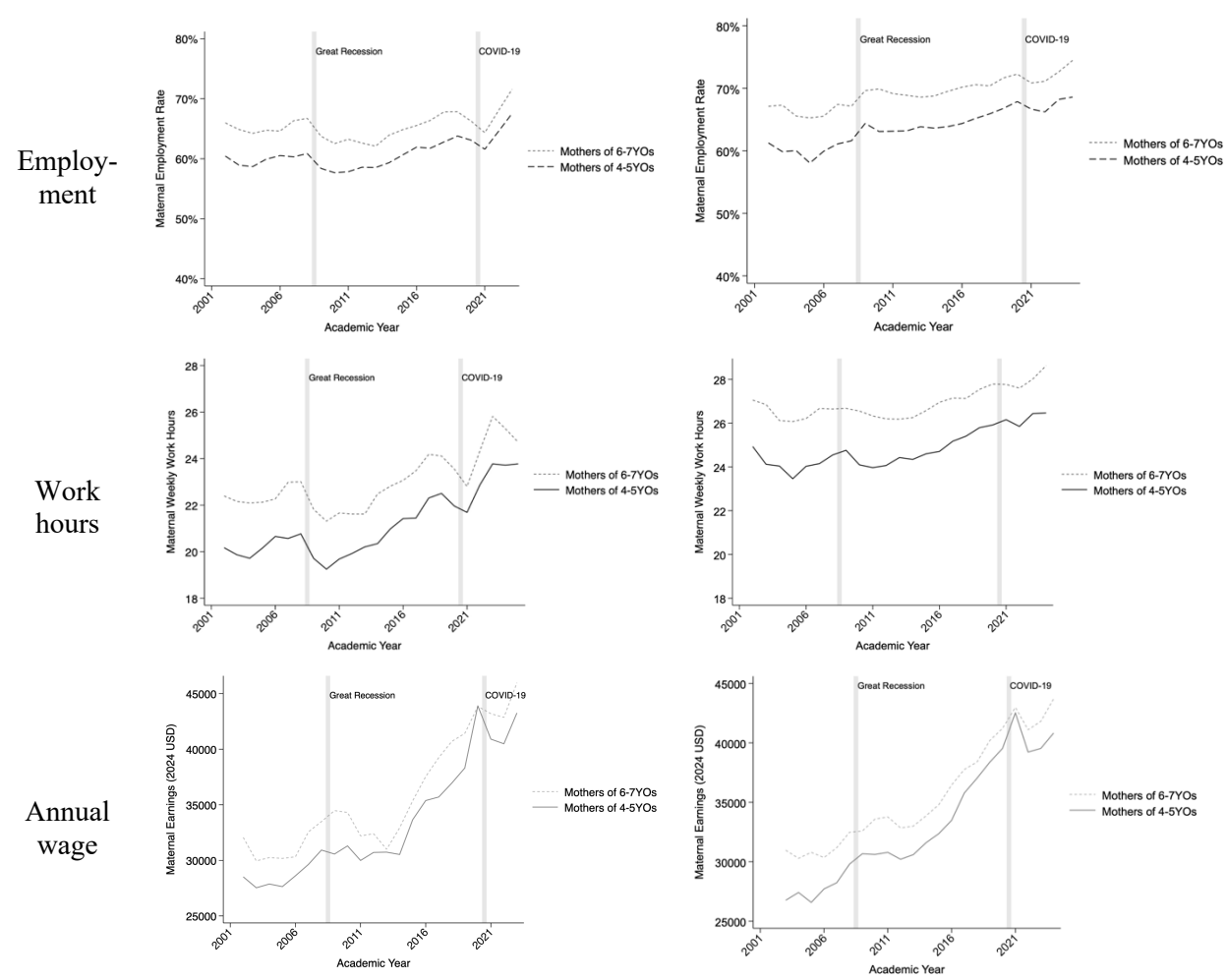
Source: NIEER State Pre-K Funding and enrollment data. State-year observations are weighted by child population.

Figure 3. Trends in preschool enrollment among 4-year-olds



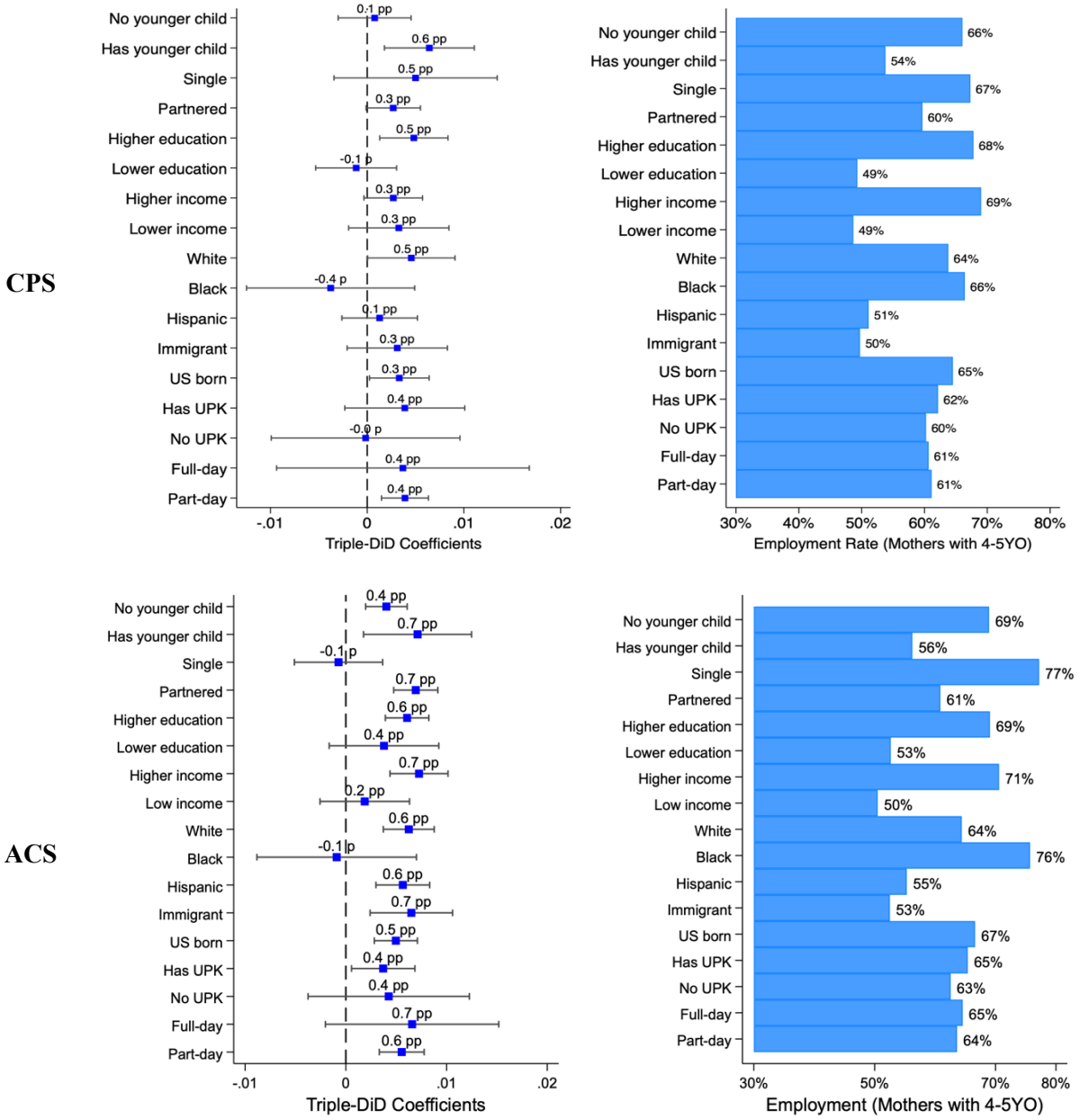
Source: CPS October Survey and ACS (academic year 2002-2024). Observations are weighted using individual-level sampling weights.

Figure 4. Trends in labor market outcomes among mothers with 4-5-year-olds and 6-7-year-olds



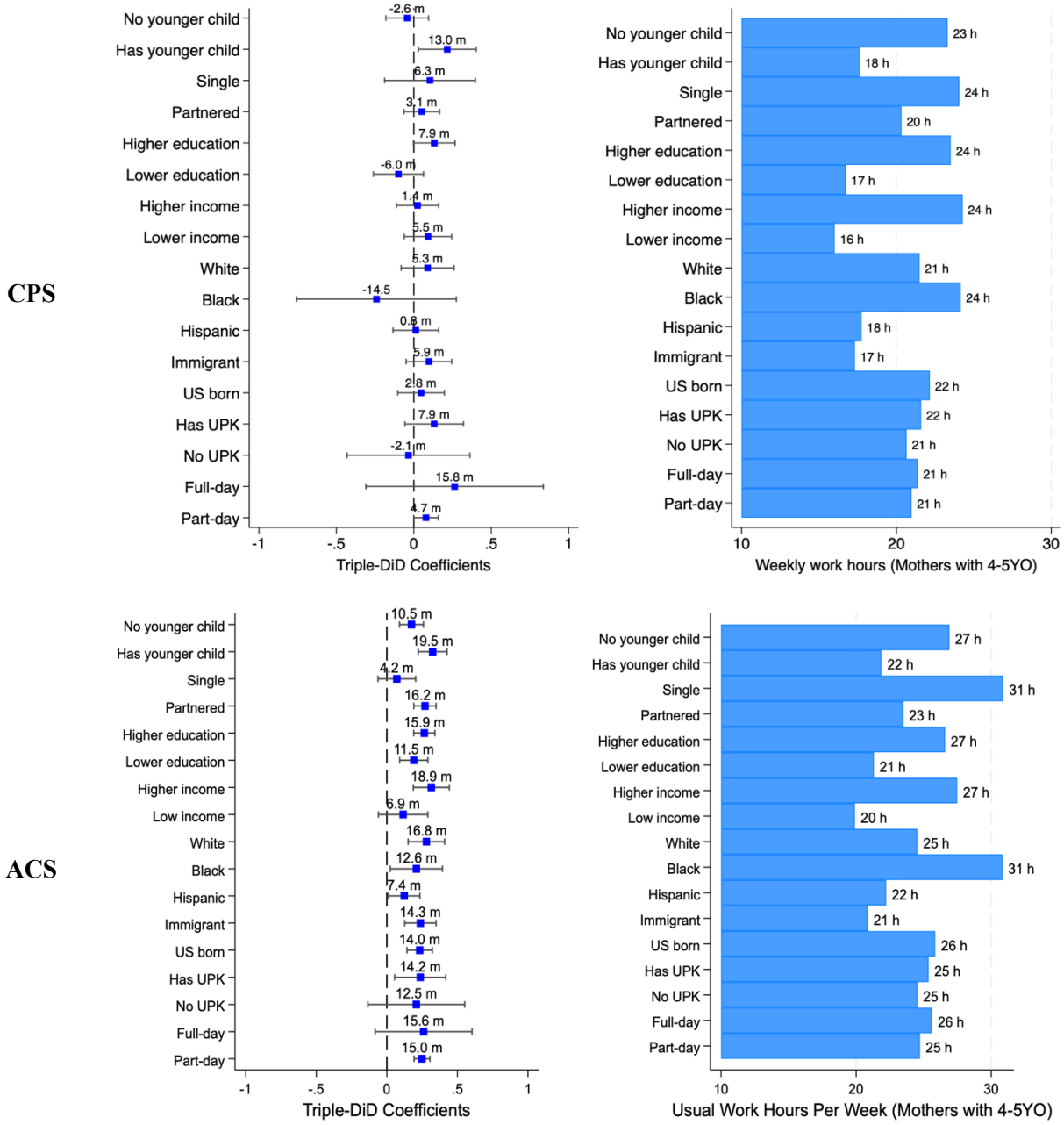
Source: CPS Monthly Survey, CPS ASEC, and ACS (academic year 2002-2024). Observations are weighted using individual-level sampling weights. Weekly work hours differ by data source: the CPS measures hours worked in the previous week, while the ACS captures respondents' usual weekly hours.

Figure 5. Effects of state pre-K funding on mothers' employment, by subgroups



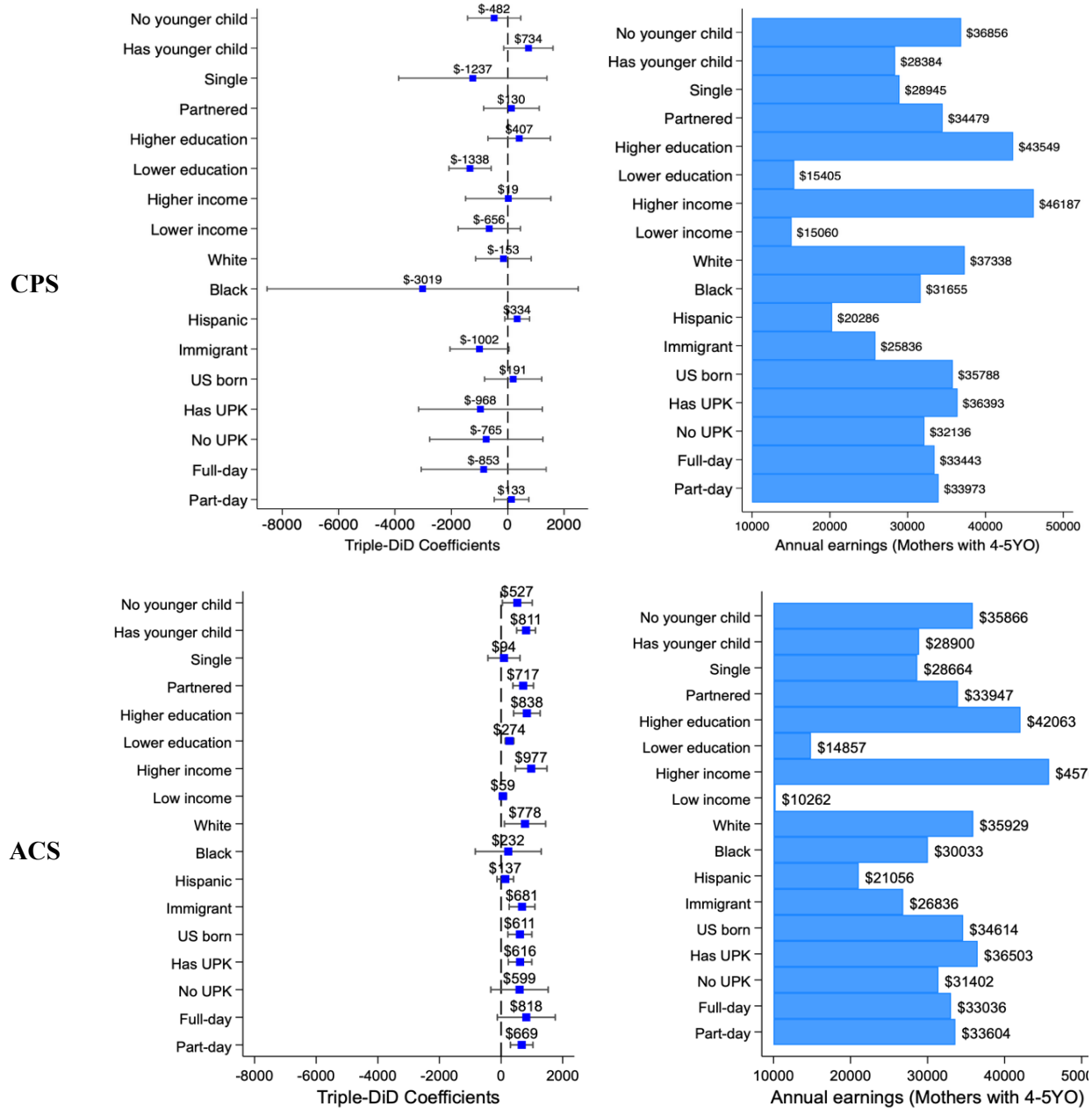
Source: CPS monthly files and ACS (academic year 2002-2024). Note: The left-side figure shows the triple-DiD coefficients and 95% confidence intervals; the right-side figure shows the subgroup-specific employment rate among mothers with 4-5-year-old children. "Partnered" indicates whether the mother lives with a spouse or a partner in the home. "Higher education" refers to mothers with some college education or higher. "Higher income" refers to mothers >185% of the federal poverty line. "Has UPK" indicates whether a state had at least one UPK program in that year. "Full day" indicates whether the state's largest pre-K program operated for at least six hours per day.

Figure 6. Effects of state pre-K funding on mothers' weekly work hours, by subgroups



Source: CPS monthly files and ACS (academic year 2002-2024). Note: The left-side figure shows the triple-DiD coefficients expressed as minutes and 95% confidence intervals; the right-side figure shows the subgroup-specific average weekly work hours among mothers with 4-5-year-old children. "Partnered" indicates whether the mother lives with a partner in the home. "Higher education" refers to mothers with some college education or higher. "Higher income" refers to mothers >185% of the federal poverty line. "Has UPK" indicates whether a state had at least one UPK program in that year. "Full day" indicates whether the state's largest pre-K program operated for at least six hours per day.

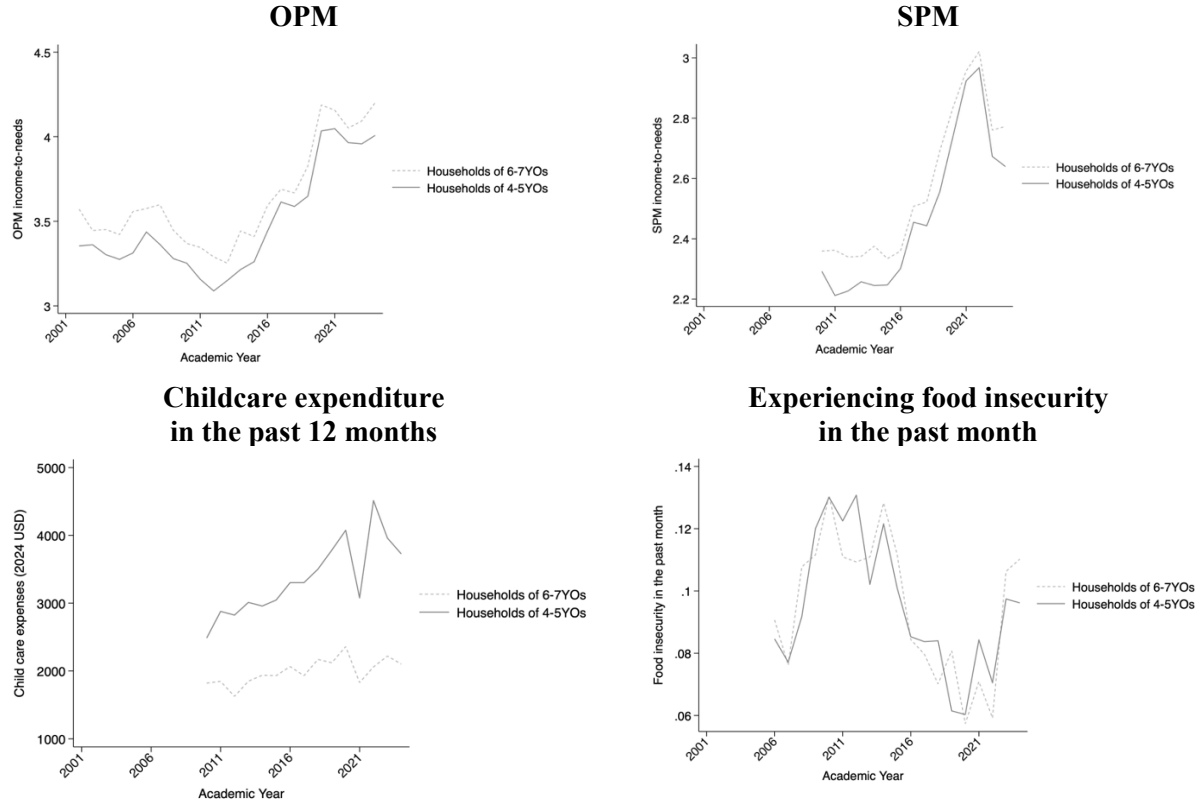
Figure 7. Effects of state pre-K funding on mothers' annual wage earnings, by subgroups



Source: CPS ASEC and ACS (academic year 2002-2024). Note: The left-side figure shows the triple-DiD coefficients expressed as 2024 dollars and 95% confidence intervals; the right-side figure shows the subgroup-specific annual earnings among mothers with 4-5-year-old children. "Partnered" indicates whether the mother lives with a partner in the home. "Higher education" refers to mothers with some college education or higher. "Higher income" refers to mothers >185% of the federal poverty line. "Has UPK" indicates whether a state had at least one UPK program in that year. "Full day" indicates whether the state's largest pre-K program operated for at least six hours per day.

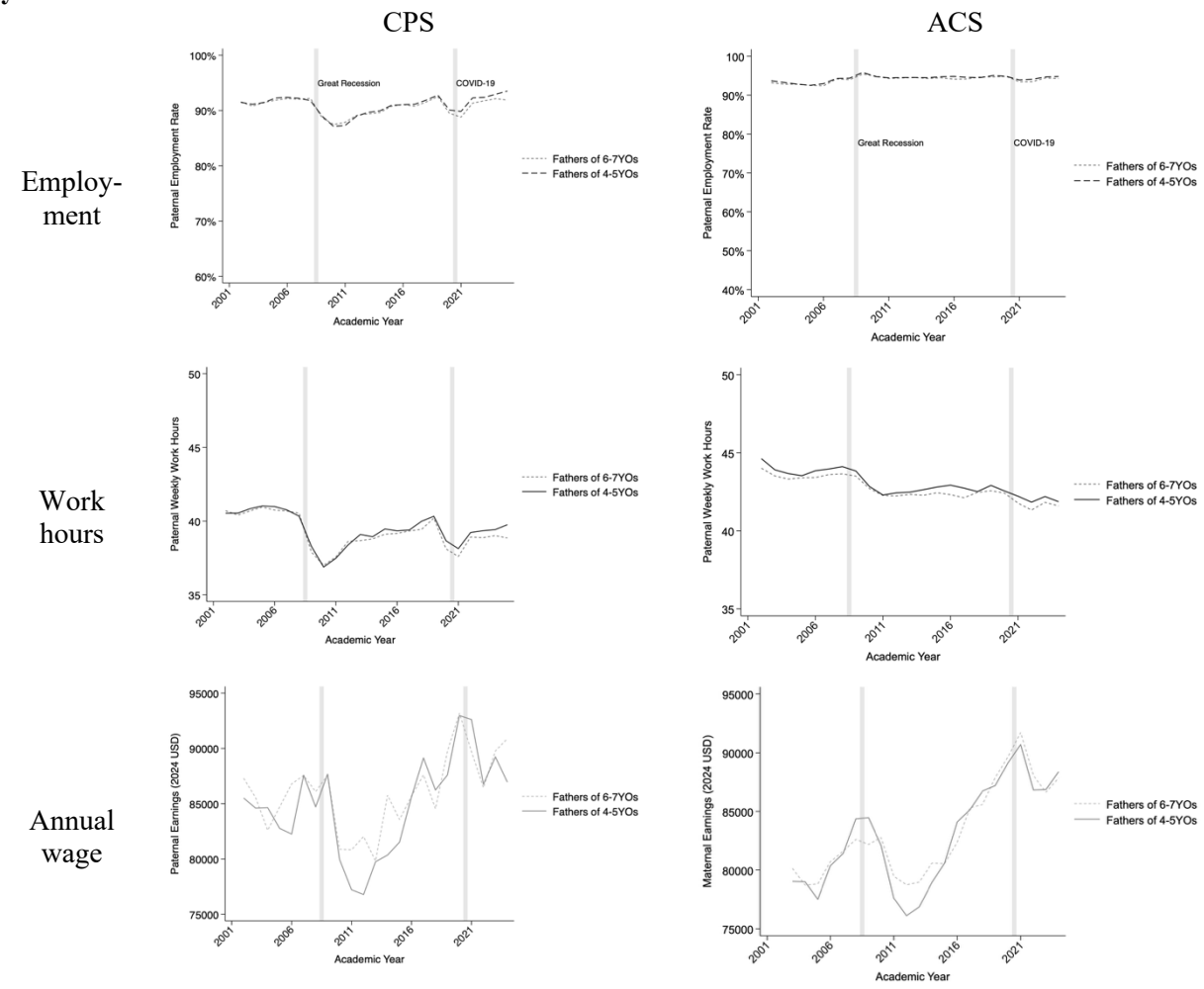
Online Appendix for: The Maternal Labor Market Effects of State Pre-K Funding

Appendix Figure A1. Trends in OPM, SPM, childcare expenditure, and food insecurity among households of 4-5-year-olds and 6-7-year-olds



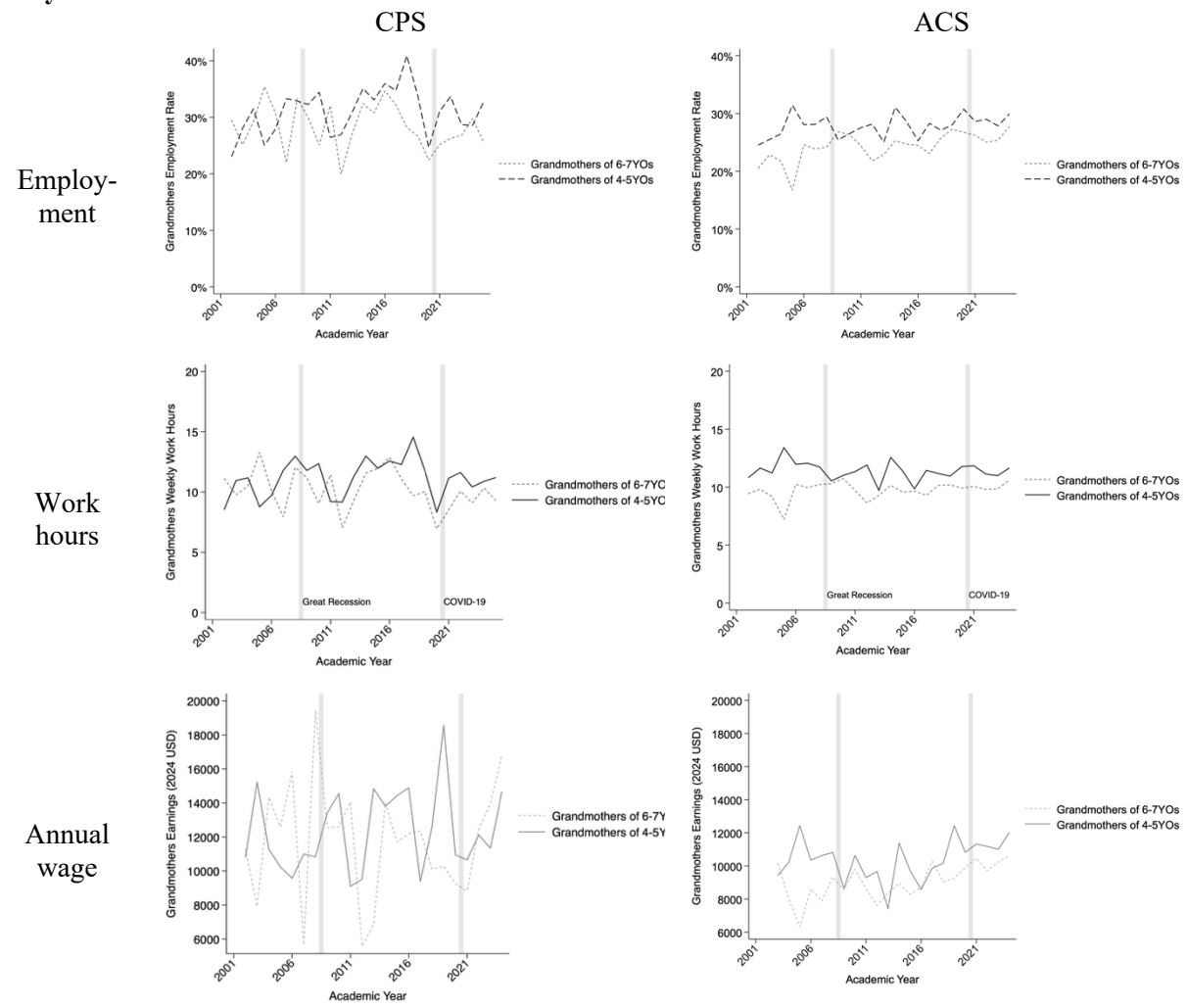
Source: CPS ASEC and CPS FSS. *Note*: Non-imputed SPM and childcare expenditure are available in CPS ASEC from 2010. Food insecurity measure is available in CPS FSS from 2005 survey (2006 academic year). Childcare expenditure is inflation-adjusted to 2024 dollars. Observations are weighted using household-level sampling weights. *** p<.001, ** p<.01, * p<.05, + p<.1

Appendix Figure A2. Trends in labor market outcomes among fathers of 4-5-year-olds and 6-7-year-olds



Source: CPS Monthly Survey, CPS ASEC, and ACS (academic year 2002-2024). Observations are weighted using individual-level sampling weights. Weekly work hours differ by data source: the CPS measures hours worked in the previous week, while the ACS captures respondents' usual weekly hours.

Appendix Figure A3. Trends in labor market outcomes among grandmothers of 4-5-year-olds and 6-7-year-olds



Source: CPS Monthly Survey, CPS ASEC, and ACS (academic year 2002-2024). Observations are weighted using individual-level sampling weights. Weekly work hours differ by data source: the CPS measures hours worked in the previous week, while the ACS captures respondents' usual weekly hours.

Appendix Table A1. Robustness test: Effects of state pre-K funding on mothers' labor market outcomes, with a balanced sample

	Mothers with children ages 4-5, relative to mothers with children ages 6-7		
Sample: CPS	Employed last week	Hours worked last week	Annual wage
Treat # PK funding$_{st}$ ($1000)	**0.006****	**0.234****	-180.639
	(0.002)	(0.079)	(341.016)
Outcome mean	0.60	20.97	33,149
Observations	189,393	189,393	189,393
Sample: ACS	Employed last week	Hours worked last week	Annual wage
Treat # PK funding$_{st}$ ($1000)	**0.006*****	**0.261*****	**715.069*****
	(0.001)	(0.034)	(170.009)
Outcome mean	0.64	24.48	33,747
Observations	1,649,748	1,649,748	1,649,748

Source: CPS monthly, CPS ASEC, and ACS (academic year 2002-2024). *Note*: PK funding and annual wage is inflation-adjusted to 2024 dollars. The model includes state-by-year fixed effects, state-by-age fixed effects, and the individual-level covariates. Observations are weighted using individual-level sampling weights. + p<.1, * p<.05, ** p<.01, *** p<.001

Appendix Table A2. ACS Calendar year merged on the fall of academic year (DDD)

	Employment	Hours	Wage	Hours (conditional on employment)	Log wage
Treat # PK funding$_{st-1}$ ($1000)	**0.006****	**0.239*****	**798.089*****	**0.102***	**0.016*****
	(0.002)	(0.046)	(193.116)	(0.042)	(0.003)
Outcome mean	0.63	24.83	32984	36.09	10.46
Observation	1,648,314	1,687,879	1,722,762	1,104,520	1,044,023

Source: ACS (calendar year 2001-2023). *Note*: PK funding and annual wage is inflation-adjusted to 2024 dollars. The model includes state-by-year fixed effects, state-by-age fixed effects, and the individual-level covariates. Observations are weighted using individual-level sampling weights. + p<.1, * p<.05, ** p<.01, *** p<.001

Appendix Table A3. State-year predictors of total state pre-K funding

	State pre-K Spending per 4-year-old	
	Coef	(S.E.)
Percent of White population	-3.022	(9.295)
Percent of Hispanic population	-25.040	(79.650)
Percent of Black population	**-110.569+**	(56.685)
Percent of Asian or AIAN population	-55.430	(64.420)
Percent of non-US-born population	-105.951	(82.595)
Percent 3 and 4 year olds in population	241.729	(438.966)
Percent population in Poverty	-13.035	(16.035)
State EITC Rate	**9.701***	(4.329)
Mean index of social safety net receipt rate	**147.705***	(63.036)
Percent Total NSLP Recipients	**-24.066+**	(12.554)
Percent Total SBP Recipients	**47.492****	(16.626)
State Minimum Wage	48.600	(36.455)
K-12 per pupil expenditures (2024 USD)	**123.231+**	(69.023)
GSP per capita (2024 USD)	-26.653	(87.532)
Governor is Democrat	54.805	(77.136)
Percent population unemployed	-33.447	(31.013)
Percent CCDF participants in 3 and 4 year old population	1.765	(25.886)
Percent Head Start participants in 3 and 4 year old population	7.241	(51.316)
State adopted Paid Family Medical Leave	252.090	(154.238)
Intercept	529.881	(2007.27)
R-squared	0.893	
N	946	

Source: NIEER (academic year 2002-2022). *Note*: Total Pre-K spending is inflation-adjusted to 2024 dollars. The model includes state and year fixed effects. Standard errors are clustered at state level. All percent and rate variables are scaled on 0 – 100, and one-unit increase represents one-percentage-point increase. + p<.1, * p<.05, ** p<.01

Appendix Table A4. Reverse causality check: Predicting State pre-K funding with lagged state maternal employment rate

Sample: CPS	PK funding	PK funding
Maternal employment rate (lagged by 1 year)	1.963	0.013
	(3.866)	(3.222)
Maternal employment rate (lagged by 2 years)		**11.020***
		(4.869)
Outcome mean	1,147	1,147
Observations	897	897
Sample: ACS	PK funding	PK funding
Maternal employment rate (lagged by 1 year)	1.309	1.364
	(5.137)	(5.442)
Maternal employment rate (lagged by 2 years)		1.075
		(7.319)
Outcome mean	1,147	1,147
Observations	897	897

Source: CPS Monthly Surveys and ACS. The regression model predicts state pre-K funding as a function of maternal employment rates lagged one or two years, controlling for state fixed effects, year fixed effects, and state-level covariates. + p<.1, * p<.05, ** p<.01

Appendix Table A5. Effects of state pre-K funding on the probability of pre-K enrollment among 4-year-olds (Individual-level analysis)

Sample: CPS	Any ECE	Public ECE	Private ECE	Full-day ECE
PK funding$_{st}$ ($1000)	-0.006	0.007	**-0.013**+	0.015
	(0.013)	(0.012)	(0.007)	(0.010)
Outcome mean	0.64	0.36	0.28	0.32
Observations	25,754	25,754	25,754	25,754
Sample: ACS	Any ECE	Public ECE	Private ECE	
PK funding$_{st}$ ($1000)	0.002	**0.010***	**-0.008*****	
	(0.003)	(0.004)	(0.002)	
Outcome mean	0.66	0.42	0.26	
Observations	503,960	503,960	503,960	

Source: CPS October Education Supplement survey and ACS (academic year 2002-2024). *Note*: PK funding is inflation-adjusted to 2024 dollars. The model includes state and year fixed effects, and individual-level and state-level covariates. Standard errors are clustered at state level. Observations are weighted using individual-level sampling weights. Rows for the full-day ECE in the second panel are left empty since full-day program participation cannot be identified in the ACS. + p<.1, * p<.05, ** p<.01, *** p<.001

Appendix Table A6. Carry-over effects: State pre-K funding lagged by 2 years and labor market outcomes for mothers with 6-7-year-old children

Sample: CPS	Employed	Hours	Wage
PK funding$_{st-2}$ ($1000, lagged by 2 years)	**-0.008****	**-0.294****	-232.042
	(0.003)	(0.115)	(732.228)
Outcome mean	0.65	22.92	35,918
Observations	441,657	427,302	66,025
Sample: ACS	Employed	Hours	Wage
PK funding$_{st-2}$ ($1000, lagged by 2 years)	-0.002	-0.123	-304.144
	(0.002)	(0.099)	(210.864)
Outcome mean	0.69	26.90	35520
Observations	727,891	746,419	762,796

Source: CPS monthly, CPS ASEC, and ACS (academic year 2002-2024). *Note*: PK funding and annual wage is inflation-adjusted to 2024 dollars. The model controls for state fixed-effects, year fixed-effects, individual- and state-level covariates. Observations are weighted using individual-level sampling weights. + p<.1, * p<.05, ** p<.01

Appendix Table A7. Effects of state pre-K funding on labor market outcomes for other potential caregivers (fathers and grandmothers)

	Fathers with 4-5-year-olds, relative to fathers with 6-7-year-olds			Grandmothers with 4-5-year-olds, relative to grandmothers with 6-7-year-olds		
Sample: CPS	Employed	Hours	Wage	Employed	Hours	Wage
Treat # PK funding$_{st}$ ($1000)	0.002	0.032	445.269	**0.020*****	**0.821*****	105.203
	(0.001)	(0.065)	(513.400)	(0.004)	(0.192)	(631.475)
Outcome mean	0.91	39.38	85,229	0.30	10.75	12,242
Observations	1,085,871	1,059,257	166,107	31,642	31,308	4,268
Sample: ACS	Employed	Hours	Wage	Employed	Hours	Wage
Treat # PK funding$_{st}$ ($1000)	0.000	**-0.047+**	23.256	**-0.005+**	**-0.401****	**-817.933*****
	(0.001)	(0.026)	(367.763)	(0.003)	(0.139)	(112.626)
Outcome mean	0.94	43.02	82802.08	0.28	11.36	10314.78
Observations	1,484,241	1,520,644	1,502,257	60,139	60,913	60,957

Source: CPS monthly, CPS ASEC, and ACS (academic year 2002-2024). *Note*: PK funding and annual wage are inflation-adjusted to 2024 dollars. The model includes state-by-year fixed effects, state-by-age fixed effects, and the individual-level covariates. Standard errors are clustered at state level. Observations are weighted using individual-level sampling weights. Trends in the labor market outcomes among fathers (grandmothers) are presented in Appendix Figure A2 (Appendix Figure A3). + p<.1, * p<.05, ** p<.01, *** p<.001

Appendix Table A8. Placebo test 1: Effects of future state pre-K funding on labor market outcomes

	Mothers with children age 4-5 relative to mothers with children age 6-7		
Sample: CPS	Employed	Hours	Wage
Treat # PK funding$_{st}$ ($1000)	0.005	0.110	399.933
	(0.007)	(0.270)	(1490.656)
Treat # PK funding$_{st+1}$ ($1000)	-0.001	-0.028	65.790
	(0.006)	(0.225)	(1105.451)
Outcome mean	0.61	21.03	33,461
Observations	1,261,848	1,220,525	189,439
Sample: ACS	Employed	Hours	Wage
Treat # PK funding$_{st}$ ($1000)	0.002	0.309*	955.714***
	(0.003)	(0.137)	(240.704)
Treat # PK funding$_{st+1}$ ($1000)	0.004	-0.009	-194.140
	(0.003)	(0.124)	(208.806)
Outcome mean	0.64	24.82	32,984
Observations	1,607,148	1,646,707	1,642,414

Source: CPS monthly, CPS ASEC, and ACS (academic year 2002-2024). *Note*: PK funding and annual wage is inflation-adjusted to 2024 dollars. The model includes state-by-year fixed effects, state-by-age fixed effects, and the individual-level covariates. Standard errors are clustered at state level. Observations are weighted using individual-level sampling weights. + p<.1, * p<.05, ** p<.01, *** p<.001

Appendix Table A9. Placebo test 2: Age-specific association with pre-K funding among mothers without preschool-age children

	Mothers with children age 0-3 relative to mothers with children age 6-7			Mothers with children age 6-7 relative to mothers with children age 8-9		
Sample: CPS	Employed	Hours	Wage	Employed	Hours	Wage
Treat # PK funding$_{st}$	0.003	0.077	**-571.547+**	-0.002	-0.091	290.616
	(0.002)	(0.083)	(319.599)	(0.001)	(0.056)	(648.213)
Outcome mean	0.59	19.96	32,579	0.67	23.53	36,357
Observations	1,268,741	1,213,140	187,489	1,017,178	983,354	152,881
Sample: ACS	Employed	Hours	Wage	Employed	Hours	Wage
Treat # PK funding$_{st}$	**0.007*** **	**0.134** **	378.131	**0.003***	0.007	**-236.282** **
	(0.001)	(0.042)	(239.525)	(0.001)	(0.031)	(71.868)
Outcome mean	0.67	27.03	35,322	0.71	27.61	35,974
Observations	1,938,285	1,987,084	1,983,701	1,577,550	1,616,066	1,612,128

Source: CPS monthly, CPS ASEC, and ACS (academic year 2002-2024). *Note*: PK funding and annual wage is inflation-adjusted to 2024 dollars. The model includes state-by-year fixed effects, state-by-age fixed effects, and the individual-level covariates. Standard errors are clustered at state level. Observations are weighted using individual-level sampling weights. + p<.1, * p<.05, ** p<.01, *** p<.001

Appendix Table A10. Placebo test 3: Effects of state pre-K funding on demographic outcomes

	Mothers with children age 4-5 relative to mothers with children age 6-7		
Sample: CPS	Obtained college degree	US born	Live with a spouse or a partner
Treat # PK funding$_{st}$ ($1000)	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)
Outcome mean	0.36	0.77	0.82
Observations	1,299,762	1,299,762	1,299,762
Sample: ACS	Obtained college degree	US born	Live with a spouse or a partner
Treat # PK funding$_{st}$ ($1000)	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)
Outcome mean	0.35	0.79	0.82
Observations	1,762,150	1,762,150	1,762,150

Source: CPS monthly, CPS ASEC, and ACS (academic year 2002-2024). *Note*: PK funding and annual wage is inflation-adjusted to 2024 dollars. The model includes state-by-year fixed effects, state-by-age fixed effects, and the individual-level covariates. Standard errors are clustered at state level. Observations are weighted using individual-level sampling weights. + p<.1, * p<.05, ** p<.01, *** p<.001

Appendix Table A11. Robustness test with alternative comparison group and model specification for employment outcome

	Outcome: Employed last week					
Sample: CPS	Compared with mothers with 8-9YOs	Only mothers with 4YOs compared with 6-7YOs	Compared with mothers with 0-3YOs	Exclude covariates	Include state-specific linear trends	Include state unemployment rate interacted with treated status
Treat # PK funding$_{st}$ ($1000)	**0.004***	**0.003***	0.000	**0.006*****	**0.003***	**0.004***
	(0.002)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)
Outcome mean	0.61	0.61	0.61	0.61	0.61	0.61
Observations	1,342,218	1,299,762	1,610,418	1,299,762	1,299,762	1,299,762
Sample: ACS	Compared with mothers with 8-9YOs	Only mothers with 4YOs compared with 6-7YOs	Compared with mothers with 0-3YOs	Exclude covariates	Include state-specific linear trends	Include state unemployment rate interacted with treated status
Treat # PK funding$_{st}$ ($1000)	**0.009*****	**0.006*****	**-0.002+**	**0.007*****	**0.006*****	**0.006*****
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Outcome mean	0.64	0.64	0.64	0.64	0.64	0.64
Observations	1,758,048	1,686,278	2,446,471	1,686,278	1,686,278	1,686,278

Source: CPS monthly and ACS (academic year 2002-2024). *Note*: PK funding and annual wage is inflation-adjusted to 2024 dollars. The baseline model includes state-by-year fixed effects, state-by-age fixed effects, and the individual-level covariates. Observations are weighted using individual-level sampling weights.
+ p<.1, * p<.05, ** p<.01, *** p<.001

Appendix Table A12. Robustness test with alternative sample and funding measures for employment outcome

	Outcome: Employed last week				
Sample: CPS	Pre-COVID period	Include DC	Pre-K funding from all reported sources	Pre-K funding per 4YO, adjusting cost-of-living (2008-2023)	Pre-K funding per 4YO enrollee
Treat # PK funding$_{st}$ ($1000)	**0.005***	**0.003***	**0.003*****	0.002	0.000
	(0.002)	(0.001)	(0.001)	(0.003)	(0.001)
Outcome mean	0.60	0.61	0.61	0.61	0.61
Observations	1,093,913	1,311,940	1,231,240	863,438	1,299,762
Sample: ACS	Pre-COVID period	Include DC	Pre-K funding from all reported sources	Pre-K funding per 4YO, adjusting cost-of-living (2008-2023)	Pre-K funding per 4YO enrollee
Treat # PK funding$_{st}$ ($1000)	**0.006****	**0.006*****	**0.004*****	**0.003**+**	0.000
	(0.002)	(0.001)	(0.001)	(0.002)	(0.001)
Outcome mean	0.63	0.64	0.64	0.64	0.64
Observations	1,308,152	1,688,588	1,649,253	1,287,746	1,686,278

Source: CPS monthly and ACS (academic year 2002-2024). *Note*: PK funding and annual wage is inflation-adjusted to 2024 dollars. The baseline model includes state-by-year fixed effects, state-by-age fixed effects, and the individual-level covariates. Observations are weighted using individual-level sampling weights.
+ p<.1, * p<.05, ** p<.01, *** p<.001

Appendix Table A13. Robustness test with alternative comparison group and model specification for work hours outcome

	Outcome: Weekly work hours					
Sample: CPS	Compared with mothers with 8-9YOs	Only mothers with 4Yos compared with 6-7YOs	Compared with mothers with 0-3YOs	Exclude covariates	Include state-specific linear trends	Include state unemployment rate interacted with treated status
Treat # PK funding$_{st}$ ($1000)	**0.092**+	0.079	-0.010	**0.168****	0.074	0.097
	(0.055)	(0.053)	(0.080)	(0.063)	(0.052)	(0.060)
Outcome mean	21.03	21.03	21.03	21.03	21.03	21.03
Observations	1,297,779	1,257,142	1,542,981	1,257,142	1,257,142	1,257,142
Sample: ACS	Compared with mothers with 8-9YOs	Only mothers with 4Yos compared with 6-7YOs	Compared with mothers with 0-3YOs	Exclude covariates	Include state-specific linear trends	Include state unemployment rate interacted with treated status
Treat # PK funding$_{st}$ ($1000)	**0.326*****	**0.244*****	**0.063**+	**0.282*****	**0.243*****	**0.241*****
	(0.046)	(0.035)	(0.033)	(0.038)	(0.035)	(0.035)
Outcome mean	24.82	24.82	24.82	24.82	24.82	24.82
Observations	1,799,532	1,726,891	2,506,570	1,726,891	1,726,891	1,726,891

Source: CPS monthly and ACS (academic year 2002-2024). *Note*: PK funding is inflation-adjusted to 2024 dollars. The baseline model includes state-by-year fixed effects, state-by-age fixed effects, and the individual-level covariates. Observations are weighted using individual-level sampling weights. + p<.1, * p<.05, ** p<.01, *** p<.001

Appendix Table A14. Robustness test with alternative sample and funding measures for work hours outcome

	Outcome: Weekly work hours				
Sample: CPS	Pre-COVID period	Include DC	Pre-K funding from all reported sources	Pre-K funding per 4YO, adjusting cost-of-living (2008-2023)	Pre-K funding per 4YO enrollee
Treat # PK funding$_{st}$ ($1000)	0.104	0.082	**0.096****	0.013	0.004
	(0.081)	(0.050)	(0.032)	(0.114)	(0.028)
Outcome mean	20.51	21.02	21.03	21.03	21.03
Observations	1,058,577	1,268,901	1,191,046	836,047	1,257,142
Sample: ACS	Pre-COVID period	Include DC	Pre-K funding from all reported sources	Pre-K funding per 4YO, adjusting cost-of-living (2008-2023)	Pre-K funding per 4YO enrollee
Treat # PK funding$_{st}$ ($1000)	**0.324*****	**0.245*****	**0.180*****	**0.159***	0.015
	(0.058)	(0.033)	(0.023)	(0.069)	(0.022)
Outcome mean	24.62	24.83	24.82	24.82	24.82
Observations	1,342,678	1,729,278	1,688,815	1,317,708	1,726,891

Source: CPS monthly and ACS (academic year 2002-2024). *Note*: PK funding is inflation-adjusted to 2024 dollars. The baseline model includes state-by-year fixed effects, state-by-age fixed effects, and the individual-level covariates. Observations are weighted using individual-level sampling weights. + p<.1, * p<.05, ** p<.01, *** p<.001

Appendix Table A15. Robustness test with alternative comparison group and model specification for annual earnings outcome

	Outcome: Annual earnings					
Sample: CPS	Compared with mothers with 8-9YOs	Only mothers with 4Yos compared with 6-7YOs	Compared with mothers with 0-3YOs	Exclude covariates	Include state-specific linear trends	Include state unemployment rate interacted with treated status
Treat # PK funding$_{st}$ ($1000)	443.251	-98.443	**464.056+**	377.255	-74.781	-83.169
	(537.834)	(348.924)	(272.180)	(401.062)	(335.836)	(343.270)
Outcome mean	33,461	33,461	33,461	33,461	33,461	33,461
Observations	201,210	194,918	238,560	194,918	194,918	194,918
Sample: ACS	Compared with mothers with 8-9YOs	Only mothers with 4Yos compared with 6-7YOs	Compared with mothers with 0-3YOs	Exclude covariates	Include state-specific linear trends	Include state unemployment rate interacted with treated status
Treat # PK funding$_{st}$ ($1000)	**666.029*****	**666.029*****	**186.030+**	**794.569*****	**668.285*****	**719.324*****
	(140.786)	(140.786)	(99.993)	(179.440)	(169.610)	(197.741)
Outcome mean	32,998	32,998	32,984	32,984	32,984	32,984
Observations	1,795,070	1,795,070	2,503,531	1,723,671	1,723,671	1,723,671

Source: CPS monthly and ACS (academic year 2002-2024). *Note*: PK funding and annual wage is inflation-adjusted to 2024 dollars. The baseline model includes state-by-year fixed effects, state-by-age fixed effects, and the individual-level covariates. Observations are weighted using individual-level sampling weights.
+ p<.1, * p<.05, ** p<.01, *** p<.001

Appendix Table A16. Robustness test with alternative sample and funding measures for annual earnings outcome

	Outcome: Annual earnings				
Sample: CPS	Pre-COVID period	Include DC	Pre-K funding from all reported sources	Pre-K funding per 4YO, adjusting cost-of-living (2008-2023)	Pre-K funding per 4YO enrollee
Treat # PK funding$_{st}$ ($1000)	-69.315	-54.618	24.495	**1152.387**+	162.125
	(610.207)	(327.048)	(290.418)	(665.387)	(161.218)
Outcome mean	31,214	33,511	33,461	33,461	33,461
Observations	164,601	196,725	184,515	128,886	194,918
Sample: ACS	Pre-COVID period	Include DC	Pre-K funding from all reported sources	Pre-K funding per 4YO, adjusting cost-of-living (2008-2023)	Pre-K funding per 4YO enrollee
Treat # PK funding$_{st}$ ($1000)	**610.181****	**683.670*****	**476.784****	**398.745***	51.219
	(191.866)	(158.439)	(154.557)	(171.699)	(95.485)
Outcome mean	31,960	33,042	32,984	32,984	32,984
Observations	1,333,788	1,726,010	1,723,671	1,346,712	1,723,671

Source: CPS monthly and ACS (academic year 2002-2024). *Note*: PK funding and annual wage is inflation-adjusted to 2024 dollars. The baseline model includes state-by-year fixed effects, state-by-age fixed effects, and the individual-level covariates. Observations are weighted using individual-level sampling weights.
+ p<.1, * p<.05, ** p<.01, *** p<.001