A Matter of Time?
The Impact of Full-day Kindergarten Expansions

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March 21, 2024

Abstract

Over the past thirty years, the prevalence of full-day kindergarten in the United States has nearly doubled. The vast majority of American children now attend full-day kindergarten rather than half-day. This study provides evidence on how the nearly universal intervention of full-day kindergarten affects parents and children. Using the American Time Use Survey, we first show that full-day kindergarten is associated with large differences in how mothers spend their time. Mothers with full-day kindergarteners spend significantly more time at work and significantly less time with their children and performing household duties relative to mothers with half-day kindergarteners. They also spend less time commuting with their children in the middle of the day. Exploiting time and place variation in full-day kindergarten access as measured in the Current Population Survey from 1990-2019, we find that full-day kindergarten increases short-run employment of mothers by 4.7%, suggesting that for some mothers the half-day kindergarten schedule is binding. Despite the rise in maternal employment and reduction in maternal time with children, access to full-day kindergarten does not harm, on net, children's academic outcomes. This evidence improves our understanding of the implications of large-scale public schooling investments on children and parents.

Keywords: early childhood education, kindergarten, maternal labor supply

JEL Codes: H75, I28, J13, J22

*PRELIMINARY AND INCOMPLETE DRAFT. Please do not cite or circulate. *Contact info:* Gibbs: University of Notre Dame (chloe.gibbs@nd.edu); Wikle: Brigham Young University (wikle@byu.edu); Wilson: Brigham Young University (riley_wilson@byu.edu).

1 Introduction

Over the last 30 years, the share of kindergarteners in full-day schooling in the United States has nearly doubled. In a relatively short period of time, states which previously supported only half-day kindergarten programs significantly changed course and began offering (and in many cases mandated) full-day kindergarten programs. Once the exception, full-day kindergarten has become the normative kindergarten context, with over 80 percent of kindergarteners enrolled in full-day programming. This growth is perhaps one of the most dramatic, but least examined changes to the delivery of early childhood education in the United States. We know little about when, where, and among whom the shift to full-day kindergarten participation is the most pronounced. Moreover, open questions remain about the impacts of extending the kindergarten school-day.

Public kindergarten serves a dual function as it invests in children's human capital development while also relaxing time and resource constraints of parents who would otherwise provide for children's care (Cascio, 2009). At school, children learn valuable skills, increase their cognitive capacities, and are supported in their development. And during the time children are at school, parents are able to shift attention to other activities, such as work. This duality in the purpose of kindergarten suggests that the length of school day matters for both children and parents, and that extending the kindergarten school day likely has ramifications for children's academics as well as the way their parents allocate time and resources.

This study explores the impact of the dramatic full-day kindergarten expansions across states and over time on parents and children. We first show descriptively when, where, and among whom the shift to full-day kindergarten participation is the most pronounced. Considering that access to full-day kindergarten for children may change the way parents allocate time and resources, we then show that kindergarten length of day matters for families' time allocation. Given these descriptive patterns, we next leverage the substantial variation in full-day kindergarten exposure across states and over time, and the narrow age targeting of kindergarten, to isolate the effects of full-day kindergarten expansions on parents'—and in particular, mothers'—labor supply and children's subsequent academic performance. This work speaks to the indirect impact of the many state and local education policies around full-day kindergarten on parents and families.

Interventions in the early childhood years have been a focus of policymakers, practitioners, and researchers, as a means to address existing school-entry achievement gaps and to improve the long-term life chances of children from disadvantaged backgrounds. The early emergence of achievement gaps by race, ethnicity, and socioeconomic status has been well-established in the literature (Lee and Burkam, 2002; Murnane et al., 2006), and the evidence on improvements in longer-term outcomes from participation in early

childhood programs is mounting (Campbell et al., 2014; Chetty et al., 2011; Schweinhart et al., 2005). Far less is known about the broader effects of early childhood education interventions on families.

While much attention has been paid in the literature to model preschool programs, to Head Start, and to state-provided public pre-kindergarten programs, full-day kindergarten has actually been a policy tool of choice by states and localities in recent decades. In the United States, kindergarten is viewed as a transition year to formal schooling and nearly all students attend kindergarten. The number of kindergarteners in full-day settings has approximately doubled since 1990, but there is no evidence capitalizing on these expansions across the U.S. to better understand the impact of these public investments on families.

As we contextualize changes in the full-day kindergarten landscape, we show that between 1990 and 2019, the share of kindergarteners in full-day programming has nearly doubled, from 43 to 83 percent. Perhaps surprisingly, early adoption of full-day kindergarten was not driven by states with other, progressive early education policy. The trend began largely in the South, followed by adoption in the Northeast and Midwest, with full-day kindergarten participation lagging in the West. It is also of note that trends in full-day kindergarten participation are similar for across maternal marital status, education level, and child race. There has been a corresponding increase in state-level full-day friendly public policy and public resources, as captured by kindergarten teach-pupil ratios. As more kindergarteners have gained access to longer programming, this has the potential to change the time allocation of mothers and fathers.

Using the American Time Use Survey, we next document, descriptively, how access to full-day kindergarten affects the time allocation of mothers and fathers. Full-day kindergarten access is associated with stark differences in time at work, time spent with children, and time traveling with children. Among mothers with children in full-day kindergarten, patterns of time use are more similar to those of mothers with older school-aged children, while mothers with half-day kindergarten students work less throughout the day, spend more time with children (particularly between 8 AM and 3 PM), and spend significantly more time with children in the car between 11 AM and 1 PM. Meanwhile travel time and total time with children among fathers does not differ by full-day kindergarten status, and fathers with half-day kindergarten students actually spend more time at work than fathers of full-day kindergarten students. These time use patterns are consistent with notions that the expansion of full-day kindergarten has relaxed time and resource constraints of mothers that in ways that facilitate greater maternal labor supply.

We provide the first large-scale evidence on how full-day kindergarten expansions have affected mothers and their ability to engage or engage more intensively in the labor market. The motivating research question is whether parents, particularly mothers, respond to greater full-day kindergarten availability in how they allocate their time and whether and how they engage with the labor market. In this context, we compare labor supply outcomes of mothers with kindergarten-aged children to similar mothers in their state and

metropolitan area with slightly older school-aged children to see if increased access to full-day kindergarten affects the labor supply behavior of mothers with kindergarteners. Our identifying assumption is that employment outcomes of parents with kindergarten aged children would have evolved similarly to employment of parents with older children if access to full-day kindergarten had not expanded. We observe increases in the likelihood that mothers worked at all in the last year, with increases in both part- and full-time work, and more hours and weeks worked. A ten percentage point increase in full-day kindergarten enrollment increases maternal employment in the last year by 0.44 percentage points. These patterns are consistent with the descriptive evidence, that during school hours, mothers of full-day kindergarteners spend less time with children, provide less mid-day transportation for them, and instead use school hours to work more. Increases in full-day kindergarten enrollment have no correspondingly effect on the labor supply of fathers. Analyses of subgroup effects suggests that they were fairly broadly realized and not solely concentrated among disadvantaged mothers, as prior research has seen for other public schooling expansions. This finding aligns with the fact that full-day kindergarten expansions generally pull more advantaged populations into full-day settings, as full-day kindergarten had previously been a targeted intervention aimed at disadvantaged children. These estimates are robust to leaving out MSA-by-year fixed effects, including individual and family controls, restricting to the pre-COVID time period, or restricting to the non-South. We find similar effects of full-day kindergarten access when we use state-level full-day kindergarten policy changes to instrument for full-day kindergarten access.

Ultimately, changes in investments in children both at school and at home have implications for child development. Full-day kindergarten access is associated with less mother-child time and more maternal employment. It is possible these changes in time use are detrimental to child development and outweigh any benefit from spending more time at school. As this is an empirical question, we also explore the subsequent effects on children's academic achievement. To do so, we exploit the variation in full-day kindergarten penetration across states and over time, during this period of dramatic full-day kindergarten expansions. To better understand the net effect on child outcomes, we use a similar identification strategy to explore the effect of full-day kindergarten access on children's long-run test scores. We find that a ten percentage point increase in full-day kindergarten penetration increases third grade test scores by 0.02 standard deviations but that this gain fades out by eighth grade. As such, it appears that the trade off between school-time and maternal time investments associated with full-day kindergarten access does not harm children's academic outcomes in the short run, and may in fact boost performance in math and for particular subgroups.

The paper proceeds as follows. Section 2 discusses the rationale for studying this question, reviews previous related research, and presents trends in full-day kindergarten access. Section 3 documents how parental time use differs by their children's full-day kindergarten status. Section 4 details the analysis of

parental labor supply, including the data and empirical strategy. In Section 5, we summarize the results of the labor supply analysis for parents, and in Section 6, we discuss implications for child outcomes and results for children's test scores. Section 7 concludes.

2 Motivation and Full-Day Kindergarten Trends

Investment in early childhood has gained significant traction in recent years as an efficient and equitable means to compensate for the impoverished developmental environments in which many disadvantaged children grow up (Currie, 2001; Heckman, 2000; Heckman and Masterov, 2007). The developmental literature has coalesced around the notion that children experience declining developmental plasticity and thus early investments—by altering cognitive and social skill development when the brain is most malleable and able to adapt its functioning—are more likely to substantially and permanently affect long-term life chances (Knudsen et al., n.d.; Shonkoff and Phillips, 2000).

There is also a growing body of empirical evidence that early childhood programs reap long-term effects for participants, generating substantial private and social returns that far outweigh program costs. Long-term evidence from the Abecedarian Project, Boston pre-kindergarten programs, Head Start, the Perry Preschool Project, and the Project STAR class-size reduction intervention suggests that interventions in the preschool and early school years can have substantial effects on schooling attainment, labor market success, and other measures of adult health and well-being (Chetty et al., 2011; Deming, 2009; Gray-Lobe et al., 2022; Schweinhart et al., 2005). Improvements include better health and higher rates of college-going (Campbell et al., 2014; Dynarski et al., 2013). These "existence proofs" have focused significant attention on the early childhood years, but far less is known about how to implement programs effectively at scale, whether programs should be targeted or universally provided, and at what age programs are most effective. And while the evidence base on participant effects is growing, very little is known about the effects of such interventions on the parents and families of those exposed, particularly in current contexts and in light of large and growing public investments in the early childhood years more recently.

Existing evidence suggests that public schooling can function as subsidized childcare. From a theoretical perspective, this points to the expansion from half to full-day provision as a factor that could affect mothers' labor force participation. In this vein, estimated childcare cost elasticities of maternal employment range from 0 to approximately -1, with the most credible estimates between -0.1 and -0.5 (Anderson and Levine, 1999; Morrissey, 2017). Overall, subsidization of childcare for young children contributes to increased maternal employment (Blau and Currie, 2006; Blau and Tekin, 2007; Herbst, 2010; Tekin, 2007).

While overall childcare cost elasticities are relevant, there is also evidence that speaks specifically to the

effects of public education on women's labor force attachment that generally finds that school enrollment increases maternal labor supply, often concentrated among certain subgroups of women (Barua, 2014; Cascio, 2009; Gelbach, 2002). Using birthdate-based school enrollment rules, Fitzpatrick (2012) finds that the labor supply of single mothers of five-year olds without additional young children increases as a result of a child's enrollment in public kindergarten, but is unchanged for other mothers. Similarly, evidence from expansions to Head Start in the 1990s and from the randomized Head Start Impact Study shows that access to the federally-funded preschool program for young children from disadvantaged households increases employment and earnings of single mothers (Wikle and Wilson, 2023). Cascio and Schanzenbach (2013) find a positive effect on maternal employment among mothers of four-year olds, as compared to mothers of five-year olds, when universal preschool was introduced in Georgia and Oklahoma, concentrated among mothers with high school diplomas or less schooling. There was no effect among mothers with some college or more.

In a paper that looks specifically at full-day kindergarten impact and maternal employment, among other outcomes, the authors use state-level policies in the 1990s (Cannon et al., 2006). They find that mothers are more likely to work full-time in the kindergarten year when full-day kindergarten is provided, but they are unable to use cross-time variation and their work precedes substantial increases in full-day kindergarten provision (Cannon et al., 2006). A recent paper explores the impact of full-day kindergarten rollout in Ontario, Canada on maternal labor supply (Dhuey et al., 2021). The authors find no extensive margin response, but do document increases in hours worked in a week and decreases in absenteeism. Somewhat consistent with other literature, these effects are realized by mothers with kindergarten-aged children and are concentrated among nonimmigrant mothers with low education levels, urban residences, and only one child (Dhuey et al. (2021)). The existing evidence is certainly suggestive that full-day kindergarten expansions that provide public schooling as subsidized childcare may affect the labor market attachment of marginal mothers.

To more fully understand the relationship between full-day kindergarten policies and household decision-making, this study seeks to explore the effects of full-day kindergarten expansions on families, through maternal employment, time use, and child outcomes. This study complements and extends the existing literature in a few ways. First, the research design relies on a quasi-experimental approach, leveraging differential exposure to kindergarten policy changes by geography, over time, and relative to similar mothers with slightly older children to generate plausibly causal estimates of program impacts. We also use policy instruments to capture plausibly exogenous changes in access. The study focuses on compositional changes in full-day kindergarten attendees to better understand who is affected by policy changes, particularly when an intervention shifts from a targeted approach to near-universal availability. Finally, we focus on a range of outcomes to better understand the interaction of full-day kindergarten policies and families' decision-making

and resource allocation. Time use, maternal employment, and child academic progress are important pieces of better understanding how early childhood education policy affects children and families. No work to date has leveraged the large changes in full-day kindergarten policy across the U.S. in the 1990s and 2000s to look at these outcomes of interest.

2.1 Full-day Kindergarten: Trends and Policy Context

Although the federal government releases administrative data on total state-level kindergarten enrollment, these data do not differentiate between full-day and half-day enrollment. There is no administrative data source that provides full- and half-day kindergarten enrollment separately. To document the expansion in full-day kindergarten enrollment we rely on the Current Population Survey (CPS) October School Enrollment Supplement. The October Supplement is completed by between 100,000 and 150,000 individuals each year in October and includes schooling related questions, including the grade or level of schooling in which household members are currently enrolled. Importantly, full-day and half-day kindergarten are reported as separate levels. As such we can estimate state-level averages and trends over time in the share of kindergarteners enrolled in full-day kindergarten. On average, just over 1,800 kindergarten students are included each year. Because of the small kindergarten sample, we do not estimate full-day enrollment rates for geographic areas smaller than states. We also construct three-year rolling averages (-1,0,+1) to reduce measurement error from small samples in some states. We exploit this October Supplement data to document descriptively the changes in the full-day kindergarten landscape over time. More details related to the CPS October Supplement are included in the data appendix.

Full-day kindergarten as a policy lever has been an area of considerable activity over the past three decades. The structure of kindergarten has changed significantly over time. As depicted in Figure 1, full-day kindergarten eclipsed half-day provision as a proportion of all kindergarten enrollment in 1995 and now constitutes greater than three-quarters of kindergarten enrollment in both private and public schools.[1] There has not been a corresponding change in full-day pre-school enrollment during this time period. Notably, recent increases in full-day kindergarten access are driven by expansion in public schools (Appendix Figure A2).

Both levels and trends of full-day kindergarten vary by Census region (Figure 2. Ever since 1990 the full-day kindergarten share in the South has been high, starting at 71 percent, and rising to 86 percent by 2019. The growth in the other Census regions has been more pronounced. Full-day enrollment in the Northeast started at a moderate level in 1990 (45 percent) but had slightly surpassed the South at 87 percent

[1]Patterns are similar if we look at the share of 5-year-olds enrolled in full-day kindergarten, suggesting this is not driven by increases in kindergarten attendance (Appendix Figure A1).

by 2019. The West and the Midwest both had low full-day kindergarten shares at 24 percent in 1990, but full-day enrollment in the Midwest has grown rapidly to match the South and Northeast at 86 percent in 2019, while full-day enrollment has grown at a slower rate in the West, only reaching 73 percent by 2019. These regional trends mask considerable variation across states, with many Southern states maintaining near complete full-day enrollment over the entire period, and some states in the West (Idaho and Utah) never reaching 50 percent full-day enrollment shares (Appendix Figure A3).

The increase in full-day enrollment is demographically, broad based. As seen in Figure 3, the patterns are fairly similar by race, maternal marital status, and maternal education.[2] Non-Hispanic Black children, and children with never married mothers have higher full-day enrollment shares initially, but these too converge by 2019. These patterns are consistent with the shift from full-day kindergarten as a policy intervention targeted towards low-income households to universal policy.

To a large extent, the increase in full-day kindergarten enrollment is correlated with state-level policy. Over this time period we see a corresponding rise in state-level full-time equivalent kindergarten teachers, the number of states requiring districts to provide full-day options, and the number of states passing other legislation that encourages full-day kindergarten (Figure 4). There was brief federal attention on full-day kindergarten during the Obama Administration, but the policy activity on full-day kindergarten has all taken place at the local and state levels. Several states have made considerable legislative efforts towards full provision of full-day, including Arizona, Indiana, Ohio, Oregon, and Minnesota. While only 11 states formally define full-day kindergarten in state statute, 24 states specify a funding formula that funds full-day kindergarten at or above the level of funding for first grade (Parker et al., 2016). Interestingly, while full-day kindergarten participation has increased substantially over time, other aspects of the early childhood experience have remained relatively stable, including preschool and Head Start participation (see Appendix Figure 1).

As enrollment in full-day kindergarten has increased, underneath enrollment rates are supporting policy changes at the state level that have increased access to and funding for full-day public kindergarten (Figure 4). A scan of databases maintained by the Education Commission of the States and the National Conference of State Legislators, as well as internet and LexisNexis searches of individual states' legislative histories, revealed two main categories of state legislation related to full-day kindergarten: (1) mandates that require school districts to offer full-day kindergarten, and (2) full-day-friendly policies that encourage, fund, or otherwise facilitate expansion, but fall short of a requirement. The latter category includes legislation that provides more funding for full-day kindergarten, alters the funding formula for kindergarten students to incentivize full-day kindergarten provision, or otherwise induces or supports greater full-day kindergarten

[2]Given the higher initial levels in the South we plot demographic trends separately for the South and Non-South.

availability. We construct two corresponding policy instruments. The first policy instrument captures full-day kindergarten legislative mandates with clear implementation dates. The second policy instrument is broader in coverage and includes both mandates and "softer" legislative efforts that were supportive of full-day kindergarten provision and expansion.

3 Full-day Kindergarten and Parental Time Use

Given the dramatic changes in the share of households who have access to full-day kindergarten, often as a result of state-level policy, it seems plausible that this would affect the way that families, and particularly primary caregiver parents spend their time. To descriptively explore how having a child in full-day versus half-day kindergarten relates to mothers' and fathers' time use on school days, we use data from the American Time Use Survey (ATUS) from 2003-2019 (Flood et al., 2023a). The ATUS sample used in this study includes parents with a full-day kindergartener, half-day kindergartener, or second grader (for comparison) based on a linked October supplement from the CPS. In addition, the sample is restricted to parents who were surveyed on weekdays during the school year. This left a sample of 1,167 mothers and 778 fathers. Demographic characteristics of parents of half-day kindergarteners and parents of full-day kindergarteners were generally similar. [3]

We provide estimates of mothers' and fathers' time use separately if they have a full-day kindergarten child, a half-day kindergarten child, or a second grader (for reference). These estimates capture both selection and any treatment effect associated with attending full-day kindergarten. We see descriptive evidence that a child's kindergarten context corresponds to large differences in parental time use on school days. Table 1 reveals large differences in time use between mothers of half-day kindergarten children and mothers of full-day kindergarten children (see column 7). Mothers whose children attend a full day of school work an additional 60 minutes more than their counterparts with children in half-day school. Mothers of full-day kindergarten children look most like mothers of second graders who have access to full-day school for their slightly older children (see column 8). For example, there is no difference in market work time when comparing mothers of full-day kindergarteners and mothers of second graders.

Table 1 suggests that when a family has a child in half-day kindergarten, mothers are the ones who usually show increased investments in child and home domains and are less attached to market work. Gender gaps in work time and parental time with children are largest among parents of half-day kindergarteners (columns 9 to 11). Mothers of full-day kindergarteners spend 57 minutes less each day with their children compared to mothers of half-day kindergarteners (with a larger gap when considering only time with young

[3] Detailed information about the sample and time use variable construction is found in the data appendix.

children). Although overall time with children differs for mothers of half- versus full-day kindergarteners, most measures of quality time investments thought to be important for development are not sensitive to a child's kindergarten context. Daily one-on-one time, quality time, reading, physical care, academic time, time spent in direct childcare are the same for all mothers of kindergarteners. Mothers of full-day kindergarteners spend more time with children than mothers of second graders overall, which is not surprising considering some of the gap can be attributed to known decreases in parental time with children as children age (Wikle and Cullen, 2022).

Differences in overall time prompt questions about family tempo—whether parent-child interactions and reduced work hours seen for mothers of half-day kindergarteners happened during typical school hours. Figure 5 delineates time use of mothers and fathers through the day to emphasize differences in timing on school days when children attend full- versus half-day kindergarten. We focus on three main categories of time use: time working, time with children and time traveling with children. Mothers of full-day kindergarteners are over 10 percentage points more likely to work during school hours than mothers of half-day kindergarteners and only slightly less likely to be working than mothers with second graders. The patterns in maternal employment converge around 5pm, with slightly more mothers of half-day kindergarteners working in the evening than mothers with full-day kindergarteners. For fathers, the pattern reverses, with fathers of half-day kindergarteners about 10 percentage points more likely to be working during school hours than fathers of full-day kindergarteners.

Mothers of full-day kindergarteners spend less time with children during school hours compared to mothers of half-day kindergarteners, suggesting families of half-day kindergarteners do not completely replace the missing school hours with out-of-home childcare. For fathers we observe virtually no differences in time with children throughout the school day. One of the most stark differences between full-day and half-day kindergarten families is in midday travel. Interestingly, mothers of full-day kindergarteners don't often travel with children in the middle of the day, whereas mothers of half-day kindergarteners are two or even three times more likely to be traveling with children between 11am and 1pm, suggesting differences in transportation needs in families with half-day kindergarteners. Fathers do not differ in their midday travel patterns based on kindergarten context. These results are descriptive. They combine both differential selection between full-day and half-day kindergarten families and any effect of full-day kindergarten access on time use. However, these patterns suggest that parents' time use, and particularly mothers', is sensitive to a child's kindergarten schedule. The half-day kindergarten schedule might introduce constraints that affect mothers' ability to spend their time doing other things, such as market work. We turn attention now to better identified models to shed light on how full-day kindergarten access affects parental labor supply.

4 Empirical Approach

We investigate the impact of greater full-day kindergarten provision using variation in the full-day kindergarten share across states and over-time, and by comparing parents of kindergartens to parents of older children. As much of the variation in full-day kindergarten provision is induced by state-level policy changes, we also provide estimates where we exploit variation when states implemented policies to scale up, immediately or over time, to full provision of full-day kindergarten.

4.1 Data

To explore impact of full-day kindergarten expansions on outcomes, this study primarily relies on the 1990-2021 Current Population Survey (CPS) October School Enrollment Supplement for full-day kindergarten data and the 1992-2021 repeated cross-sections of the Annual Social and Economic Supplement (ASEC) of the CPS, a detailed survey of more than 75,000 households conducted each March, for employment outcomes (Flood et al., 2023b).

To understand parental labor supply responses to full-day kindergarten access we use the 1992-2021 CPS ASEC. We restrict the sample to parents with a child between the ages of 5 and 9 in the home, and examine patterns separately for men and women. Using the household roster, we are able to identify parents who have a kindergarten aged child in March (ages 5 and 6) or a slightly older grade-school-aged child (ages 7 to 9). We merge the individual ASEC observations in March to the state-level full-day kindergarten enrollment share constructed from the October supplement in the preceding calendar year, to capture state-level full-day enrollment in the same academic year.

In the ASEC, we observe two types of labor supply outcomes. First, we observe the individuals reported labor force participation and employment status in the week prior to the survey. The ASEC is conducted in March. We also observe retrospective outcomes, relating to the individual's labor supply during the previous calendar year, including whether the individual worked in the last year, whether or not the individual worked full-time or part-time in the previous year, usual hours worked during the past year, weeks worked in the past year, and individual wage income during the previous calendar year. We also observe demographic measures including race, marital status, and educational attainment.

Our main explanatory variable of interest is a measure of local full-day kindergarten availability for each family. We use the three-year rolling average proportion of full-day kindergarten students in each state for each year constructed from the CPS October Supplement, as described above. This measure provides a state-by-year measure of full-day kindergarten access. Combined with within-place variation, we estimate

how increased full-day access affects parental labor supply.

4.2 Estimation Strategy

As seen in Figure 1, there has been a dramatic increase in full-day kindergarten enrollment over the past 30 years, with the share of kindergarteners in full-day kindergarten nearly doubling between 1990 and 2020. Kindergarten teacher-student ratios and the presence of state-level full-day access mandates or other full-day-friendly policies have experienced a similar trend in growth over this same time period. This study employs a quasi-experimental approach, leveraging variation in the provision of full-day kindergarten across states and over time. One concern is that the states and labor markets that select into more full-day kindergarten provision are selected in ways that are correlated with potential outcomes, such as maternal employment or children's test scores. For example, people in areas with upward trending female labor force participation might lobby state leaders for broader full-day kindergarten access. This would introduce bias into our estimates. To overcome this potential bias, we exploit within-state and within-local labor market variation in whether or not full-day kindergarten access is applicable for a given individual. We explore how state-level increases in full-day kindergarten provision affects labor supply decisions of parents with kindergarten children (ages 5 and 6), relative to parents with slightly older children, in first, second, and third grade (ages 7, 8, and 9).

Our baseline specification for assessing the impact of full-day kindergarten expansions on parental labor supply is as follows

$$Y_{imst} = \beta_0 + \beta_1 FullDayK_{st-1} * (Have\ Child\ 5\text{-}6) + \beta_2 (Have\ Child\ 5\text{-}6) + \gamma_{st} + \lambda_{mt} + \varepsilon_{imst} \tag{1}$$

where Y is the employment outcome for an individual i in metropolitan areas (MSA) m in state s in year t. *FullDayK* is the treatment variable measured in the prior fall, which measures the proportion of kindergarten students in full-day settings in a particular state and year. This is interacted with a binary indicator variable, *Have Child 5-6*, that equals one if the parent had a child that was 5- or 6-years old. The direct effect of having a 5- or 6-year-old is also included, while the direct effect of the full day kindergarten share is absorbed by the state-by-year fixed effects. State-by-year fixed effects (γ) control for time varying trends within the state, while MSA-by-year fixed effects (λ) make this a comparison between parents in the same MSA at the same time. As such, any local trend in labor markets or gender norms that might affect the outcome and the provision of full-day kindergarten is held constant. The sample is limited to parents with a child between the ages of 5 and 9. As such, the coefficient β_1 is an intention-to-treat estimate of the effect of the full-day kindergarten share increasing for families with a kindergarten aged child, relative to

families with a slightly older child. The full-day kindergarten share ranges from 0 to 1. Standard errors are heteroskedasticity-robust, clustered at the state level.

Analyses are conducted separately for mothers and father, to explore differential responses by parental gender. The estimates from equation (1) are provided in Table 2. Subgroup estimates of the effect on employment for different groups of mothers are provided in Figure 6.

Our main specification relies on a triple-difference approach to isolate impacts. Our identifying assumption is that parents of kindergarten-aged children would have experienced the same trends in employment as parents of slightly older children in the same labor market if the increase in full-day provision had not occurred. Many of the drivers of full-day kindergarten provision are likely to be correlated with geography, but this strategy holds those characters fixed within a given metropolitan area.

To further assuage concerns about the exogenous nature of local penetration of full-day kindergarten in a given area, we also use an instrumental variables approach to identify the relationship between full-day kindergarten access and maternal labor supply. In our setting, states instituted a variety of policies which expanded funding and seats in full-day kindergarten, giving rise to policy variation over time and across states, as discussed in more detail in Section 2.1.

The instrumental variable approach implicitly assumes policy movements were unexpected and exogenous from families' characteristics and decisions. With these instruments we isolate variation in full-day kindergarten share that is driven by policy changes rather than local trends or norms that could influence parental labor supply. We estimate the IV model in a typical two stage process. First, the potentially endogenous local penetration rates are regressed on two policy instruments. Next, we estimate equation (1) using predicted values for full day kindergarten penetration. Elements of the second stage mirror the main specification, including conducting separate analyses for mothers and fathers. Both the full-day mandate and the full-day friendly policy measure are highly predictive of the full-day kindergarten share at the state level, leading to a 18.4 percentage point (standard error of 0.056) and 15.2 percentage point (standard error of 0.044) increase in the full-day share (see Appendix Table A1. We use this IV approach to confirm that our baseline estimates are not driven by changes in local demand for full-day kindergarten (which might be correlated with outcomes) and that the patterns persist if we isolate changes in full-day access that are due to policy action.

5 Results – Mothers and Fathers

As described in the empirical strategy, we present results from the triple difference models for mothers' and fathers' employment outcomes in Table 2. Each column in each panel presents the results of a separate

regression. The treatment variable is the continuous full-day kindergarten participation proportion (0-1) and the outcomes are either binary or continuous measures of hours, weeks, or wages. The effect sizes correspond to a shift from no full-day kindergarten provision to all full-day kindergarten provision. The average annual increase in full-day kindergarten participation is two-percentage points.

While the estimates correspond to a large shift in full-day kindergarten, we find evidence of positive effects on female labor force participation as displayed in Panel A of Table 2. A shift from no full-day kindergarten (i.e., all kindergarten is provided in half-day format) to all full-day kindergarten corresponds to a 6.2 percentage point increase in being in the labor force at the time of the ASEC. This represents a 9 percent increase off a base of 68 percent labor force participation for mothers, suggesting full-day kindergarten induces increases in labor supply among the mothers of kindergarteners. In the same vein, full-day kindergarten induces an increase of 4.7 percentage points in employment. Looking at a more retrospective measure of employment points in the same direction– movement to full-day kindergarten corresponds to a 4.4 percentage point increase in the likelihood of a mother working last year, representing an increase of 6 percent.

A complete full-day kindergarten expansion increases the full-time employment rate last year by 2.3 percentage points and the part-time employment rate by 2.2 percentage points, suggesting the increase in employment is roughly equally split between full time and part time workers. However, it is unclear whether mothers entering the labor force moved into full-time work or if some mothers working part-time moved into full-time work and mothers entering the labor force moved into part-time work. An increase in the full-day kindergarten share from 0 to 1 is associated with an additional 2 weeks of work during the previous year (6.4 percent) and a 1.6-hour increase in usual hours worked during the previous year (6.5 percent). We see that an increase in the full-day kindergarten share from 0 to 1 increases the likelihood that a mother has any wage income by 5.7 percentage points, similar to the effects on employment. The increase in full-day kindergarten share from 0 to 1 is also associated with an imprecisely estimated increase of $1276 dollars. Since we cannot observe everyone in the CPS over time, it is unclear to what extend these effects are driven by the extensive or intensive margin. However, as explained below, we evaluate intensive margin responses for a subset of respondents that we can link over time.

Turning attention to fathers we see that men with kindergarten-aged children do not adjust labor supply along any of the dimensions we examine (Panel B of Figure 2), with point estimates close to zero. These patterns stand in contrast to those observed for mothers. For most fathers, labor supply appears to be insensitive to the public provision of childcare through early childhood education, whereas for mothers, who are more often primary care providers for children, we see sensitivity.

In Figure 6, we present results of subgroup analyses among mothers. These analyses split by women's

education level, marital status, and race. The upshot of these analyses is that maternal employment gains associated with the increase in full-day kindergarten access are not just concentrated among disadvantaged families. Perhaps due to the universal nature of expansions, more educated women, those who were married and living with their spouse present, and white women also benefited from the full-day kindergarten expansions.[4]

We probe the robustness of these results in Table 3. The effect of the full-day kindergarten share on employment during the previous calendar year is robust to removing the MSA-by-year fixed effects, including controls for mother's demographics (e.g., race/ethnicity, marital status, education level, and age fixed effects), excluding states in the South, which was early in adopting full-day kindergarten, or if we exclude observations from 2020 and 2021 during the COVID-19 pandemic. In all specifications effects for fathers remain small and insignificant.

As noted above, the cross-sectional nature of the ASEC prevents a complete decomposition of extensive and intensive margin effects. However, the CPS sampling framework surveys households according to a 4-8-4 rotation, so households are in the survey for four months, out for eight months, and then back in for four months. As such, we can identify a subset of parents for whom we observe employment measures in the ASEC one year prior. We provide estimates for mothers who were employed during their first observed ASEC wave, and see no effect on employment (it does not appear to prevent exit) and a marginally significant 0.76 hour increase in usual hours worked (Table 3. The effect on wage income is over $550 larger, consistent with an intensive margin response in addition to the extensive margin increase in employment. These point estimates are consistent with the results found in Table 2. If we attribute all increases in hours to the extensive margin and attribute the 4.1 percentage point increase in employment last year only to new entrants– with half of new entrants working full time (40 hours) and half of new entrants working part time (20 hours), this would represent a 5.0 percent increase in hours worked at the mean. The slightly larger hours increase of 6.5 percent suggests there may be some intensive margin adjustment among mothers already in the labor force, as seen in Table 3.

We see broadly similar patterns in Table 4, when we leverage state-level policy changes to instrument for full-day kindergarten availability.[5] Interestingly, most patterns emerging from this alternate specification to isolate variation point in the same direction as results found in the main specification. As seen in Panel A of the figure, a shift from no full-day kindergarten to all full-day kindergarten increases mothers' labor force participation at the time of the ASEC interview by 4.4 percentage points. Given a base of 68%, this translates to an employment increase of 6.4%. Full-day kindergarten increases contemporaneous employment

[4]Results are slightly larger, but not significantly different if we focus on outcomes of mothers whose own mother is in the household (Appendix Table A2).

[5]First stage and reduced form estimates provided in Appendix Table A1.

of mothers by an insignificant 2.8 percentage points. When considering measures that better capture longer-term employment experiences, we see that movement to full-day kindergarten corresponds with increased employment over the past year by 4.0 percentage points, equivalent to an increase of 5.7%. The estimates for full-time and part-time employment are similar, but imprecisely estimated. We see a similar increase in usual weekly work hours of 2 additional hours and an insignificant 1.0 week increase in weeks worked. Results show similarly sized increases in the likelihood or reporting and wage income, while the point estimate on wage income is over twice as large (but still imprecisely estimated). We see no responses for fathers, except a large and significant decrease in wage income (see Panel B).

6 Child Outcomes

The shift to full-day kindergarten in the United States has created more school-level investment in young children, but has also led to more maternal time out of the home at work. As these patterns might push child outcomes in opposite directions, we evaluate the net effect of increasing full-day kindergarten access on children.

We examine this along one dimension: children's test scores. We evaluate performance in reading and math in third through eighth grades at the state-by-year level, standardized across state tests and aggregated in the Stanford Education Data Archive (SEDA; Reardon et al. (2023)) from 2009-2018. These test scores come from annual testing, administered in the late spring of each academic year. These are then standardized using the National Assessment of Educational Progress (NAEP) to obtain comparable estimates across states and over time.

Using the state-level, annual standardized performance by grade in the SEDA, we implement an approach analogous to our estimation of labor supply responses in Equation (1. Using the SEDA, we link grade cohorts for each state back to the year that third graders were in kindergarten. We then consider how the full-day kindergarten share of the third grade cohort affects differences in outcomes for third graders, relative to fifth graders. With the age adjustment, we are making a similar comparison of 5- and 6-year-olds to older children (likely 8- and 9-year-olds) as made when using the CPS. We estimate the effect of the state-level full-day kindergarten share of standardized test scores, as follows:

$$\textbf{Std. Score}_{sgt} = \beta_1 \textit{Share Younger Grade in Full-day}_{st} * 1(\textit{In Younger Grade}_g + \beta_2 1(\textit{In Younger Grade}_g + \phi_{st} + \varepsilon_{sgt} \quad (2)$$

Where *Std. Score* is the standardized test score (either math or reading/language arts) in state s for

grade g in year t. Scores are standardized to be comparable across states. The coefficient β_1 represents the effect of a one unit increase in the full-day kindergarten share for the younger of the two grades on test scores for the younger grade. We also control for an indicator for being in the younger grade to capture level differences in performance across grades. State-by-year fixed effects are included to make this a comparison between students in the younger grade and the older grade in the same state and year. Standard errors are corrected for clustering at the state-level. Throughout we restrict the sample to third and fifth graders. As such, we are examining how the full-day kindergarten share of the third graders is related to test scores for third graders relative to its relation to test scores for fifth graders in the same state at the same time. As in equation (1), we include older children to account for differential trends across place that could affect the outcome. These results are provided in Table 5 for the overall average, as well as for different race/ethnicity, sex, and poverty status groups.

One concern with this specification is it does not account for the fact that the older students (fifth graders) were also exposed to treatment, full-day kindergarten share, to some extent. As such, we expand this analysis to trace out the effect of full-day kindergarten share on test scores within a cohort over time. For each year we determine the kindergarten start year for each grade. We use this start year to define the cohort. For example, third graders in 2009, fourth graders in 2010, and eighth graders in 2014 are all observations of the 2005-2006 cohort, as this was the year that they were in kindergarten.

We next assign each cohort the state-level full-day kindergarten share calculated from the October CPS. We then estimate the following regression

$$Score_{csgy} = \sum_{g=3}^{8} \beta_g Full\text{-}day\ Share_c * (Grade\ g) + \delta_{sy} + \theta_c + \gamma_g + \varepsilon_{csgy} \quad (3)$$

The outcome is the average, standardized score (either math or reading/language arts) for cohort c in state s in grade g in year y. The β_g coefficients trace out the effect of the full-day kindergarten share in the cohort's kindergarten year on average test scores from third through eighth grades. Cohort and grade level fixed effects are included to control for cohort-specific or grade-specific effects. Because cohorts overlap (e.g., both the 2005 cohort and the 2006 cohort will be observed in 2010, as fourth and fifth graders) we are able to include state-by-year fixed effects. As such, we can account for any state-level trends that might be changing the provision of full-day kindergarten and affecting children's test scores. Standard errors are corrected for clustering at the state-level. We limit the sample to cohorts that we observe in all years between third and eighth grade to avoid compositional changes across grades over time. This means that our estimates include cohorts that started kindergarten between 2005 and 2009. The effects from third to eighth grade are plotted with 95-percent confidence intervals for the overall average, as well as for different race/ethnicity, sex, and

poverty status groups in Figure 7.

Table 5 shows results from the first analytical approach, comparing children in third grade to children in fifth grade. In this specification, a school moving from half-day kindergarten to full-day kindergarten experiences a 0.1 standard deviation increase in school math and reading test scores by third grade relative to students two years older. Consistent with the nature of a policy that is universal, boosts in student achievement are broadly applicable, and are found among Black students, Hispanic students, White students, disadvantaged students, boys and girls.

When evaluating persistence of impacts from moving to full-day kindergarten, the patterns remain qualitatively similar to those seen in the previous specification. Figure 7 demonstrates that a 10 percent increase in the state full-day kindergarten share is accompanied by gains in math test scores that remain elevated by 0.02 standard deviation in third grade. In fact, test scores remain elevated through sixth grade, although they appear to fade over time. Test score improvements appear to be concentrated among White children, with particularly large gains among disadvantaged students, although this also appears to diminish over time. We see no evidence of effects on reading/language arts scores, and estimates are actually negative (but not significant) for Hispanic and Asian students.[6] In sum, findings from both specifications on child test scores suggest that any negative effects on child performance from the decrease in maternal time investment is more than offset in the short run by the gains associated with increased school-time investments.

7 Discussion

This study provides important new evidence on the impact of sizable full-day kindergarten expansions across U.S. states from 1990 to 2019 on women's engagement with the labor force. While there is a limited body of work on the impact of full-day kindergarten on participants, this work sheds light on a broader question – that of the policy impact of expanding full-day kindergarten on the parents of children served by the longer school day. Greater provision of full-day kindergarten in a particular state in a given year corresponds to greater labor force attachment among mothers relative to similar mothers with slightly older children. There is no corresponding response among fathers of similarly aged children.

This work complements existing work by documenting the effects of expanded public school on maternal employment. Further, while extant literature hypothesizes that public provision of early childhood education acts as a childcare subsidy, we show descriptive evidence that mothers time their workday around children's school schedules and use the extended kindergarten school day to increase market work. Our work

[6]Given that full-day kindergarten penetration was much higher in the South during the analysis period, we re-estimate results excluding the South in Appendix Figure A6 and find stronger evidence of improvements in math for non-minority and disadvantaged students, no effects on reading/language arts, but also we observe strongly negative effects for Hispanic and Asian children.

deviates from the prior literature in findings on heterogeneity. While previous papers on pre-K and Head Start expansions find concentrated effects among disadvantaged mothers, the effects of full-day kindergarten expansions are more broadly realized. This result is likely driven by the shift over this time period of full-day kindergarten from a largely targeted intervention to a near-universal program. In other words, more advantaged mothers, as measured by education level, marital status, or race, are precisely the mothers moved into program exposure by these policy expansions. These patterns serve as the foundation for understanding broad-based effects on these mothers' time use and labor supply as well as their children's academic achievement.

In considering the effectiveness of full-day kindergarten policy—one of the primary ways that public funds have supported young children in early childhood education settings over recent decades—it is critical to understand the net policy effect beyond direct effects on participants. This evidence contributes to our improved understanding of the broader return on early childhood and early schooling investments and the implications for families and parents.

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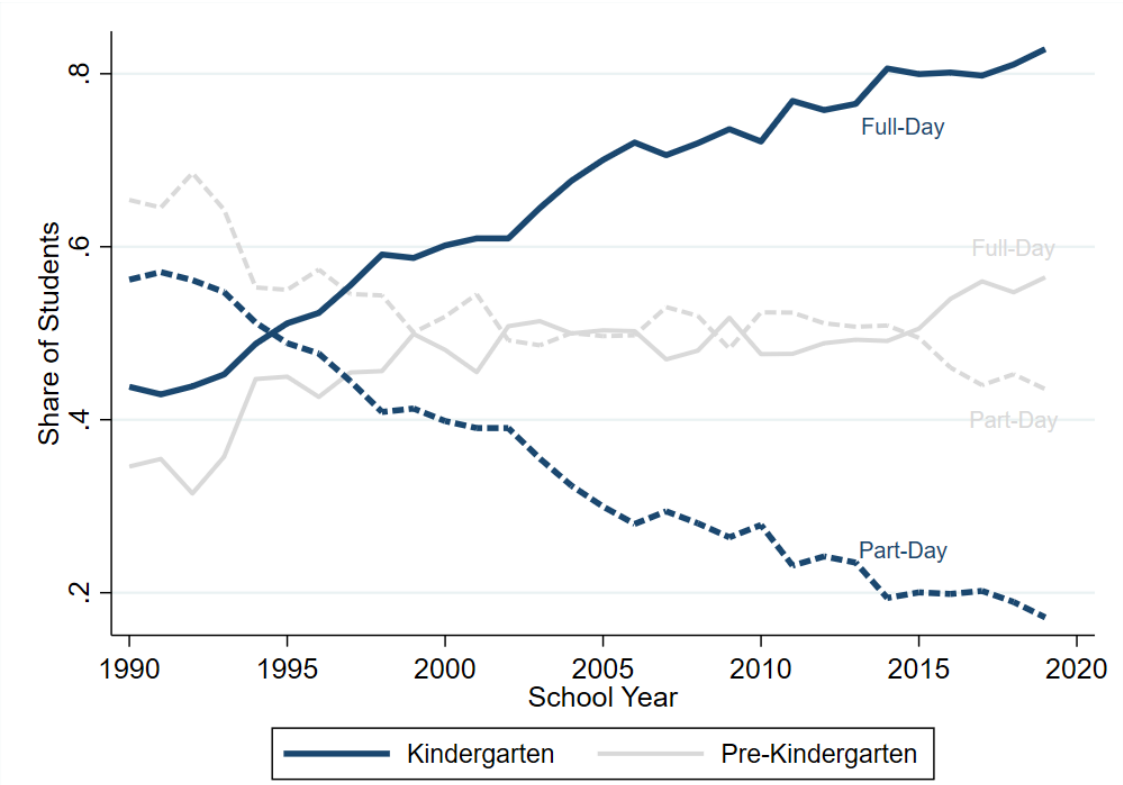
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Tables and Figures

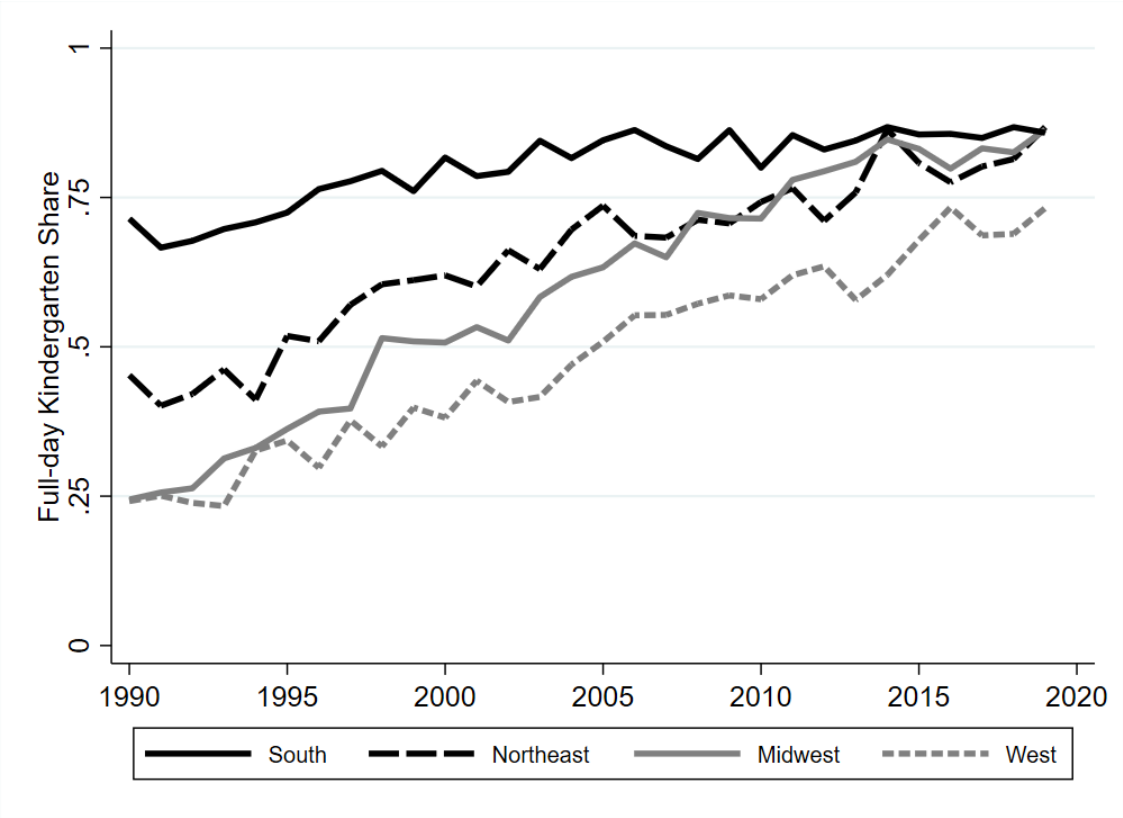
Figure 1: Full-Day and Part-Day Kindergarten and Pre-Kindergarten Enrollment



NOTE: Sample restricted to children from the CPS October Education Supplement between 1990 and 2019 who reported either being in nursery/pre-kindergarten or in kindergarten. We do not impose an age restriction. Individual weights are used to make this nationally representative.

SOURCE: CPS October Supplement 1990-2019.

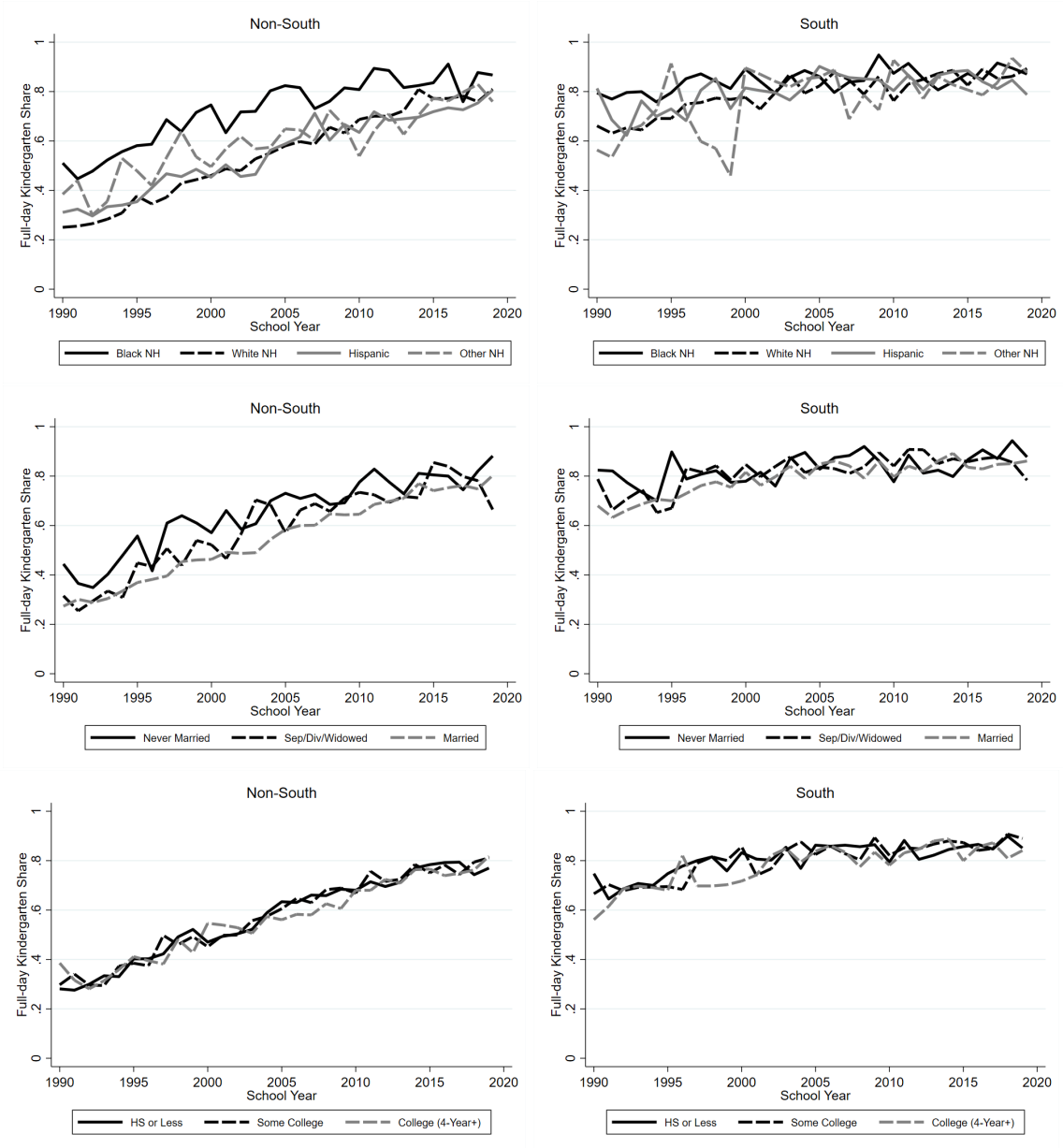
Figure 2: Share Kindergarten Students in Full-Day Enrollment by Region



NOTE: Sample restricted to children from the CPS October Education Supplement between 1990 and 2019 who reported being in kindergarten. We do not impose an age restriction. Individual weights are used to make this nationally representative.

SOURCE: CPS October Supplement 1990-2019.

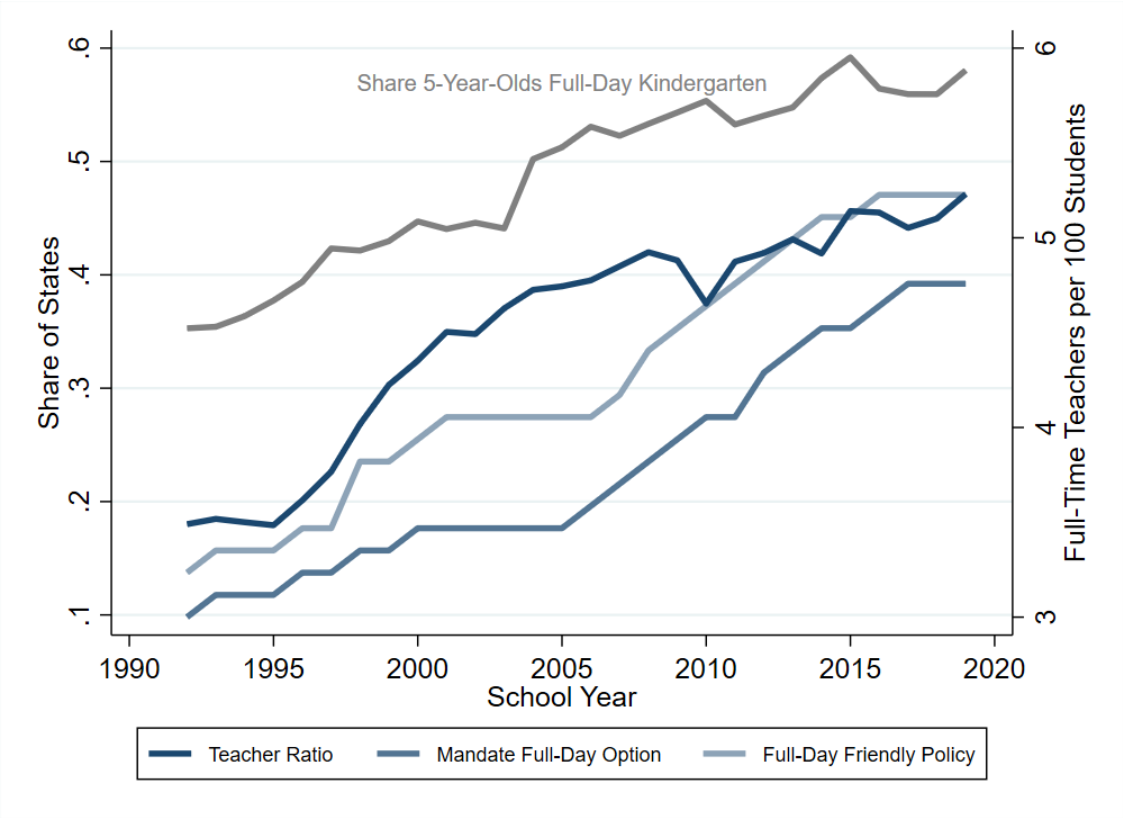
Figure 3: Full-Day Kindergarten Enrollment by Demographics



NOTE: Sample restricted to children from the CPS October Education Supplement between 1990 and 2019 who reported being in kindergarten. We do not impose an age restriction. Individual weights are used to make this nationally representative.

SOURCE: CPS October Supplement 1990-2019.

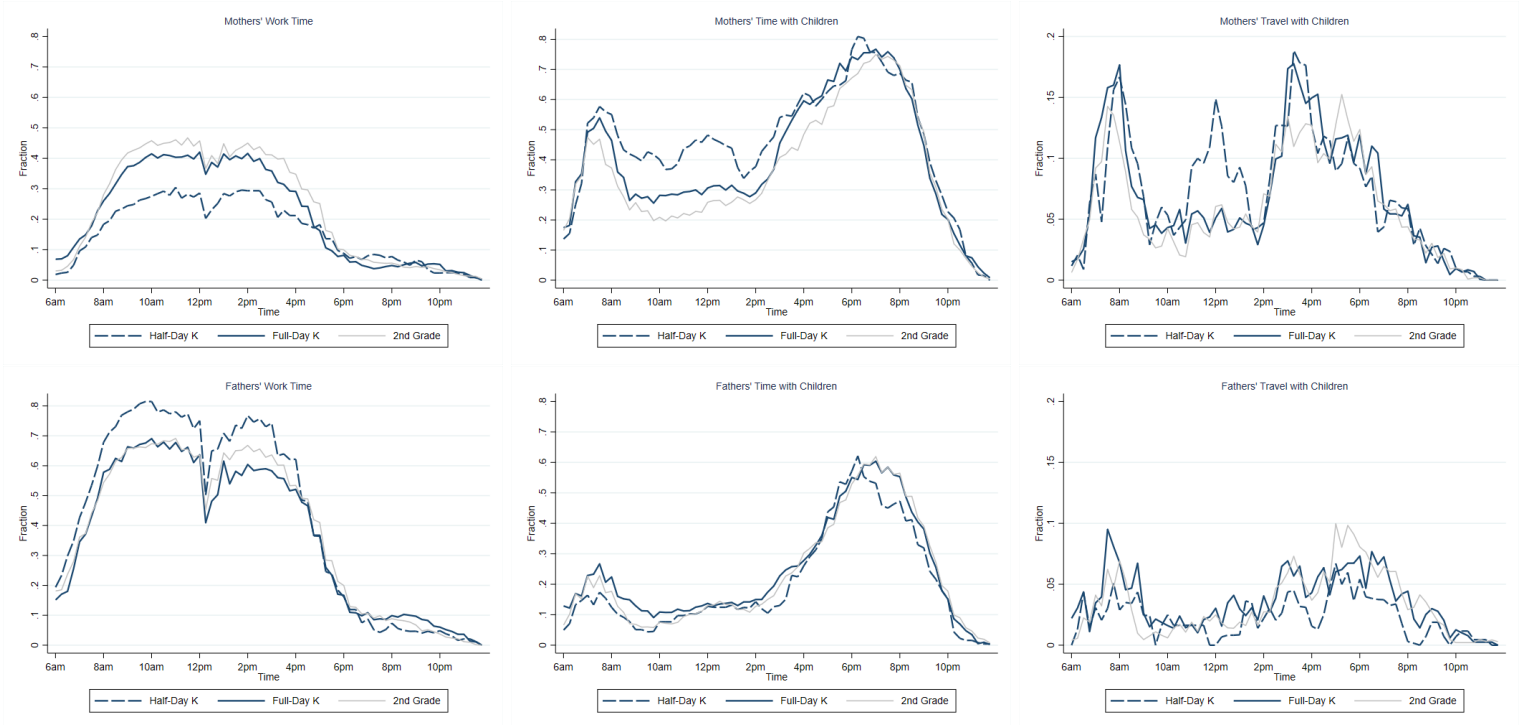
Figure 4: Role of Policy: Full-Day Enrollment and Full-Day Friendly Policies



NOTE: Sample restricted to 5-year-olds from the CPS October Education Supplement between 1992 and 2019. Individual weights are used to make this nationally representative. Full-time Teacher Equivalent ratios and total student enrollment by grade obtained from the Common Core of Data. Full-day option mandates and other full-day friendly policies obtained from state legal code.

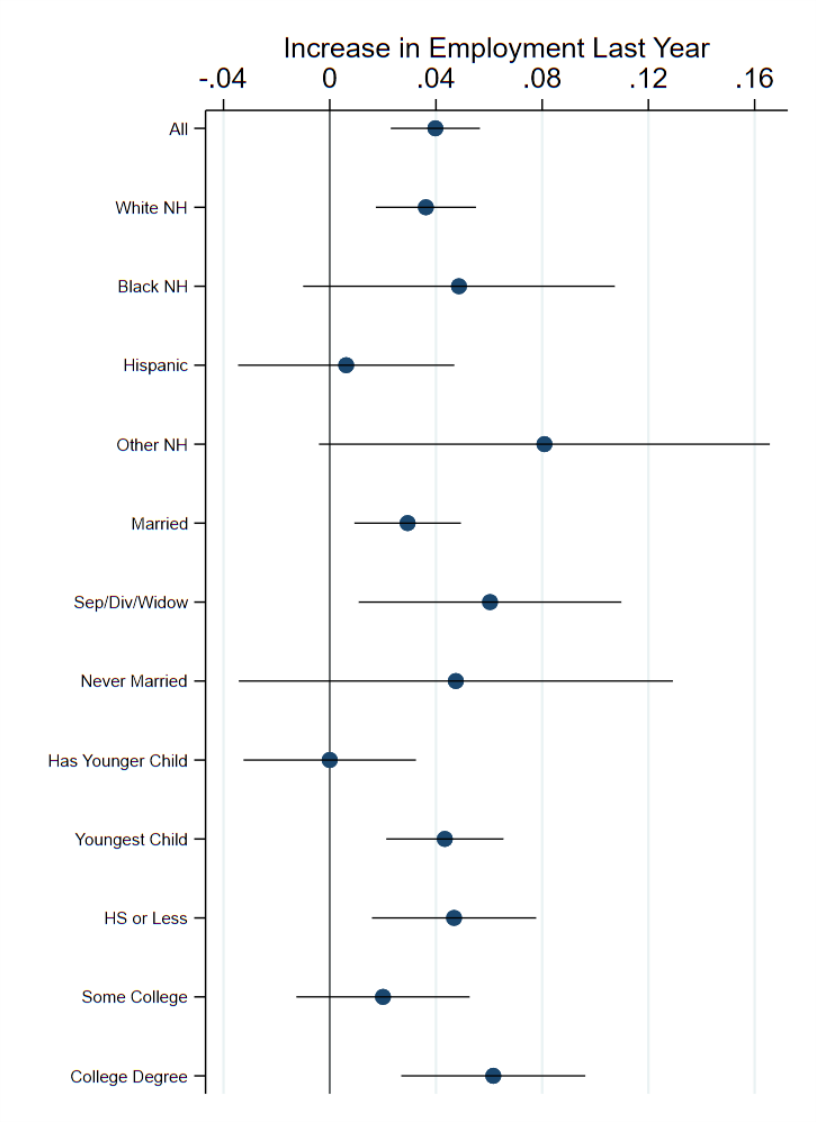
SOURCE: CPS October Supplement 1992-2019 and Common Core of Data 1992-2019.

Figure 5: Parent Time Use in Full-Day versus Part-Day Kindergarten



Notes: ATUS 2003-2022. Sample restricted to parent with a child in kindergarten or second grade who linked with the most prior CPS October Supplement before the ATUS interview. p< 0.01 ***, p< 0.05 **, p<0.1 *.

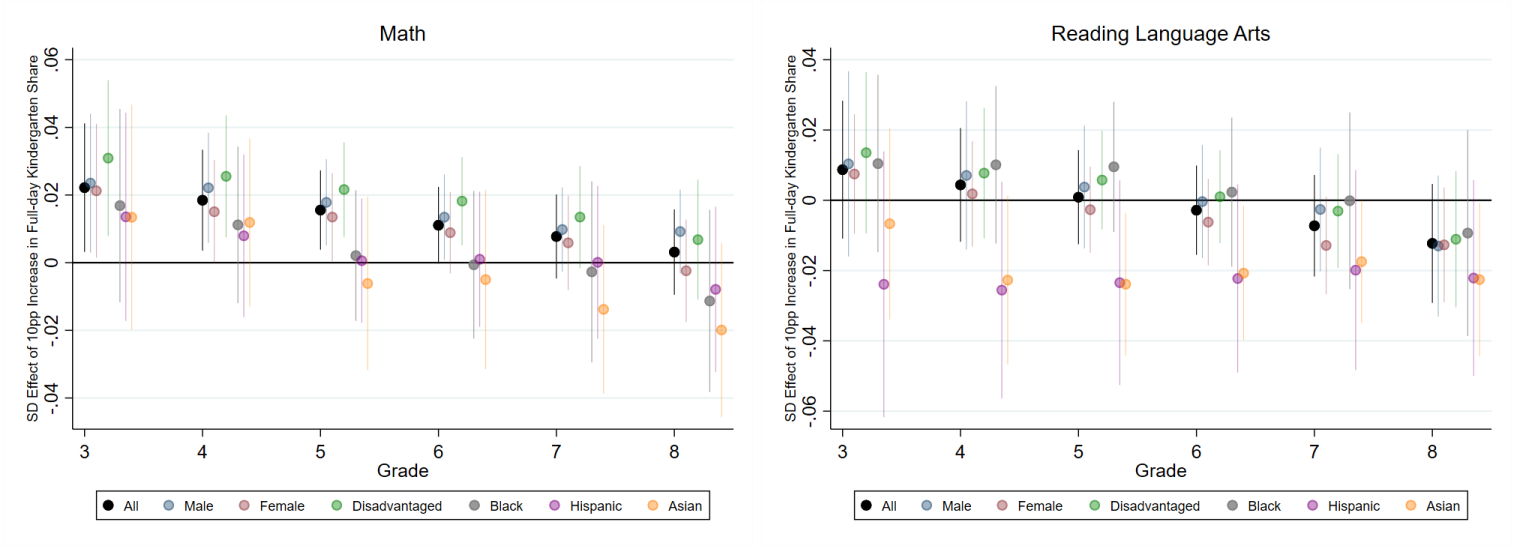
Figure 6: Heterogeneous Impacts of Full-Day Kindergarten Levels on Employment of Mothers



NOTE: Sample restricted to mothers and fathers in the CPS ASEC between 1992 and 2020 that had a child between the age of 5 and 9. The Full-day Kindergarten share constructed from the CPS October supplement. As such, we use the measure from the previous year, as this corresponds to the same school year as the March ASEC observation. Because the October supplement samples are small, we use the state 3-year rolling average of the Full-day Kindergarten share. State-by-year fixed effects are including, absorbing the direct effect of the Full-day Kindergarten share and controlling for state-specific trends in parental employment. MSA-by-year fixed effects are also included, making this a comparison between parents with 5- and 6-year-olds and parents of 7- to 9-year-olds in the same MSA and year. This will hold labor market conditions fixed between the treatment and counterfactual groups. Standard errors corrected for clustering at the state level with 95 percent confidence intervals plotted.

SOURCE: Authors' calculations from the CPS 1992-2020.

Figure 7: Dynamic Impact of Full-Day Kindergarten Access on Test Scores, by Group



NOTE: Sample restricted to state-cohort specific average test scores by demographic groups for cohorts that started school between 2006 and 2010 and have test scores for all six years between 3rd and 8th grade. The Full-day Kindergarten share constructed from the CPS October supplement. As such, we use the measure from the previous year, as this corresponds to the same school year as the March ASEC observation. Because the October supplement samples are small, we use the state 3-year rolling average of the Full-day Kindergarten share. State-by-year fixed effects are including, making this a comparison between different aged children in the same state and year. Cohort fixed effects are also included, to absorb secular trends in test scores. Standard errors corrected for clustering at the state level with 95 percent confidence intervals plotted.

SOURCE: Authors' calculations from the SEDA 2009-2018.

Table 1: Summary of Time Use for Parent with Children Enrolled in Part-day versus Full-Day Kindergarten

	Mothers			Fathers							
	Half-Day K (1)	Full-Day K (2)	Second Grade (3)	Half-Day K (4)	Full-Day K (5)	Second Grade (6)	(2)-(1) (7)	(2)-(3) (8)	(2)-(5) (9)	(1)-(4) (10)	Diff-N-Diff (9)-(10) (11)
Time Use on School Days											
Primary Measures											
Work	160.44	220.22	246.93	439.05	391.56	423.78	59.78**	-26.71	-171.34***	-278.61***	107.27**
Time with Children	459.17	402.22	358.85	195.33	239.55	222.43	-56.95**	43.37**	162.67***	263.83***	-101.16***
Home Duties	230.19	197.53	198.50	88.60	104.93	85.30	-32.66**	-0.97	92.60***	141.59***	-49.00*
Leisure	235.24	225.32	215.35	240.43	255.57	243.10	-9.92	9.97	-30.25**	-5.19	-25.06
Additional Measures											
One On One Time with Children	245.87	245.07	240.97	310.87	280.97	264.75	-0.80	4.09	-35.91*	-65.01*	29.10
Quality Time with Children	110.01	98.69	89.56	71.50	71.14	70.97	-11.32	9.13	27.55***	38.51***	-10.96
Reading with Children	7.74	7.35	3.93	5.24	2.84	2.30	-0.39	3.42***	4.51***	2.50	2.00
Playing with Children	22.79	13.09	10.78	14.80	19.11	11.71	-9.69**	2.31	-6.02*	7.98	-14.00**
Physical Care of Children	80.01	79.98	64.35	25.18	28.41	25.32	-0.03	15.63***	51.57***	54.83***	-3.26
Academic Time with Children	29.13	32.05	29.67	13.10	12.50	14.74	2.92	2.38	19.55***	16.03***	3.52
Direct Childcare	176.98	177.32	151.38	69.81	83.82	75.68	0.34	25.94***	93.50***	107.17***	-13.67
Time with Children Under 5	280.01	207.35	158.35	117.84	107.26	81.61	-72.66***	48.99**	100.09***	162.17***	-62.09*
Traveling with Children	39.46	37.61	31.72	12.67	21.81	20.40	-1.85	5.88	15.80***	26.79***	-10.99
Observations	198	443	526	117	295	366					

Notes: ATUS 2003-2022. Sample restricted to parent with a child in kindergarten or second grade who linked with the most prior CPS October Supplement before the ATUS interview. p< 0.001 ***, p< 0.01 **, p<0.05 *.

Table 2: Impact of Full-Day Kindergarten Penetration on Labor Supply of Parents with 5 to 6-year-olds Relative to Parents with 7 to 9-year-olds

	In Labor Force (1)	Employed (2)	Employed Last Year (3)	Full-Time Last Year (4)	Part-time Last Year (5)	Usual Hours Last Year (6)	Weeks Worked Last Year (7)	Wage Income Last Year> 0 (8)	Wage Income Last Year (2020) (9)
					Sample: Mothers				
Share Full-day Kindergarten$_{t-1}$	0.062***	0.047***	0.044***	0.023**	0.022*	1.605***	2.031***	0.057***	1276.0
*Have Child 5-6	(0.009)	(0.009)	(0.008)	(0.011)	(0.012)	(0.391)	(0.381)	(0.008)	(902.754)
Have Child 5-6	-0.098***	-0.091***	-0.082***	-0.070***	-0.013	-3.393***	-4.532***	-0.090***	-3334.4***
	(0.006)	(0.006)	(0.006)	(0.008)	(0.009)	(0.287)	(0.262)	(0.006)	(593.007)
Dependent Mean	0.68	0.64	0.70	0.49	0.21	24.87	31.61	0.66	24325.96
Observations	318,477	318,477	318,477	318,477	318,477	318,477	318,477	318,477	318,477
					Sample: Fathers				
Share Full-day Kindergarten$_{t-1}$	0.006	0.002	0.001	0.000	0.000	-0.226	0.335	-0.004	-869.0
*Have Child 5-6	(0.005)	(0.010)	(0.004)	(0.006)	(0.004)	(0.312)	(0.291)	(0.007)	(1520.528)
Have Child 5-6	0.001	-0.001	0.003	0.002	0.001	0.398	-0.038	0.011**	-66.2
	(0.004)	(0.008)	(0.003)	(0.004)	(0.003)	(0.238)	(0.204)	(0.005)	(1082.611)
Dependent Mean	0.94	0.88	0.94	0.90	0.04	41.84	46.63	0.88	62895.34
Observations	259,587	259,587	259,587	259,587	259,587	259,587	259,587	259,587	259,587

NOTE: Sample restricted to mothers and fathers in the CPS ASEC between 1992 and 2021 that had a child between the age of 5 and 9. Outcomes in column (1) and (2) refer to outcomes in the proceeding week (the ASEC is conducted in March). The rest of the outcomes refer to the previous calendar year. The Full-day Kindergarten share constructed from the CPS October supplement. As such, we use the measure from the previous year, as this corresponds to the same school year as the March ASEC observation. Because the October supplement samples are small, we use the state 3-year rolling average of the Full-day Kindergarten share. State-by-year fixed effects are including, absorbing the direct effect of the Full-day Kindergarten share and controlling for state-specific trends in parental employment. MSA-by-year fixed effects are also included, making this a comparison between parents with 5- and 6-year-olds and parents of 7- to 9-year-olds in the same MSA and year. This will hold labor market conditions fixed between the treatment and counterfactual groups. Standard errors corrected for clustering at the state level. p< 0.01 ***, p< 0.05 **, p<0.1 *.

Table 3: Robustness: Impact of Full-Day Kindergarten Penetration on Labor Supply of Parents with 5 to 6-year-olds Relative to Parents with 7 to 9-year-olds

	Employed Last Year					First Wave Employed		
	Baseline	No MSA-by-Year Fixed Effects	Include Controls	Restrict to Non-South	Pre-COVID	Employed Last Year	Usual Hours Last Year	Wage Income Last Year (2020)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
				Sample: Mothers				
Share Full-day Kindergarten$_{t-1}$	0.044***	0.043***	0.043***	0.045***	0.040***	0.004	0.764*	1828.2
*Have Child 5-6	(0.008)	(0.008)	(0.009)	(0.012)	(0.009)	(0.005)	(0.442)	(1325.651)
Have Child 5-6	-0.082***	-0.081***	-0.079***	-0.082***	-0.081***	-0.009**	-1.300***	-2303.0**
	(0.006)	(0.006)	(0.006)	(0.007)	(0.006)	(0.004)	(0.326)	(908.496)
Dependent Mean	0.70	0.70	0.70	0.70	0.70	0.97	34.35	32644.29
Observations	318,477	318,573	318,476	219,436	301,855	140,609	140,609	140,609
				Sample: Fathers				
Share Full-day Kindergarten$_{t-1}$	0.001	-0.000	0.000	-0.005	0.000	-0.002	-0.368	-1087.6
*Have Child 5-6	(0.004)	(0.004)	(0.004)	(0.005)	(0.004)	(0.002)	(0.249)	(1950.548)
Have Child 5-6	0.003	0.004	-0.003	0.006**	0.003	0.001	0.407**	-280.6
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.001)	(0.173)	(1149.964)
Dependent Mean	0.94	0.94	0.94	0.95	0.94	0.99	44.21	64812.77
Observations	259,587	259,745	259,583	182,340	245,661	151,493	151,493	151,493

NOTE: Sample restricted to mothers and fathers in the CPS ASEC between 1992 and 2021 that had a child between the age of 5 and 9. The Full-day Kindergarten share constructed from the CPS October supplement. As such, we use the measure from the previous year, as this corresponds to the same school year as the March ASEC observation. Because the October supplement samples are small, we use the state 3-year rolling average of the Full-day Kindergarten share. State-by-year fixed effects are including, absorbing the direct effect of the Full-day Kindergarten share and controlling for state-specific trends in parental employment. MSA-by-year fixed effects are also included, making this a comparison between parents with 5- and 6-year-olds and parents of 7- to 9-year-olds in the same MSA and year. This will hold labor market conditions fixed between the treatment and counterfactual groups. Column (1) provides our baseline estimates from Table (2). Column (2) excludes MSA-by-Year fixed effects. Column (3) controls for parental characteristics including race, education, and marital status bins, and age fixed effects. Column (4) only includes the Non-South, to ensure this is not driven only by the early adopting states in the South. Column (5) excludes observations from 2020 and 2021 to avoid concerns about the pandemic. Columns (6)-(8) limit the sample to individuals who can be linked across ASEC CPS waves one year apart, and conditions the sample on parents who reported working last year in their first survey wave. This allows us to examine expensive margin responses among those who were working previously. Standard errors corrected for clustering at the state level. p< 0.01 ***, p< 0.05 **, p<0.1 *.

Table 4: IV Estimates: Impact of Full-Day Kindergarten Penetration on Labor Supply of Parents with 5 to 6-year-olds Relative to Parents with 7 to 9-year-olds

	In Labor Force (1)	Employed (2)	Employed Last Year (3)	Full-Time Last Year (4)	Part-time Last Year (5)	Usual Hours Last Year (6)	Weeks Worked Last Year (7)	Wage Income Last Year> 0 (8)	Wage Income Last Year (2020) (9)
					Sample: Mothers				
Share Full-day Kindergarten$_{t-1}$	0.044**	0.028	0.040**	0.019	0.021	1.996**	0.998	0.065***	2628.9
*Have Child 5-6	(0.020)	(0.019)	(0.016)	(0.020)	(0.014)	(0.774)	(0.799)	(0.020)	(1950.087)
Have Child 5-6	-0.086***	-0.078***	-0.080***	-0.067***	-0.012	-3.653***	-3.843***	-0.095***	-4236.5***
	(0.014)	(0.013)	(0.011)	(0.015)	(0.011)	(0.540)	(0.551)	(0.014)	(1334.091)
Dependent Mean	0.68	0.64	0.70	0.49	0.21	24.87	31.61	0.66	24325.96
Observations	318,477	318,477	318,477	318,477	318,477	318,477	318,477	318,477	318,477
					Sample: Fathers				
Share Full-day Kindergarten$_{t-1}$	-0.005	-0.022	-0.005	-0.007	0.003	-0.801	-0.031	0.004	-7937.7**
*Have Child 5-6	(0.012)	(0.019)	(0.010)	(0.012)	(0.008)	(0.635)	(0.685)	(0.019)	(3332.926)
Have Child 5-6	0.008	0.015	0.007	0.007	-0.000	0.778	0.205	0.006	4614.4*
	(0.008)	(0.014)	(0.007)	(0.008)	(0.005)	(0.474)	(0.470)	(0.013)	(2491.274)
Dependent Mean	0.94	0.88	0.94	0.90	0.04	41.84	46.63	0.88	62895.34
Observations	259,587	259,587	259,587	259,587	259,587	259,587	259,587	259,587	259,587

NOTE: Sample restricted to mothers and fathers in the CPS ASEC between 1992 and 2021 that had a child between the age of 5 and 9. Outcomes in column (1) and (2) refer to outcomes in the proceeding week (the ASEC is conducted in March). The rest of the outcomes refer to the previous calendar year. The Full-day Kindergarten share constructed from the CPS October supplement. As such, we use the measure from the previous year, as this corresponds to the same school year as the March ASEC observation. Because the October supplement samples are small, we use the state 3-year rolling average of the Full-day Kindergarten share. State-by-year fixed effects are including, absorbing the direct effect of the Full-day Kindergarten share and controlling for state-specific trends in parental employment. MSA-by-year fixed effects are also included, making this a comparison between parents with 5- and 6-year-olds and parents of 7- to 9-year-olds in the same MSA and year. This will hold labor market conditions fixed between the treatment and counterfactual groups. Standard errors corrected for clustering at the state level. p< 0.01 ***, p< 0.05 **, p<0.1 *.

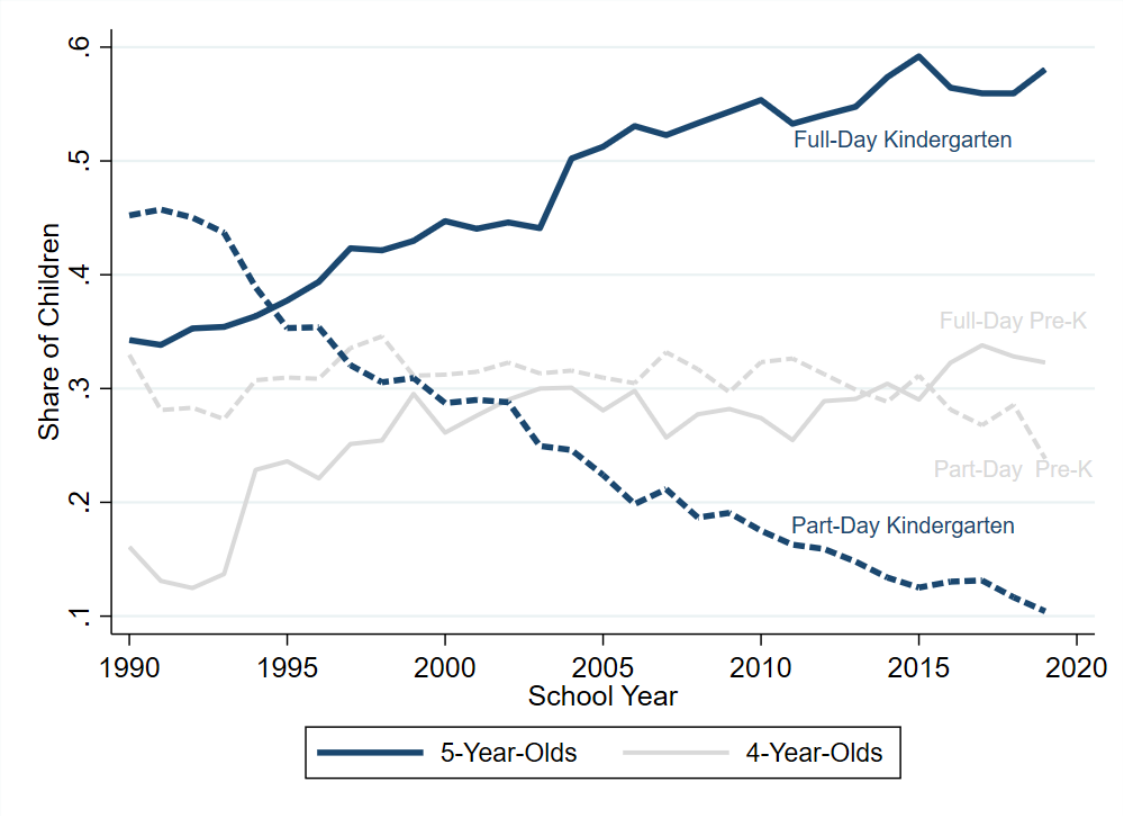
Table 5: Impact of Full-Day Kindergarten Penetration on SEDA Test Scores

	Math							ReadingLanguage Arts						
	All	Asian	Black	Hispanic	Female	Male	Disadvantaged	All	Asian	Black	Hispanic	Female	Male	Disadvantaged
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
	Third Grade vs. Fifth Grade													
Share Younger Grade Full-day Kindergarten	0.096***	0.087	0.079*	0.098***	0.106***	0.107***	0.099***	0.087***	0.085**	0.032	0.058*	0.086***	0.100***	0.098***
*In Younger Grade	(0.032)	(0.054)	(0.040)	(0.032)	(0.034)	(0.034)	(0.035)	(0.021)	(0.042)	(0.034)	(0.030)	(0.023)	(0.026)	(0.023)
In Younger Grade	-0.063**	-0.137***	-0.050	-0.081***	-0.085***	-0.058**	-0.054*	-0.046***	-0.091***	0.007	-0.045*	-0.058***	-0.043**	-0.037**
	(0.025)	(0.040)	(0.031)	(0.025)	(0.025)	(0.027)	(0.027)	(0.015)	(0.031)	(0.023)	(0.024)	(0.016)	(0.020)	(0.016)
Dependent Mean	0.00	0.51	-0.51	-0.29	0.00	0.01	-0.33	0.02	0.36	-0.42	-0.30	0.14	-0.09	-0.32
Observations	902	882	882	884	892	894	864	916	850	872	890	906	906	878

NOTE: Sample restricted to 3rd and 5th grade level observations. The Kindergarten full-day enrollment rate (3-year rolling average) from 4 years ago is used. This is because the outcome is observed in October while test scores are observed in the end of the school year. State-by-year fixed effects are including. Standard errors corrected for clustering at the state level. p< 0.01 ***, p< 0.05 **, p<0.1 *.

Additional Tables and Figures (Online Appendix)

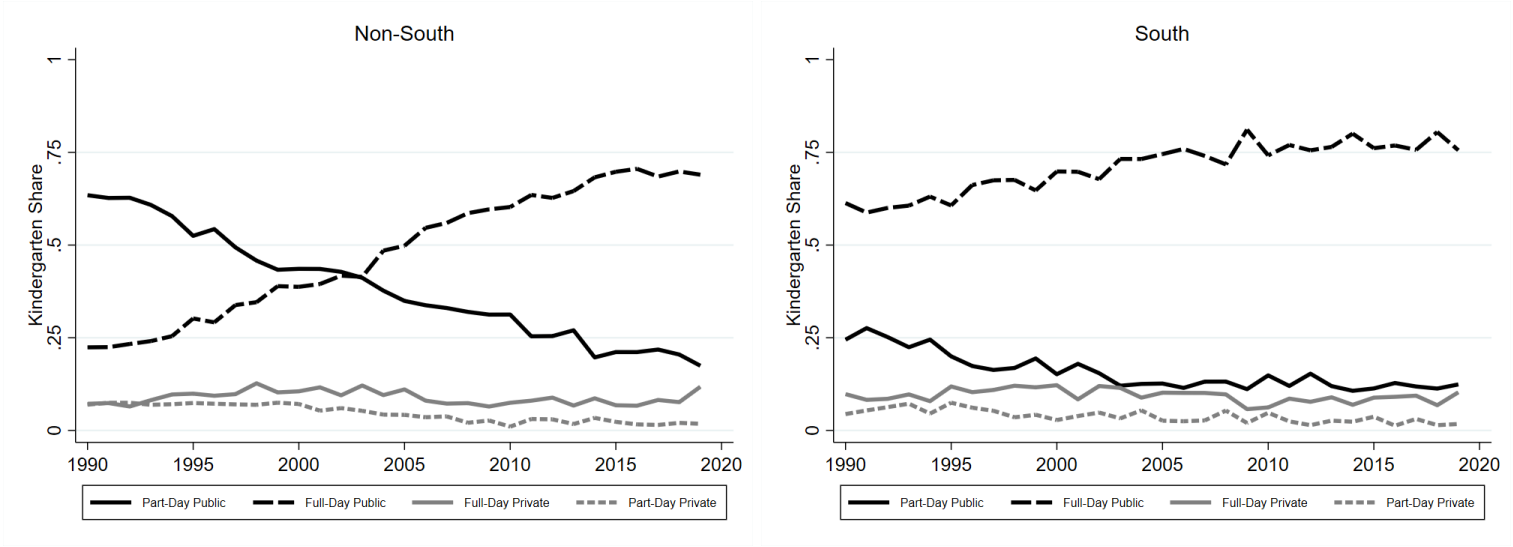
Figure A1: Full-Day and Part-Day Kindergarten and Pre-Kindergarten Enrollment



NOTE: Sample restricted to 4- and 5-year-olds from the CPS October Education Supplement between 1990 and 2019. Individual weights are used to make this nationally representative. A small fraction of 4-year-olds are enrolled in kindergarten.

SOURCE: CPS October Supplement 1990-2019.

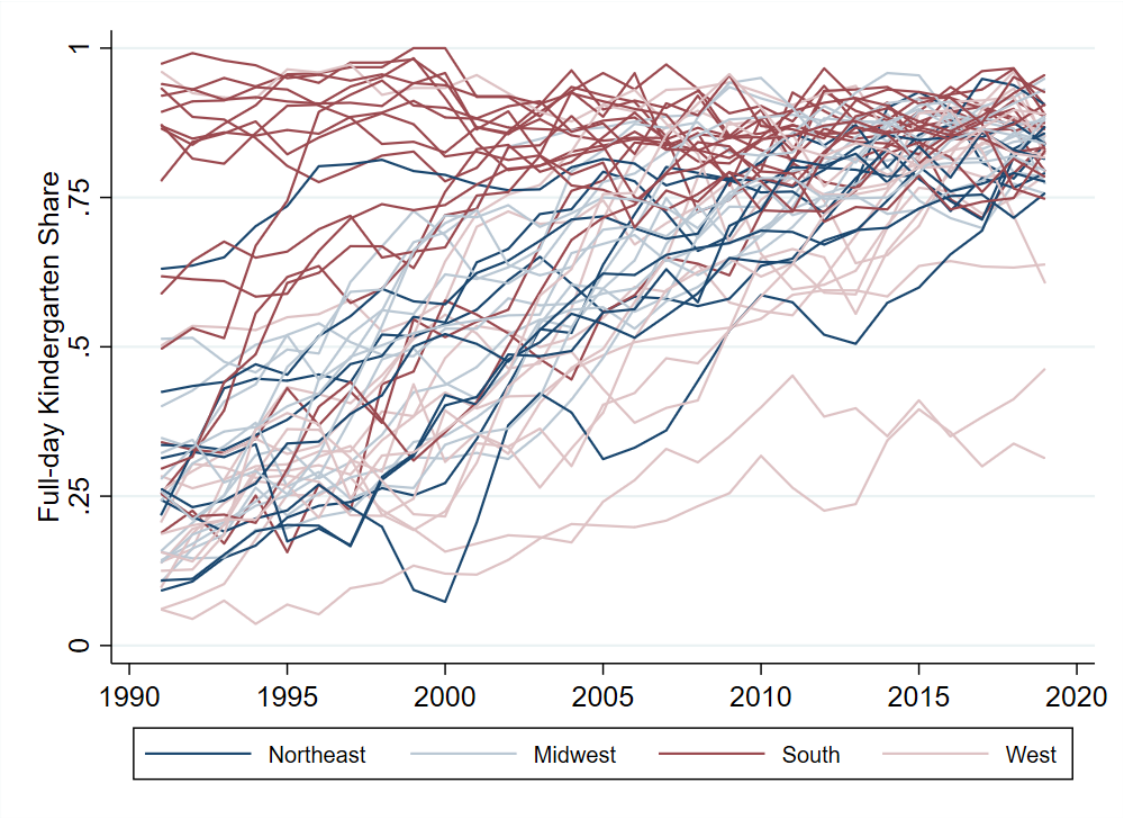
Figure A2: Public vs. Private Kindergarten Enrollment



NOTE: Sample restricted to children from the CPS October Education Supplement between 1990 and 2019 who reported being in kindergarten. We do not impose an age restriction. Individual weights are used to make this nationally representative.

SOURCE: CPS October Supplement 1990-2019.

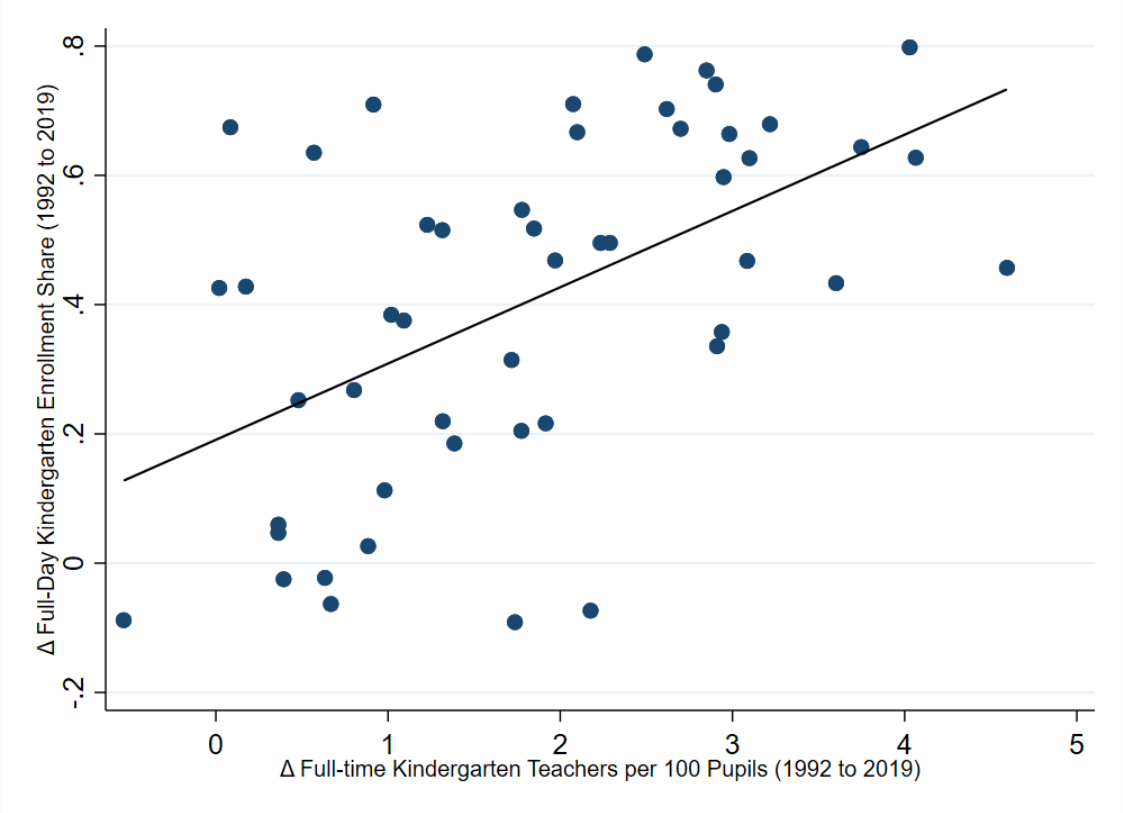
Figure A3: Full-Day Kindergarten Enrollment Share by State



NOTE: Sample restricted to children from the CPS October Education Supplement between 1990 and 2019 who reported either being in kindergarten. We do not impose an age restriction. Individual weights are used to make this nationally representative.

SOURCE: CPS October Supplement 1990-2019.

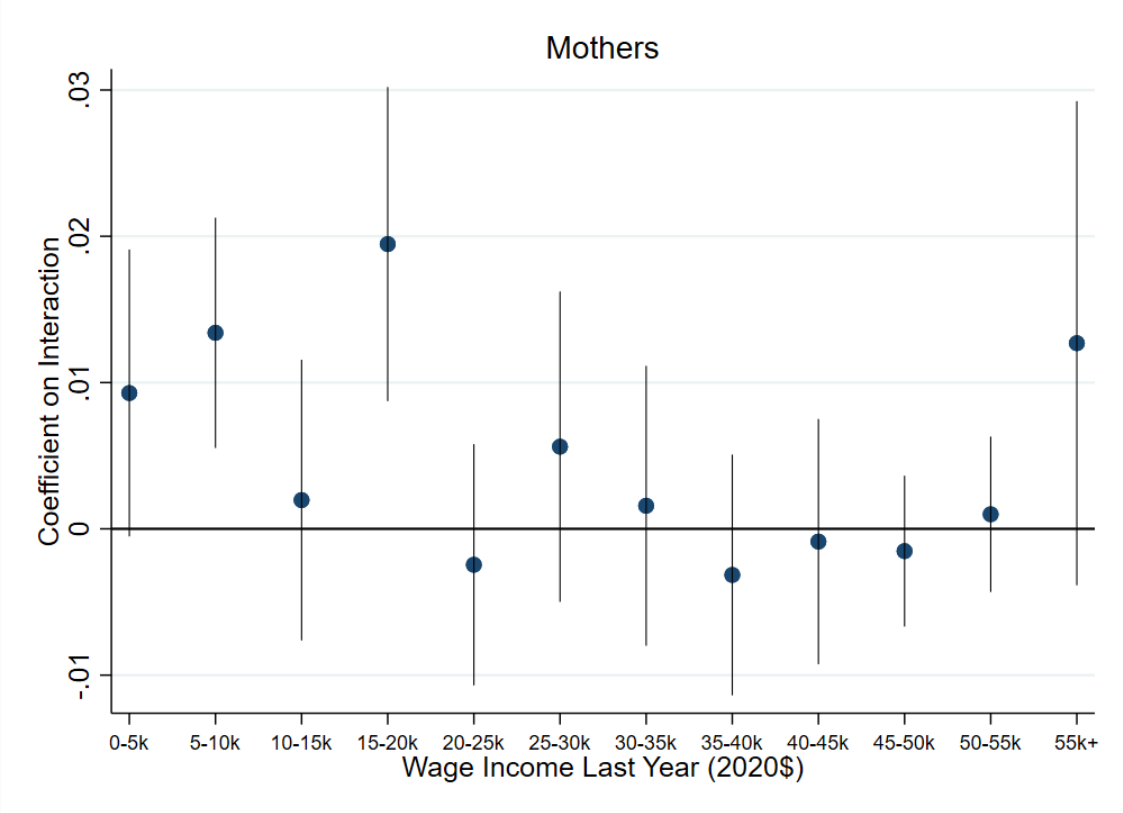
Figure A4: Role of Policy: State-level Changes in Full-time Equivalent Teacher Ratios and Full-Day Kindergarten Enrollment, 1992-2019



NOTE: Each observation is the difference between outcomes in 2019 and 1992 at the state level. The full-day kindergarten enrollment share is the three year rolling average of kindergarteners enrolled in full-day programming. Full-time Teacher Equivalent ratios and total student enrollment by grade obtained from the Common Core of Data.

SOURCE: CPS October Supplement 1992-2019 and Common Core of Data 1992-2019.

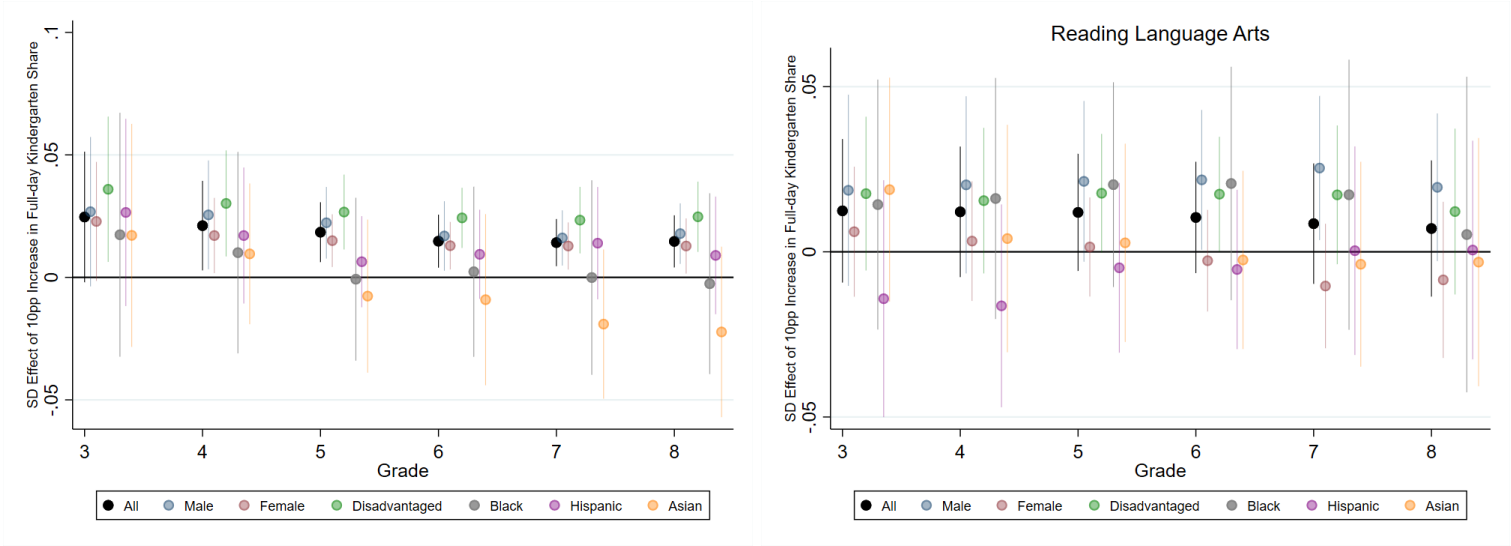
Figure A5: Effect of Full-Day Kindergarten Share on Wage Income of Mothers with 5 to 6-year-olds Relative to Mothers with 7 to 9-year-olds



NOTE: Sample restricted to mothers and fathers in the CPS ASEC between 1992 and 2021 that had a child between the age of 5 and 9. Each point represents the coefficient on the interaction between full-day kindergarten share and an indicator for if the mother has a 5- or 6-year-old child, where the outcome in a binary indicator for having wage income within the specified bin. The Full-day Kindergarten share constructed from the CPS October supplement. As such, we use the measure from the previous year, as this corresponds to the same school year as the March ASEC observation. Because the October supplement samples are small, we use the state 3-year rolling average of the Full-day Kindergarten share. State-by-year fixed effects are including, absorbing the direct effect of the Full-day Kindergarten share and controlling for state-specific trends in parental employment. MSA-by-year fixed effects are also included, making this a comparison between parents with 5- and 6-year-olds and parents of 7- to 9-year-olds in the same MSA and year. This will hold labor market conditions fixed between the treatment and counterfactual groups. Standard errors corrected for clustering at the state level, with 95 percent confidence intervals plotted.

SOURCE: Authors' calculations using ASEC CPS 1992-2021.

Figure A6: Dynamic Impact of Full-Day Kindergarten Access on Test Scores in the Non-South, by Group



NOTE: Sample restricted to state-cohort specific average test scores by demographic groups for cohorts that started school between 2006 and 2010 and have test scores for all six years between 3rd and 8th grade. The Full-day Kindergarten share constructed from the CPS October supplement. As such, we use the measure from the previous year, as this corresponds to the same school year as the March ASEC observation. Because the October supplement samples are small, we use the state 3-year rolling average of the Full-day Kindergarten share. State-by-year fixed effects are including, making this a comparison between different aged children in the same state and year. Cohort fixed effects are also included, to absorb secular trends in test scores. Standard errors corrected for clustering at the state level with 95 percent confidence intervals plotted.

SOURCE: Authors' calculations from the SEDA 2009-2018.

Table A1: IV Estimates First Stage and Reduced Form: Impact of Full-Day Policy on Labor Supply of Parents with 5 to 6-year-olds Relative to Parents with 7 to 9-year-olds

	First Stage Full-day Share*Child 5-6 (1)	In Labor Force (2)	Employed (3)	Employed Last Year (4)	Full-Time Last Year (5)	Part-time Last Year (6)	Usual Hours Last Year (7)	Weeks Worked Last Year (8)	Wage Income Last Year> 0 (9)	Wage Income Last Year (2020) (10)
					Sample: Mothers					
Full-day Availability Mandate	0.246***	0.010*	0.007	0.009**	0.004	0.005	0.479**	0.266	0.015***	803.4
*Have Child 5-6	(0.043)	(0.006)	(0.005)	(0.004)	(0.005)	(0.003)	(0.201)	(0.229)	(0.005)	(513.111)
Full-day Friendly Policy	0.050	0.012*	0.017***	0.006	0.007	-0.001	0.465**	0.758**	0.007	889.8
*Have Child 5-6	(0.059)	(0.006)	(0.006)	(0.004)	(0.006)	(0.005)	(0.221)	(0.286)	(0.006)	(836.593)
F-stat	26.66									
Dependent Mean	0.67	0.68	0.64	0.70	0.49	0.21	24.89	31.58	0.66	24345.85
Observations	318,477	335,609	335,609	335,609	335,609	335,609	335,609	335,609	335,609	335,609
					Sample: Fathers					
Full-day Availability Mandate	0.249***	-0.001	-0.005	0.000	-0.001	0.001	-0.148	0.056	0.002	-1949.8***
*Have Child 5-6	(0.043)	(0.003)	(0.004)	(0.002)	(0.003)	(0.002)	(0.133)	(0.152)	(0.004)	(719.717)
Full-day Friendly Policy	0.053	-0.002	0.007	-0.000	-0.003	0.003	-0.016	0.141	0.001	-741.1
*Have Child 5-6	(0.057)	(0.003)	(0.006)	(0.003)	(0.003)	(0.003)	(0.162)	(0.168)	(0.004)	(2050.838)
F-stat	28.41									
Dependent Mean	0.66	0.94	0.88	0.94	0.90	0.04	41.83	46.64	0.88	62696.41
Observations	259,587	273,501	273,501	273,501	273,501	273,501	273,501	273,501	273,501	273,501

NOTE: Sample restricted to mothers and fathers in the CPS ASEC between 1992 and 2021 that had a child between the age of 5 and 9. The outcome in column (1) is the three year rolling average of the share of kindergarten students in full-day programming, at the state level interacted with whether the parent has a child that is between 5 and 6. Columns (2)-(10) replicate the reduced form version of Table 2. State-by-year fixed effects are including, absorbing the direct effect of the Full-day Kindergarten share and controlling for state-specific trends in parental employment. MSA-by-year fixed effects are also included, making this a comparison between parents with 5- and 6-year-olds and parents of 7- to 9-year-olds in the same MSA and year. This will hold labor market conditions fixed between the treatment and counterfactual groups. Standard errors corrected for clustering at the state level. p< 0.01 ***, p< 0.05 **, p<0.1 *.

Table A2: Impact of Full-Day Kindergarten Penetration on Labor Supply of Parents with 5 to 6-year-olds Relative to Parents with 7 to 9-year-olds, by Grandmother in Home

	In Labor Force (1)	Employed (2)	Employed Last Year (3)	Full-Time Last Year (4)	Part-time Last Year (5)	Usual Hours Last Year (6)	Weeks Worked Last Year (7)	Wage Income Last Year> 0 (8)	Wage Income Last Year (2020) (9)
				Sample: Mothers with Grandmother in Household					
Share Full-day Kindergarten$_{t-1}$	0.082	0.042	0.052	0.014	0.038	1.726	2.894	0.069	178.6
*Have Child 5-6	(0.052)	(0.065)	(0.058)	(0.068)	(0.030)	(2.815)	(2.635)	(0.054)	(2358.618)
Have Child 5-6	-0.083**	-0.064	-0.067	-0.044	-0.023	-2.574	-4.270**	-0.075*	-1632.8
	(0.037)	(0.047)	(0.045)	(0.052)	(0.019)	(2.212)	(1.888)	(0.040)	(1392.130)
Dependent Mean	0.70	0.62	0.69	0.53	0.17	25.32	31.05	0.67	19730.94
Observations	15,932	15,932	15,932	15,932	15,932	15,932	15,932	15,932	15,932
				Sample: Mothers with No Grandmother in Household					
Share Full-day Kindergarten$_{t-1}$	0.060***	0.046***	0.042***	0.022*	0.020	1.522***	1.931***	0.054***	1250.6
*Have Child 5-6	(0.008)	(0.009)	(0.008)	(0.012)	(0.012)	(0.419)	(0.405)	(0.009)	(973.652)
Have Child 5-6	-0.099***	-0.091***	-0.082***	-0.070***	-0.012	-3.404***	-4.512***	-0.089***	-3317.4***
	(0.006)	(0.006)	(0.006)	(0.009)	(0.009)	(0.315)	(0.278)	(0.007)	(638.732)
Dependent Mean	0.68	0.64	0.70	0.49	0.21	24.84	31.64	0.66	24620.78
Observations	300,693	300,693	300,693	300,693	300,693	300,693	300,693	300,693	300,693

NOTE: Sample restricted to mothers in the CPS ASEC between 1992 and 2021 that had a child between the age of 5 and 9. Outcomes in column (1) and (2) refer to outcomes in the proceeding week (the ASEC is conducted in March). The rest of the outcomes refer to the previous calendar year. The top panel restricts the sample to mothers whose own mother is on the household roster. The bottom panel restricts the sample to mothers whose own mother is not on the household roster. The Full-day Kindergarten share constructed from the CPS October supplement. As such, we use the measure from the previous year, as this corresponds to the same school year as the March ASEC observation. Because the October supplement samples are small, we use the state 3-year rolling average of the Full-day Kindergarten share. State-by-year fixed effects are including, absorbing the direct effect of the Full-day Kindergarten share and controlling for state-specific trends in parental employment. MSA-by-year fixed effects are also included, making this a comparison between parents with 5- and 6-year-olds and parents of 7- to 9-year-olds in the same MSA and year. This will hold labor market conditions fixed between the treatment and counterfactual groups. Standard errors corrected for clustering at the state level. p< 0.01 ***, p< 0.05 **, p<0.1 *.

8 Data Appendix

8.1 Full-day Kindergarten Trends Data

We primarily rely on the October School Enrollment Supplement of the Current Population Survey (CPS) to measure trends in full-day kindergarten from 1990 to 2021 (Flood et al., 2023b). The CPS is a nationally representative survey in the United States which is administered by the U. S. Census Bureau. Participating households provide information for eight waves that span over sixteen months. Going back before 1990, all households being surveyed during October are offered additional education questions. Families report school enrollment for each child in the household, including participation in full-day and half-day kindergarten. We take the household-level reports for each year and aggregate them to study broad trends in full-day kindergarten. The full-day kindergarten data is constructed as weighted annual counts of total kindergarten students and full-day kindergarten students in each state, calculated as a full-day proportion, and averaged as three-year moving averages. Because reports were made at the household level, we can evaluate trends with sensitivity to geography and family demographics.

We supplement the full-day kindergarten participation data with data from the National Center for Education Statistics' Common Core of Data on full-time equivalent kindergarten teachers and other education resource measures by state for the same years.

8.2 Parent Time Use Data

We draw time use data from the American Time Use Survey (ATUS) (Flood et al., 2023a). The dataset is nationally representative of households in the United States. The Bureau of Labor Statistics administers the survey in connection with the CPS. Households are selected to participate in the ATUS from a random sample of the outgoing rotation of the CPS. The ATUS is a subsample of the CPS offered two to five months after the final wave of the CPS. The ATUS holds an interview with one household memeber to document their time use over a 24-hour period from 4:00am of the day preceding the interview until 4:00am of the interview day. Time diary data collection using the Day Reconstruction Method has been validated (Kahneman et al. (2004)) and provides high quality and detailed data on family time use.

The October supplement of the CPS has detailed information on whether a child is enrolled in full- versus part-day kindergarten. We leverage this information by linking ATUS respondents to their most previous October Supplement. Not all ATUS respondents took the CPS October supplement. Given the October supplement linking and school day requirement, all included respondents were surveyed in the ATUS from December to May. Importantly, the linking facilitates a comparison of families with children in different kindergarten contexts. We used information from the family roster in the October supplement of the CPS to identify parents with a child in either half-day kindergarten or full-day kindergarten. No parents had both a half- and full-day kindergartener. We also identified parents who had a child in second grade and no child in kindergarten, so that we could use these parents who all had slightly older children in a full-day school context as a comparison group.

We measured time use variable from the ATUS. The primary measures of interest were work time, time spent with any children, and travel time with children. We also measured additional activities relevant to the parenting context such as one-on-one time, developmental care time, etc. (see Table 1 for a complete list of time use variables). Time use measures were developed in two ways. First, we measured the total minutes spent through the day to study the duration of time devoted to activities and companions. Second, to explore the timing of parent-child time and other activities through the day, we measured as a binary variable whether a parent participated in an activity of interest or not for each 15-minute intervals through the sample day.