



Working Paper:

The Effects of Universal Preschool on Grade Retention

Luke C. Miller¹ & Daphna Bassok¹

Nationwide, the percentage of 4-year-olds enrolled in state-supported preschool programs has more than doubled since the early 2000s as states dramatically increased their investments in early childhood education. Florida's Voluntary Pre-Kindergarten Program (VPK), which began in 2005, has been a national leader with respect to preschool access. This paper provides the first evidence of the program's impacts. We measure the effect of VPK participation on the likelihood children are retained at any point between kindergarten and third grade. Employing an instrumental variables approach, we leverage local program expansion and detailed student-level data on eight cohorts of children, four who were preschool-age in the years before VPK was implemented and four who had access to VPK programs. The results indicate that VPK did not lead to changes in the likelihood children complete the third grade without ever being retained. We do find that VPK led to a change in the timing of retention. Specifically, the program led to a drop in the likelihood children were retained during the kindergarten year, but this drop was counteracted by increases in retention in subsequent school years. Implications for policy are discussed.

¹University of Virginia

Updated September 2017

EdPolicyWorks
University of Virginia
PO Box 400879
Charlottesville, VA 22904

EdPolicyWorks working papers are available for comment and discussion only. They have not been peer-reviewed. Do not cite or quote without author permission. Working paper retrieved from:
http://curry.virginia.edu/57_Effects_of_Preschool_on_Retention.pdf

Acknowledgements: This research was funded by the Annie E. Casey Foundation, the Foundation for Child Development, and the Smith Richardson Foundation. We thank them for their support and acknowledge that the findings and conclusions presented in this report are those of the authors alone, and do not necessarily reflect the opinions of these foundations.

EdPolicyWorks Working Paper Series No. 57. September 2017.

Available at <http://curry.virginia.edu/edpolicyworks/wp>

Curry School of Education | Frank Batten School of Leadership and Public Policy | University of Virginia

EFFECTS OF PRESCHOOL ON RETENTION

The Effects of Universal Preschool on Grade Retention

Public investment in early childhood education is on the rise. Between 2002 and 2016, state funding for preschool rose from \$3.3 to \$7.4 billion (constant 2017 dollars) and the percentage of 4-year-olds in state-supported preschool doubled from 14 to 32 percent (Barnett et al., 2017). Federal spending has also grown rapidly. Through its Race to the Top – Early Learning Challenge, the federal government has also allocated roughly one billion dollars to 20 states since 2011, with the explicit goal of improving access to *high-quality* early learning experiences.

These rising investments in early childhood education are motivated, in large part, by evidence that intensive, high-quality early childhood programs can yield striking and long-lasting benefits for children, and produce a high return on investment (Campbell et al., 2012; Schweinhart et al., 2005). Today’s state pre-kindergarten programs, however, differ from the “model” preschool programs that took place four or five decades ago, with respect to quality, intensity, and scope, and it is unclear whether scaled-up early childhood education initiatives yield meaningful long-term benefits (Phillips et al., 2017).

A number of studies have now documented notable short-term benefits from scaled-up public preschool initiatives (Gormley & Phillips, 2005; Weiland & Yoshikawa, 2013; Wong, Cook, Barnett, & Jung, 2008). The evidence on medium-term benefits from large, scaled-up programs is more mixed. Several quasi-experimental studies of large-scale programs in Georgia, North Carolina, and Oklahoma suggest sustained positive effects with respect to academic achievement and on-time grade progression, as well as drops in special education placements (Cascio & Schanzenbach, 2013; Fitzpatrick, 2008; Ladd, Muschkin, & Dodge, 2014; Muschkin, Ladd, & Dodge, 2015).

However, a recent experimental study of Tennessee’s Voluntary Prekindergarten Program, a full-day public preschool, yielded less encouraging results (Lipsey, Farran, & Hofer, 2015). Although program participants saw significant benefits at the end of the preschool year, by the end of the

EFFECTS OF PRESCHOOL ON RETENTION

second grade non-participants had not only caught up, but had somewhat exceeded those of their peers who attended preschool. Similarly, results from the Head Start Impact Study, another randomized experiment of a scaled-up preschool initiative, indicated that the short-term program benefits dissipated by the end of the kindergarten year (Puma et al., 2010).

It is not immediately apparent what explains the differences in results across studies, though methodological differences across the studies as well as differences in the quality and intensity of the early childhood programs examined are worthy candidate explanations.

What is clear, however, is that we still have a relatively limited understanding of the effects of large-scale preschool interventions and that more research is necessary as states rapidly expand early childhood interventions. This study aims to add to the growing literature on the impacts of large-scale early childhood programs within the context of Florida's Voluntary Pre-Kindergarten Program, and focusing on the program's impact on on-time grade progression.

In 2005 Florida introduced Voluntary Pre-Kindergarten (VPK), a free, universal preschool initiative. Florida's implementation of the VPK program represents the most rapid expansion of state-funded preschool in the United States. In its first year, VPK offered free preschool to nearly half of all 4-year-olds in the state, and was among the top state preschool programs in the country with respect to access. Ten years later the program serves the more than three quarters of 4-year-olds in the state. Although the program is in its eleventh year, there has been no rigorous evidence published examining the programs' impacts on Florida's children. Our study provides the first such evidence, examining the impact of the program on one key educational outcome: on-time grade progression.

Rather than measuring the impacts of a highly-regulated and expensive early childhood intervention, such as those which have already been studied in Oklahoma and Georgia, our study measures the effects of a much lower-cost and less-regulated public preschool program. The results

EFFECTS OF PRESCHOOL ON RETENTION

are particularly policy-relevant to states expanding their public preschool offerings by leveraging their existing early childhood infrastructure to provide universal access.

Background

Our study estimates the effect of Florida's VPK program on rates of retention. In this section we motivate our focus on grade retention and discuss the relatively small literature examining the relationship between preschool participation and retention. We also summarize the Florida policy context which generated the data we analyze.

Why study retention?

Most of the research on state-funded preschool has focused on program impacts at the end of the preschool year (Phillips et al., 2017). Many of the studies that have consider longer-term data focus on administrative data collected at third grade (Ladd et al., 2014) or later (Fitzpatrick, 2008). This is because state-wide standardized tests typically begin at third grade. While both the immediate outcomes and the results from third grade and beyond are important, due to data limitations, few studies have considered the interim elementary school years. This is a problematic omission, especially in light of growing evidence that the benefits of many preschool interventions fade by third grade (Lipsey, Hofer, Dong, Farran, & Bilbrey, 2013; Puma et al., 2012). It is essential to understand the experiences of preschool participants and non-participants during the early elementary school years to better understand how and why the initial benefits observed at school entry dissipate as children progress through the early, untested grades. Our study aims to fill this gap focusing on one key early outcome: retention. .

Retention rates offer a compelling measure of children's early performance in schools. Retention is a critical early elementary school outcome for two primary reasons. First, retention is a strong predictor of a variety of negative subsequent outcomes and therefore serves as an important

EFFECTS OF PRESCHOOL ON RETENTION

early indicator of children's success in school. Second, retention is costly; one important way preschool interventions yield high returns on investments is by reducing later remediation.

A number of studies have demonstrated that retention rates are strongly predictive of a variety of negative longer-term outcomes including high school drop-out rates, lower levels of educational attainment, lower earnings, and worse behavioral outcomes (Hammond, Linton, Smink, & Drew, 2007; Jimerson, Anderson, & Whipple, 2002; Ou & Reynolds, 2010; Pagani, Tremblay, Vitaro, Boulerice, & McDuff, 2001). For instance, Eide & Showalter (2001) reported that the raw difference in drop-out rates between Black men who were retained and those who were not was 30 percentage points, and similarly, that Black men who were not retained had earnings that were 31 percent higher. Relatedly, McCoy & Reynolds (1999) demonstrated that children retained between first and seventh grade had significantly lower reading and math achievement at age 14, lower levels of perceived school competence and higher levels of delinquency.

These patterns capture the raw *associations* between retention and various outcomes. An extensive body of research has sought to identify the causal relationship between retention and child outcomes, and has yielded mixed results depending on the methodology employed, the grade in which a child was retained, the presence of remedial supports, and the outcomes considered (Alexander, Entwisle, & Dauber, 2003; Allen, Chen, Willson, & Hughes, 2009; Hong & Raudenbush, 2005; Jimerson et al., 2006). In recent years, a number of careful studies have leveraged discontinuities in rules governing retention to examine the policy's causal impact. In general, these studies have shown positive and neutral impacts of grade retention (Jacob & Lefgren, 2004, 2009; Mariano & Martorell, 2013; Schwerdt, West, & Winters, 2015; Winters & Greene, 2012), with a few notable exceptions (Manacorda, 2010; Özek, 2015). Irrespective of the policy's subsequent impact on children's development, however, grade retention certainly provides a proxy measure of young children's struggles in school and serves as a predictor or risk factor of important negative

EFFECTS OF PRESCHOOL ON RETENTION

outcomes. It is therefore worthwhile to explore whether preschool participation reduces its incidence.

A second policy-relevant reason to study the impacts of preschool on retention is that retention is costly and represents a substantial public investment. Average annual per-pupil spending in the United States is roughly \$10,700. In addition, retention is often accompanied by remedial services that are also costly (Eide & Showalter, 2001). Eide & Goldhaber (2005) estimated that the public cost of retention is between \$3.5 and \$17.8 billion annually (assuming retention rates of 1 percent and 5 percent), and that the private costs of retention are high as well. They argue that even if retention led to sizeable (.25 SD) increase in student achievement, it is unlikely to be a cost-effective practice. Early childhood interventions are often touted as uniquely cost-effective interventions in part because they are hypothesized to reduce the need for costly remediation as children progress through school. It therefore makes sense to examine whether Florida's program led to drops in retention.

Does preschool participation lower retention rates?

Although much of the research on preschool program effectiveness focuses on their impact on child assessments at school entry, there is a growing body of research exploring a broader set of outcomes and tracking children after they enter elementary school. Evidence from two seminal experiments that evaluated the effects of high-quality, intensive preschools in the 1960s and 1970s suggest that preschool participation substantially reduced grade repetition. At age 15, children who had been randomly assigned into the Abecedarian preschool program were 23 percentage points less likely to ever have been retained in grade (Campbell & Ramey, 1995). Similarly, female Perry preschool participants saw a 20 percentage point drop in retention relative to non-participants, though no drops in retention were seen among males (Anderson, 2012).

EFFECTS OF PRESCHOOL ON RETENTION

Findings from some quasi-experimental studies of larger-scale preschool echo the experimental results. For instance, children who participated the Chicago Child Parent Centers, which provided intensive preschool interventions for Title 1 eligible children in the eighties, had retention rates that were about 15 percentage points lower than their comparison group (Reynolds, Temple, Robertson, & Mann, 2002). Similarly, several studies have documented drops in retention for children who participated in the Federal Head Start program (Currie & Thomas, 1995; Deming, 2009). In addition, using nationally representative data, Magnuson, Meyers, Ruhm & Waldfogel (2004) found that children who attended a preschool or Head Start in the year prior to kindergarten were 27 percent less likely to repeat kindergarten relative to children who only experienced parental care.

On the one hand, this existing body of research provides encouraging evidence that preschool participation may substantially reduce grade repetition. On the other hand, the bulk of the existing evidence stems from studies tracking children who attended preschool two to five decades ago. Since that time, investment in early childhood opportunities has grown substantially, and participation in some form of out-of-home, child care center has become the norm (Bassok & Loeb, 2015). Since both the preschool experiences themselves and the “counterfactual” experiences have changed substantially over this period, it is essential to examine the impacts of more recent preschool interventions. Studies of more recent programs have yielded mixed results. For instance, there is some evidence that public preschool initiatives in New Jersey, North Carolina and Texas have led to drops in elementary school retention (Andrews, Jargowsky, & Kuhne, 2012; Barnett, Jung, Youn, & Frede, 2013; Dodge, Bai, Ladd, & Muschkin, 2017). However, the Head Start Impact Study provided experimental evidence that participation in the Federal preschool program had no effect on retention at any point between kindergarten and third grade (Puma et al., 2010).

EFFECTS OF PRESCHOOL ON RETENTION

Florida background

The VPK program. Florida's Voluntary Pre-Kindergarten program (VPK) started in the 2005-06 school year. Unlike many states that gradually scale up targeted preschool programs over time, from its inception Florida's program was open to all 4-year-olds in the state. In fact, in its first year of operation Florida was ranked fourth in the nation with respect to the percent of four year olds who participated (Barnett, Hustedt, Hawkinson, & Robin, 2006).

The 2005 VPK statute created a large, flexible program that emphasized parental choice. Parents could enroll their 4-year-old child in a VPK program either during the school year or during the summer prior to kindergarten entrance.¹ VPK programs can operate in a wide range of settings including private schools, public schools, faith-based settings, and private centers. Notably, however, more than three quarters of all VPK programs are housed in private centers. Although some informal sector providers are eligible to operate VPK programs, VPK is almost entirely a formal sector program (less than 1 percent of participants are served in home-based settings).

The VPK program has often been criticized for low levels of funding and lax quality regulations. For example, in its first year of operation the program ranked 35th of 38 state preschool programs with respect to per pupil state funding. That year, Florida spent \$2,163 per child. The average state preschool program spent \$3,482, and 10 states spent at least twice as much as Florida. The widely evaluated Federal Head Start program spent \$7,287 per child (Barnett et al., 2006).

The National Institute for Early Education Research (NIEER), which evaluates state preschool programs on a host of quality dimensions, noted that Florida met only 4 of 10 benchmarks for high quality programs. For instance, Florida *did not* require that teachers have a Bachelor's degree, hold specialized training in teaching pre-kindergarten, or clock at least 15 hours a year in professional development.

¹ School year programs must offer a minimum of 540 instructional hours, summer programs must offer at least 300 instructional hours.

EFFECTS OF PRESCHOOL ON RETENTION

Although the VPK program fares poorly in national comparisons of quality, the program does require all applicants to meet a set of quality regulations. First, all private centers providing VPK must be licensed as child care facilities by the state and must meet an accreditation requirement. Every VPK program must use a developmentally appropriate curriculum, though they have the option to choose or design the curriculum.

VPK regulations also govern classrooms and teachers. For instance, in school-year programs, each classroom must have between 4 and 20 students. Instructors must hold a Child Development Associate (CDA) certificate or equivalent, complete ten clock hours per year of professional development, and complete a Department of Education course on emergent literacy. Notably, the regulations that govern the VPK program exceed requirements for Florida's private licensed child care centers with respect to class size, accreditation, staff characteristics, professional development, etc.

Retention policies in Florida. Starting in 2002, Florida's legislature required that all children who scored at Level 1 or Level 2 (of 5 levels) on the Florida Comprehensive Assessment Test (FCAT) reading test would repeat third grade and receive a number of remedial services.² According to the state, performance at Level 2 indicates only "limited success with the challenging content of the Sunshine State Standards."

Florida's third grade retention policy had a large impact on retention rates in the state. The year before the policy was introduced, 2.8 percent of Florida's third graders were retained. In the policies' first year, this figure rose to 13.5 percent (Schwerdt et al., 2015). The policy may have also led to changes in retention rates in kindergarten, first or second grade, though the direction of this effect is ambiguous. Teachers may have opted to retain children earlier in the hopes to bolster their reading abilities before the high-stakes third grade tests. Alternatively, teachers may have been more

² The policy did allow for several exemptions including for children with limited English proficiency with less than two years of English instruction, students with disabilities, and students who demonstrated proficiency through a portfolio.

EFFECTS OF PRESCHOOL ON RETENTION

likely to socially promote students prior to the third grade in hopes the students close their learning deficits before the end of the third grade and thus avoid the potential negative consequences of retention.

Critically for the current paper, Florida's retention policy was in effect for all the years in which each of the eight cohorts in our analytic sample were enrolled in kindergarten through third grade. Our first cohort, assuming on time grade promotion, entered third grade when the retention policy was in its fourth year. The fact that all children in our sample experienced the retention policy strengthens our assertion that any measured difference in retention rates is due to preschool attendance rather than the implementation of this retention policy.

The Current Paper

This paper examines whether Florida's VPK program led to drops in the likelihood children are retained between kindergarten and third grade. To do so, we leverage an instrumental variables approach and detailed student-level data on eight cohorts of children, four who were preschool-age in the years before VPK was implemented and four who had access to VPK programs. The paper makes several contributions. First, it provides the first quasi-experimental evidence on the impact of Florida's preschool program, one of the largest state preschool programs nationwide. Second, by considering the impact of VPK participation on retention through third grade, we add to the small body of literature tracking the impacts of large-scale, state-funded preschool programs beyond kindergarten entry. Finally, our study provides evidence about the impact of a relatively low-cost, scaled-up preschool initiative rather than an intensive intervention. Florida's VPK program is often characterized as privileging access over quality. This makes the program unique relative to the more costly and intensive programs that have been the focus of most studies to date.

The results indicate that VPK did not lead to changes in the likelihood children *complete the third grade without ever being retained*. We do find that VPK led to a change in the *timing* of retention.

EFFECTS OF PRESCHOOL ON RETENTION

Specifically, the program led to a drop in the likelihood children were retained during the kindergarten year, but this drop was counteracted by increases in retention in subsequent school years. In addition, we find little systematic evidence of heterogeneity in program impacts across subgroups.

Methods

Data and Measures

This study tracks eight cohorts of students who enrolled in kindergarten for the first time between fall 2002 and fall 2009. The first four cohorts did not have access to VPK when they were 4-years-old while the later four cohorts did. We follow these students through their enrollment in third grade or through the 2011-12 school year, whichever occurs first.³

Our analytic sample includes over 1.5 million students across the eight cohorts. For each student in each year, we observe demographic characteristics, school and grade enrollment, and grade-level retention. We exclude a very small share of students who are observed skipping or regressing in grade, attending a non-traditional, non-charter public school (i.e., virtual schools or schools for homebound students and those in hospital), or attending one of the state's specialty school districts (university lab schools or schools for the deaf).

We assemble an analytic dataset that includes annual observations on these children as they progress from kindergarten to third grade, so long as they remain enrolled in Florida's public school system and have a retention status recorded in the EDW data at the end of the school year. Our models are estimated on the remaining children which represent 93.7 percent of all the children in the year they first enroll in kindergarten, 89.8 percent one year later, 87.2 percent two years later, and 83.4 percent three years later when they would be in 3rd grade if they were never retained.

³ The lack of data for 2012 means we can only follow the 2009 cohort through when they should be enrolled in the second grade. Also note that throughout we refer to a school year using the fall year.

EFFECTS OF PRESCHOOL ON RETENTION

VPK Participation and Expansion. Florida’s Department of Education (FDOE) provided child-level VPK enrollment data through a data sharing agreement with the Florida Office of Early Learning (FLOEL), which has statutory authority for overseeing the VPK program and maintaining enrollment records to reimburse VPK providers. A particular strength of our treatment measure therefore is that it does not rely on parental reports of VPK participation; parental reports of child care and preschool participation may be error prone (Baydar & Brooks-Gunn, 1991; Johnson & Herbst, 2013)

We define VPK availability within a local community in a given year as the ratio of the number of VPK slots available in the community to the number of 4-year-olds in that community, using the year before kindergarten as the reference year (e.g. for children who started kindergarten in 2006 we consider VPK availability in 2005).

We define “community” as a 10-mile radius around a public school offering kindergarten. We set the availability measure to zero for all students in the four pre-VPK cohorts. Then, for each public kindergarten we estimate the number of VPK slots in the surrounding community based on the observed enrollment in the surrounding VPK programs.⁴ We estimate the size of the 4-year-old population in the community as the total kindergarten enrollment at all public and private schools located within the community the following year. In other words, VPK availability for the 2006 kindergarten cohort equals the estimated number of VPK slots in the community in 2005 year divided by the number of kindergarteners enrolled at schools in this community in 2006.

⁴ We assembled information on the exact location and enrollment of the VPK programs from FLOEL’s VPK Program Provider Kindergarten Readiness Rate website. We then account for the potential presence of available but unfilled VPK slots by applying the VPK class size rules to the observed enrollment at each VPK program. For example, consider a private center program that during the 2006 program year served 15 children. Under VPK rules, all 15 children can be in one classroom. We assume this classroom had capacity for 18 students, the maximum allowed. This assumes the programs are profit maximizers and will want to have the maximum class size allowed by law given they will receive a fixed reimbursement by the state. Consider a second program that served 25 children. VPK rules require this provider have at least two classrooms, so we assume the provider had 36 slots available.

EFFECTS OF PRESCHOOL ON RETENTION

The extent to which our availability measure captures the true VPK “choice set” parents faced when they decided whether to enroll their 4-year-old depends on several assumptions: that the kindergarten program is located in the same 10-mile “community” as the families’ home at the time they were making preschool decisions and that 10 miles is a reasonable radius to capture the typical “choice set” for a child care search.

Ideally, we would use families’ home addresses when the child was four to assess proximate access to VPK. Unfortunately, we do not observe home addresses for students either at kindergarten entry or in the prior year when they entered preschool.

We therefore assume that families live near the kindergarten school their child attends. In 2009, the average distance elementary students travelled from home to school was 3.6 miles, about a third of students in elementary and middle school children nationally live within a mile of their school and roughly 50 percent live less than 2 miles from the school they attended (McDonald, Brown, Marchetti, & Pedroso, 2011; National Center for Safe Routes to School, 2011). In Florida, residential proximity to elementary schools is particularly likely given that all Florida districts employ geographic attendance zones to assign students to schools.⁵

Further, earlier studies have shown that when choosing child care and preschool programs (Herbst & Barnow, 2008; Johansen, Leibowitz, & Waite, 1996) as well as public schools more broadly (Cullen, Jacob, & Levitt, 2005; Hastings, Kane, & Staiger, 2008), proximity to home is a major draw. This assumption—that parents select child care and preschool from a very local market is embedded into the design of the National Survey of Early Care and Education, which is the first comprehensive, national study of child care availability. In that study, parents are assumed to choose

⁵ School assignment in two counties is determined partly by geographic attendance zones and partly by other factors. Since the late 1990s, Lee County has divided the district into zones and allowed parents to rank order the schools within the zone in which they live. The district gives preference to proximity to home when matching students to schools. In Hendry County, school assignment in a portion of the county is based on attendance zones with the school assignment in the remaining portion based on racial, socio/economic, academic, and other equity concerns.

EFFECTS OF PRESCHOOL ON RETENTION

child care among the programs located in the community or any census tract within 2-miles (National Survey of Early Care and Education Project Team, 2013).

Although Florida does not geographically restrict the set of VPK programs from which parents can select, we assume that, in keeping with the earlier literature, parents generally choose programs close to home. Florida does not provide transportation to VPK programs, making it more likely that parents sought out care nearby. Finally, we assume parents do not make residential moves between the preschool and kindergarten year in a way that is systematically related to VPK availability (e.g., from low to high availability communities). The lack of information on residential addresses prevents us from assessing this directly.

Retention. Our measure of grade-level retention indicates whether a student is not making on-time progress from kindergarten to third grade. A student that enrolls in kindergarten for the first time in the fall of 2005, for example, will exhibit on-time progress if she is promoted to the first grade at the end of the 2005 school year, is promoted to the second grade at the end of the 2006 school year, and so on. Once a student fails to make on-time progression, we record her as not making on-time progression in all subsequent school years in which she is observed.

We rely on end-of-year reports schools submit to the EDW indicating whether a student is promoted or retained in grade. A strength of this approach to defining grade-level retention is that it requires only one year of data rather than two. An alternate definition would infer retention by comparing the grade in which the student is enrolled the following year to the student's grade in the current year. If the student is observed in the next grade the following year, they are considered promoted and are considered retained otherwise. We do not adopt this definition for two reasons. First, by focusing on the end of year reports, we are able to include children even if they are not observed in the data in the subsequent year. In addition, because we do not observe fourth grade enrollments in our data, relying on subsequent year enrollment would imply we could only examine

EFFECTS OF PRESCHOOL ON RETENTION

grade-level retention through the end of the second grade. By using the end-of-year measure we are able to consider third grade outcomes.

A limitation of relying on the official reports is that the reports may deviate from actual student behavior, perhaps as a result of summer school experiences or parental interventions. Fortunately, there is a great deal of agreement between the official reports and observed retention behavior among students for whom we have both; 97.2 percent of those reported as retained are observed as retained and 99.3 percent of those reported as promoted are observed as promoted.

Student- and Community-level Characteristics. All student-level characteristics we use are based on the EDW data and are either time-invariant or pinned to values observed in the kindergarten year. These data include measures of student gender, race/ethnicity (Asian/Pacific Islander, Black, Hispanic, White, and other race), month of birth, whether the student or parents speaks a language other than English at home, and eligibility for free or reduced-price lunch. We also construct a crude measure of immigrant status: immigrants are students born outside the country, first-generation citizens are students born in the country but whose parents speak a language other than English at home, and all others are classified as at least second-generation citizens.

We supplemented the EDW-provided data with publicly-available data from a number of other sources in order to characterize the communities in which students are assumed to have resided when four years old using data on their kindergarten school and county from the year they were four years old. These characteristics do not vary within a student across time. School characteristics come from NCES's annual *Common Core of Data*: total student enrollment, racial/ethnicity composition (percent Asian, Black, Hispanic, White, and other race), free/reduced-price lunch eligibility (percent eligible for free lunch, eligible for reduced-price lunch, and not eligible), and pupil-teacher ratio. The county-level characteristics we assemble are the county's racial composition (percent Black, White, and other race), ethnic composition (percent Hispanic), poverty

EFFECTS OF PRESCHOOL ON RETENTION

rates for individuals under age 18 years, and median income from the U.S. Census; unemployment rates from the U.S. Bureau of Labor Statistics; average household size from the Florida Bureau of Economic and Business Research; and the median sales prices of single-family homes from the Florida Housing Data Clearinghouse. All dollars are converted to 2011 dollars.⁶

Analytic Plan

We estimate the effects of VPK participation on a student's probability of being retained at any point before completing a given grade using standard regression models like that in equation 1 estimated separately for each of grade, kindergarten through third. These probabilities are known as survival rates in language of survival analysis (Singer & Willett, 2003)

$$(1) \quad R_{icl} = \delta_0 + \delta_1 T_{icl} + \delta_2 C_c + X_{icl} \alpha + W_{cl} \beta + \eta_l + e_{icl}$$

Equation 1 predicts the probability that student i in cohort c who attended kindergarten in local community l is retained at any point prior to completing a given grade (R_{icl}) as a function of whether the student participated in VPK (T_{icl}), a linear time trend (C_c), student characteristics (X_{icl}), local community characteristics (W_{cl}) measured when the student was four years old, and local community fixed effects (η_l).

Although large numbers of parents choose to enroll their child in a VPK program, the program is voluntary. The decision to participate is not random and is very likely correlated with unobserved characteristics of the child and his or her family and community. Equation 1 will therefore yield biased estimates of VPK's participation effects. To account for these unobserved characteristics, and isolate exogenous variation in VPK participation, we estimate a two-stage least squares model in which we instrument VPK participation (T_{icl}) with VPK availability within the local community when student i was four years old (V_{cl}) (equation 2).

⁶ County-level information is easily linked to students given that Florida's 67 school districts perfectly coincide with counties.

EFFECTS OF PRESCHOOL ON RETENTION

$$(2) \quad T_{icl} = \gamma_0 + \gamma_1 V_{cl} + \gamma_2 C_c + X_{icl}\pi + W_{cl}\omega + \tau_l + u_{icl}$$

We assign weights equal to the inverse of the student's estimated propensity to be observed in that school year. All standard errors are clustered on the local community where the student attends kindergarten.

The extent to which this instrumental variables model yields unbiased estimates of the effect of VPK participation on grade-level retention depends on the extent to which local VPK availability is a valid instrument. First, our instrument must influence the participation decision. There is a strong positive correlation between availability and attendance and the F-tests from the first-stage models (equation 2) all far exceed the threshold for strong instruments (Stock & Yogo, 2005). Second, the measured variation in local VPK availability cannot be directly correlated with any unobserved predictor of VPK participation or grade-level retention. Toward satisfying this requirement, we include community fixed effects controlling for all time-invariant community characteristics and a rich set of student and community characteristics that vary across time within a community. Additionally, the manner in which we constructed the instrument reduces the probability these correlations are present in that we use estimated capacity rather than observed enrollment in the calculation of VPK availability. Our instrument therefore does not solely reflect the met demand for VPK.

Ideally, we would want an instrument that fully isolates the supply of VPK from its demand. This is an inherent challenge in all studies that leverage changes in the availability of some service to identify its impact. As we have described above, we have used a number of standard approaches to eliminate the possibility that our measure is capturing both supply and demand, but we acknowledge that this is an untestable assumption.

Results

Descriptive Analysis

We first present a descriptive analysis of VPK participation and availability and grade-level retention before turning to the results of our causal analysis.

The VPK participation rate among the students in our analytic sample increased steadily from 40.9 percent to 53.1 percent across the four post-VPK cohorts (Table 1).⁷ Over the same period, average local availability increased 44 percent from 68 to 98 slots per 100 students. There is considerable variability in availability among students in each of the four cohorts.

{insert Table 1 about here}

VPK was implemented during a period in which retention rates were decreasing. Across the four pre-VPK cohorts, the percent of students retained before completing the first grade dropped 1.3 percentage points (8 percent). The percent retained before completing the second grade dropped 2.6 percentage points (13 percent), and there was also a 2.9 percentage points (12 percent) drop in the likelihood of being retained before completing the third grade (Table 2, first panel).⁸ The kindergarten retention rate was relatively stable, dropping 0.2 percentage points (3 percent). These retention rates continued to decline across the post-VPK cohorts at all grade levels such that the percent of students retained at least once before completing the third grade decreased 26 percent from 24.8 to 18.3 percent. In other words, the percent of students who completed the third grade without ever being retained increased from 75.2 to 81.7 percent.

⁷ Our VPK rates are lower than the state's official estimates of participation which suggest an increase from 48.9 to 69.4 percent. There are several reasons why we would not expect our participation rates to match the state's estimates. First, the state's rates reflect participation in the state as a whole; ours include only the public school kindergartener population. Second, the denominator in the state's rates is an *estimate* of the state's population of 4-year-olds whereas we observe everyone in our denominator. Finally, the state's rates reflect participation among 4-year-olds while ours reflects participation among 5-year-olds (of whom some were ineligible to participate). Any student that moves into the state to attend kindergarten will automatically reduce the participation rate we estimate. Our participation rates are therefore accurate rates for our *analytic sample* which differs from overall participation for the state as a whole.

⁸ While the outcome variable is calculated by looking at subsequent school years, we can interpret them as grade-levels so that year $y + 1$ is first grade, $y + 2$ is second grade, and $y + 3$ is third grade. If a student is retained in first grade, even though in year $y + 3$ they are not in third grade, they have retained at least once before completing the third grade.

EFFECTS OF PRESCHOOL ON RETENTION

{insert Table 2 about here}

Notably, retention rates in Florida are among the highest in the nation (Warren & Saliba, 2012). In 2007, approximately 10 percent of kindergarteners through *eighth graders* nationwide had ever been retained (Planty, Hussar, & Snyder, 2009). Florida's higher rates may partly reflect the state's efforts to eliminate social promotion, embodied in their third grade retention policy.

Impact Analysis

Local VPK availability is strong predictor of VPK participation. As shown in Table 3 (fitted parameters from the first-stage model), an increase in VPK availability within 10 miles of the student's kindergarten school from 0 slots to 1 slot per 4-year-old increases the student's probability of attending VPK by 49 percentage points ($p < 0.001$). The F-statistic on the excluded instrument is over 3,000 at each grade, well above the threshold for strong instruments. The Shea's partial R-squares of 0.053 and 0.058 indicate that local VPK availability alone accounts for 17-18 percent of the total variance in VPK participation explained by the first-stage model (i.e., 0.306-0.316).

{insert Table 3 about here}

Our main effect estimates from the second-stage model are presented in Table 4 and show that VPK participation significantly reduces the probability of being retained at least once before completing first grade, but that this effect disappears by second grade. At the end of kindergarten, VPK participants are 1.7 percentage points ($p < 0.001$) less likely than non-participants to have been retained. This is a 25.8 percent reduction relative to the predicted retention rate of 6.6 percent for non-participants.⁹ This effect is maintained through the completion of first grade by which point VPK participants are 1.6 percentage points ($p < 0.01$) less likely than non-participants to have been

⁹ The base retention rate is predicted from the 2SLS model by constraining the effect of VPK participation to zero. It represents the retention rate we would expect to have observed for the average student in the post-VPK period if they did not participate in VPK.

EFFECTS OF PRESCHOOL ON RETENTION

retained at least once. By the completion of the second grade, however, there is no difference in the probability of having been retained at least once between VPK participants and non-participants.¹⁰

{insert Table 4 about here}

Comparing these effects to estimates from an OLS specification suggests our 2SLS models are removing a considerable amount of bias generated by self-selection into VPK. The OLS estimates (see bottom panel of Table 4) suggest VPK's negative effect on retention rates increased monotonically as students advance through the grades rather than fading out by the second grade.

Choice Set Sensitivity. Our identification strategy relies on our ability to accurately assess VPK availability among all those centers that parents may reasonably consider for their child. While we lack perfect information on exactly how far parents are willing to transport their children to a VPK center, based on existing literature, we chose 10-miles as an approximation. However, some families, for instance, those without reliable access to transportation, may consider 10 miles may be too far. Others may be willing to travel further. For instance, rural parents, already accustomed to travelling greater distances than city and suburban parents to access services, may be more willing to consider VPK centers farther from home than their non-rural counterparts.

We test the sensitivity of our results to these varying choice sets by re-estimating our models instrumenting VPK participation with availability within 5 and 20 miles of the kindergarten school. Table 5 shows that the availability measure is remarkably stable irrespective of the distance used to define a community. The standard deviations do differ depending on the radius used (40 percent greater at 5 miles than at 10 miles and about 23 percent lower at 20 miles relative to 10).

{insert Table 5 about here}

¹⁰ We ran two sets of specification checks in order to assess two of these models' underlying assumptions. First, we estimate the models without the attrition weights and the results were nearly identical suggesting that the pattern of attrition on the observables (and any unobserved characteristics with which they are correlated) is not correlated with either our local VPK availability or retention. Second, we dropped the community characteristics from the model to test whether local VPK availability is correlated with community-level predictors of VPK participation and retention. The results are quite similar to our main results with one exception: the significant drop in retention rates in kindergarten is maintained through the second (rather than first) grade. There continues to be no effect by the completion of third.

EFFECTS OF PRESCHOOL ON RETENTION

The key results from our 2SLS models are presented in Table 6. The 10-mile results are reproduced from Tables 3 and 4 to assist with comparisons. All three VPK availability measures significantly predict VPK participation. The effect of increasing the number of local VPK slots from 0 to 1 slot per 4-year-old is somewhat smaller for 5-mile availability relative to 10-mile ability (37 versus 49 percentage points) and slightly larger for 20-mile availability (55 percentage points). All three instruments account for between 14 and 19 percent of the total variance in VPK participation explained by the model and the F-statistics are all well above the conventional threshold for strong instruments.

{insert Table 6 about here}

Our estimates of VPK's effect on grade-level retention are quite robust to these alternate measures of VPK availability. Expanding the choice set to 20 miles produces nearly identical results. The effect estimates when instrumenting VPK participation with the narrower choice set at 5 miles also tell a similar story—VPK reduces a student's likelihood of being retained in kindergarten which is maintained through the completion of the first grade and fades out by the completion of the third grade. The kindergarten effect is slightly larger (2.5 versus 1.7 percentage points) and that effect persists through the completion of the second grade.

Heterogeneous Effects. In the pre-VPK period, retention rates through the completion of all four grade levels were higher among Black and Hispanic students than among White students, higher for students eligible for the Federal Meals Program than ineligible students, and higher for rural and city students than suburban students (Table 7).¹¹ The magnitudes of these differences are striking. For instance, we find that by the completion of the third grade 17 percent of white children have been retained at least once compared to 32 percent of Black children. Similarly, 12 percent of

¹¹ NCES's urban-centric locale codes are used to classify communities as rural, suburb, and city. We collapse town and rural schools together as less than 4 percent of schools are located in towns.

EFFECTS OF PRESCHOOL ON RETENTION

children who are ineligible for a free or reduced-priced lunch were retained at least once compared to 33 percent of children eligible for a free lunch.

{insert Table 7 about here}

Earlier studies have shown that the impacts of preschool initiatives are often most pronounced among low-income, non-white, and rural children (Bassok, 2010; Fitzpatrick, 2008; Gormley & Phillips, 2005; Weiland & Yoshikawa, 2013). For this reason we examine whether there were greater reductions in the retention rates for Black and Hispanic students relative to White students and for students eligible for free or reduced-price lunch relative to ineligible students. We also test if there were greater reductions for rural and city students compared to suburban students.

VPK participation varies meaningful among racial/ethnic subgroups and with eligibility for free or reduced-price lunch (Table 8). White students participate at higher rates than Black and Hispanic students (49.1 versus 44.1 and 45.7 percent) and free lunch eligible students participate at a lower rate than students ineligible or eligible for reduced-price lunch (42 versus over 50 percent). There is little difference, however, in the average VPK availability across these subgroups—about 11 percent of the overall standard deviation of availability. The pattern is the opposite with respect to community type where *participation rates* are rather similar across rural, suburb, and city students yet the difference between rural and city VPK *availability* is 41 percent of the overall standard deviation.

{insert Table 8 about here}

VPK did little to reduce the gaps in retention rates across racial and economic student subgroups. In kindergarten, VPK significantly reduced the retention likelihood among white students by 2.1 percentage points ($p < 0.001$) and among Hispanic students by 1.9 percentage points ($p < 0.001$) (Table 9). There was no significant effect in kindergarten among Black students. By the completion of the second grade we see no difference in retention rates between VPK participants and non-participants for any group, and by the completion of the third grade we actually see that

EFFECTS OF PRESCHOOL ON RETENTION

Black VPK participants are *more* likely to be retained at least once relative to Black children who did not participate in VPK, a puzzling result given research that suggests Black children may benefit more from preschool than other children (Bassok, 2010; Bassok, Gibbs, & Latham, 2017).

{insert Table 9 about here}

We also find that students who are *ineligible* for free or reduced-priced lunch are the ones that show the greatest drops in retention. Ineligible students who participate in VPK have significantly lower retention rates than ineligible non-participants through the completion of the second grade (Table 10). By the completion of the third grade this difference is eliminated. Again, counter to our hypotheses, at third grade, free-lunch eligible VPK participants are somewhat *more* likely to have been retained at least once relative to non-participants.

{insert Table 10 about here}

Finally, VPK did contribute to reducing the difference in retention rates across rural, suburban, and city students through the completion of the first grade. There are significant effects for rural and city students who have the highest retention rates and no significant effects for suburban students who have the lowest retention rates (Table 11). Among rural students, VPK participants are 4.6 percentage points ($p < 0.001$) less likely than non-participants to be retained in kindergarten and 4.2 percentage points ($p < 0.01$) less likely by the completion of first grade. These effects are almost double those for city students: 2.3 percentage points ($p < 0.05$) in kindergarten and 2.4 percentage points ($p < 0.05$) by the completion of first grade. As with the main effects, there are no significant differences in retention rates between participants and non-participants within any of these groups at the completion of second or third grade.

{insert Table 11 about here}

EFFECTS OF PRESCHOOL ON RETENTION

Discussion & Conclusion

This study examined the effect of attending Florida's universal preschool program on subsequent retention rates. We observe no difference in the likelihood of on-time completion of the third grade between children who attended VPK and those that did not. The results do indicate that Florida's VPK program had an impact on the *timing* of grade retention. VPK led to a substantial drop in retention during the kindergarten year, however, this boost in the likelihood of on-time grade progression was only maintained through the first grade. VPK's effect fades out by the completion of the second grade because, conditional on not having been previously retained, VPK participants were actually *more* likely to be retained in second grade compared to similar non-participants.

One plausible explanation is that participating in VPK helped children transition into kindergarten and the expectations of a formal classroom setting more smoothly. Kindergarten teachers consider behavioral and regulation skills as the most essential skills for school readiness. For example, 91 percent of kindergarten teachers indicated that the ability to follow directions was very important or essential, 89 percent indicated not disrupting was very important or essential, and 87 percent mentioned the importance of taking turns and sharing (Bassok, Latham, & Rorem, 2016). In contrast, only 48 percent noted that letter recognition was very important and even fewer noted the importance of basic math skills. Perhaps VPK helped children improve on the type of behavioral skills that are very salient in the retention decisions of kindergarten teachers. It may be that the program was less effective preparing children for the academic demands of schools that are likely more relevant in second grade retention decisions.

Irrespective of the mechanism, our results are consistent with several other recent studies that show large-scale programs yield initial benefits, but that those benefits fade quickly as children progress through elementary school (Lipsey et al., 2015; Puma et al., 2012). It is worth noting that

EFFECTS OF PRESCHOOL ON RETENTION

the impacts of scaled-up preschool programs are heterogeneous with respect to the counterfactual condition. Two studies now demonstrate that participation in Head Start led to greater benefits for children who would have attended informal care settings in the absence of the program, and smaller benefits for children who would have attended other formal settings (Feller, Grindal, Miratrix, Page, & others, 2016; Kline & Walters, 2016).

Bassok, Miller, & Galdo (2016) find that many VPK attendees would have attended other licensed care settings in the absence of VPK. In addition, although the quality regulations that govern VPK exceed those of licensed care settings, the treatment contrast for participants and non-participants may be relatively modest. It may be the case that highly-regulated programs, such as Boston's Prekindergarten program, which focus on providing more intensive and higher quality instruction and spend substantially more resources per-child, are able to create longer-term impacts. Indeed, new research evaluating North Carolina's public preschool program *does* suggest reductions in retention in third grade and beyond (Dodge et al., 2017).

The timing of retention decisions

As discussed above, the “fade-out” of preschool effects is a major question in the early childhood literature, and a number of recent studies have called for greater understanding of this fade-out as children persist through school (Bailey, Duncan, Odgers, & Yu, 2017; Bassok et al., 2017). The current paper speaks to that by exploring not only the impact of VPK on the likelihood children are retained by the time they complete the third grade, but also by documenting patterns year-by-year. This approach allows us to carefully examine whether preschool had no effect on retention, or whether an initial effect then faded out.

Indeed, we find that although VPK did not reduce the likelihood that children would be retained at some point between kindergarten and the completion of third grade, it did have an effect on retention during kindergarten. It may be the case that the program still yielded long-term benefits

EFFECTS OF PRESCHOOL ON RETENTION

if the timing of early grade retention matters such that second grade retention is more beneficial than kindergarten retention. Unfortunately, there is not yet sufficient evidence on the extent to which the *timing* of retention decision influences their ultimate impacts. The limited evidence that exists suggests that retaining children *earlier* might be more beneficial (or less detrimental) than later retention. For instance, Jacob & Lefgren (2004) found that retention had a modest positive impact on third but not sixth graders' subsequent test scores. Ou & Reynolds (2010) find that late retention (between fourth and eighth grade) has far more negative effects than early retention (between first and third grade).

Focusing specifically on kindergarten retention, two studies have demonstrated that children retained in kindergarten learn less mathematics and reading than they would have had they been promoted, but that kindergarten retention may actually benefit children with respect to their social-emotional development (Hong & Raudenbush, 2005; Hong & Yu, 2008). Hong & Yu (2007) provides some insights on the *comparative* effects of grade retention across early elementary grades. They find that retention in either kindergarten or first grade has negative impacts on children's academic skills, but provide suggestive evidence that the negative effects dissipate more rapidly for children retained in kindergarten. Leveraging the same data, Fruehwirth, Navarro, & Takahashi (2016) explicitly test whether children retained in kindergarten would have been better off had they been promoted into first grade and then retained. They do not find evidence to support this hypothesis.

More research is certainly needed to assess whether changing the timing of retention from kindergarten to second grade impacted children's cognitive or socio-emotional outcomes. The limited existing evidence seems to suggest that retention in kindergarten is likely preferable to later retention. VPK, in delaying the timing of retention, may therefore have had detrimental effects.

EFFECTS OF PRESCHOOL ON RETENTION

Policy Implications & Conclusions

This study adds to the growing body of research examining the impact of state-funded preschool initiatives on child outcomes. Using quasi-experimental methods and rich student-level data on eight cohorts of Florida kindergarteners, we find no evidence that participation in Florida's large state preschool program led to drops in the likelihood that children complete the third grade on-time (i.e., without being retained at any prior year). This is true both for the full population and for demographic subgroups.

Rather, VPK delayed the timing of the retention from kindergarten to the second grade. In response to similar findings about third grade achievement outcomes for participants in Tennessee's preschool program some have called for wider acknowledgement that not all pre-kindergarten programs are created equal and that quality matters (Farran & Lipsey, 2015). Indeed, our findings likely will not surprise preschool advocates who have long criticized VPK for low levels of funding and quality and described it as not "much more than a basic child care program" (Hale, 2009).

On the other hand, retention is only one outcome. The lack of program benefits with respect to retention rates, both overall and for low-income and minority children, does not preclude positive impacts on other important outcomes such as achievement and school attendance, issues we are taking on in future work. Further, the fact that VPK *did* lead to substantial drops in kindergarten retention, despite concerns about program quality, is intriguing, and raises questions about the way this low-cost program effects young children's learning trajectories.

Bibliography

Alexander, K. L., Entwisle, D. R., & Dauber, S. L. (2003). *On the success of failure: A reassessment of the effects of retention in the primary school grades*. Cambridge University Press. Retrieved from https://books.google.com/books?hl=en&lr=&id=iIP4r5qsBJMC&oi=fnd&pg=PR7&dq=success+of+failure+alexander&ots=Zxj_TlwBXF&sig=Ea-IpidjV3wgJcF39OGTPSUJGYc

EFFECTS OF PRESCHOOL ON RETENTION

- Allen, C. S., Chen, Q., Willson, V. L., & Hughes, J. N. (2009). Quality of Research Design Moderates Effects of Grade Retention on Achievement: A Meta-Analytic, Multilevel Analysis. *Educational Evaluation and Policy Analysis, 31*(4), 480–499.
<https://doi.org/10.3102/0162373709352239>
- Anderson, M. L. (2012). Multiple inference and gender differences in the effects of early intervention: A reevaluation of the Abecedarian, Perry Preschool, and Early Training Projects. *Journal of the American Statistical Association*. Retrieved from <http://amstat.tandfonline.com/doi/abs/10.1198/016214508000000841>
- Andrews, R. J., Jargowsky, P., & Kuhne, K. (2012). *The Effects of Texas's Targeted Pre-Kindergarten Program on Academic Performance* (Working Paper No. 18598). National Bureau of Economic Research. Retrieved from <http://www.nber.org/papers/w18598>
- Bailey, D., Duncan, G. J., Odgers, C. L., & Yu, W. (2017). Persistence and fadeout in the impacts of child and adolescent interventions. *Journal of Research on Educational Effectiveness, 10*(1), 7–39.
- Barnett, W. S., Friedman-Krauss, A. H., Weisenfeld, G. G., Horowitz, M., Kasmin, R., & Squires, J. H. (2017). *The State of Preschool 2016*. National Institute for Early Education Research.
- Barnett, W. S., Hustedt, J., Hawkinson, L., & Robin, K. (2006). *The State of Preschool, 2006*. National Institute for Early Education Research.
- Barnett, W. S., Jung, K., Youn, M., & Frede, E. C. (2013). Abbott Preschool Program longitudinal effects study: Fifth grade follow-up. *New Brunswick, NJ: National Institute for Early Education Research, Rutgers-The State University of New Jersey*. Retrieved from <http://www.first5kids.org/sites/default/files/2129.pdf>
- Bassok, D. (2010). Do Black and Hispanic children benefit more from preschool? Understanding differences in preschool effects across racial groups. *Child Development, 81*(6), 1828–1845.

EFFECTS OF PRESCHOOL ON RETENTION

- Bassok, D., Gibbs, C. R., & Latham, S. (2017). Preschool and Children's Outcomes in Elementary School: Have patterns changed nationwide between 1998 and 2010? *EdPolicyWorks Working Paper*. Retrieved from http://curry.virginia.edu/uploads/resourceLibrary/36_Preschool_Fade_Out.pdf
- Bassok, D., Latham, S., & Rorem, A. (2016). Is kindergarten the new first grade? *AERA Open*, 2(1), 2332858415616358. <https://doi.org/10.1177/2332858415616358>
- Bassok, D., & Loeb, S. (2015). Early childhood and the achievement gap. In H. F. Ladd & M. Goertz (Eds.), *Handbook of Research in Education Finance and Policy* (2nd ed.).
- Bassok, D., Miller, L. C., & Galdo, E. (2016). The Effects of Universal State Pre-Kindergarten on the Child Care Sector: The Case of Florida's Voluntary Pre-kindergarten Program. *Economics of Education Review*. Retrieved from <http://www.sciencedirect.com/science/article/pii/S027277571630259X>
- Baydar, N., & Brooks-Gunn, J. (1991). Effects of maternal employment and child-care arrangements on preschoolers' cognitive and behavioral outcomes: Evidence from the Children of the National Longitudinal Survey of Youth. *Developmental Psychology*, 27(6), 932–945. <https://doi.org/10.1037/0012-1649.27.6.932>
- Campbell, F. A., Pungello, E. P., Burchinal, M., Kainz, K., Pan, Y., Wasik, B. H., ... Ramey, C. T. (2012). Adult outcomes as a function of an early childhood educational program: an Abecedarian Project follow-up. *Developmental Psychology*, 48(4), 1033.
- Campbell, F. A., & Ramey, C. T. (1995). Cognitive and school outcomes for high-risk African-American students at middle adolescence: Positive effects of early intervention. *American Educational Research Journal*, 32(4), 743–772.
- Cascio, E. U., & Schanzenbach, D. W. (2013). *The impacts of expanding access to high-quality preschool education* (Working Paper No. 19735). National Bureau of Economic Research.

EFFECTS OF PRESCHOOL ON RETENTION

- Cullen, J. B., Jacob, B. A., & Levitt, S. D. (2005). The impact of school choice on student outcomes: an analysis of the Chicago Public Schools. *Journal of Public Economics*, 89(5–6), 729–760.
<https://doi.org/10.1016/j.jpubeco.2004.05.001>
- Currie, J., & Thomas, D. (1995). Does Head Start Make a Difference? *The American Economic Review*, 341–364.
- Deming, D. (2009). Early childhood intervention and life-cycle skill development: Evidence from Head Start. *American Economic Journal: Applied Economics*, 111–134.
- Dodge, K. A., Bai, Y., Ladd, H. F., & Muschkin, C. G. (2017). Impact of North Carolina’s Early Childhood Programs and Policies on Educational Outcomes in Elementary School. *Child Development*, 88(3), 996–1014. <https://doi.org/10.1111/cdev.12645>
- Eide, E. R., & Goldhaber, D. D. (2005). Grade Retention: What Are the Costs and Benefits? *Journal of Education Finance*, 31(2), 195–214.
- Eide, E. R., & Showalter, M. H. (2001). The effect of grade retention on educational and labor market outcomes. *Economics of Education Review*, 20(6), 563–576.
[https://doi.org/10.1016/S0272-7757\(00\)00041-8](https://doi.org/10.1016/S0272-7757(00)00041-8)
- Farran, D. C., & Lipsey, M. W. (2015, October 8). Expectations of sustained effects from scaled up pre-K: Challenges from the Tennessee study. Retrieved from <http://www.brookings.edu/research/papers/2015/10/08-expectations-of-sustained-effects-from-scaled-up-prek-challenges-tennessee-study-farran-lipsey>
- Feller, A., Grindal, T., Miratrix, L., Page, L. C., & others. (2016). Compared to what? Variation in the impacts of early childhood education by alternative care type. *The Annals of Applied Statistics*, 10(3), 1245–1285.
- Fitzpatrick, M. D. (2008). Starting school at four: the effect of universal pre-kindergarten on children’s academic achievement. *The B. E. Journal of Economic Analysis & Policy*, 8(1), 1897.

EFFECTS OF PRESCHOOL ON RETENTION

- Fruehwirth, J. C., Navarro, S., & Takahashi, Y. (2016). How the timing of grade retention affects outcomes: Identification and estimation of time-varying treatment effects. *Journal of Labor Economics*, 34(4), 979–1021.
- Gormley, W. T., & Phillips, D. (2005). The effects of Universal Pre-K in Oklahoma: Research highlights and policy implications. *Policy Studies Journal*, 33(1), 65–82.
- Hale, L. W. (2009, July 12). State program to get 4-year-olds ready for school still a work in progress. *Naples Daily News*. Retrieved from <http://www.naplesnews.com/community/photos-state-program-to-get-4-year-olds-ready-for-school-still-a-work-in-progress-ep-397430693-331758351.html>
- Hammond, C., Linton, D., Smink, J., & Drew, S. (2007). Dropout risk factors and exemplary programs: A technical report. *National Dropout Prevention Center/Network (NDPC/N)*. Retrieved from <http://eric.ed.gov/?id=ED497057>
- Hastings, J., Kane, T., & Staiger, D. (2008). Heterogeneous preferences and the efficacy of public school choice. *NBER Working Paper*, 2145. Retrieved from https://www.dartmouth.edu/~dstaiger/Papers/WP/2008/HastingsKaneStaiger_Combined_200806.pdf
- Herbst, C. M., & Barnow, B. S. (2008). Close to home: A simultaneous equations model of the relationship between child care accessibility and female labor force participation. *Journal of Family and Economic Issues*, 29(1), 128–151.
- Hong, G., & Raudenbush, S. W. (2005). Effects of Kindergarten Retention Policy on Children's Cognitive Growth in Reading and Mathematics. *Educational Evaluation and Policy Analysis*, 27(3), 205–224. <https://doi.org/10.3102/01623737027003205>

EFFECTS OF PRESCHOOL ON RETENTION

- Hong, G., & Yu, B. (2007). Early-Grade Retention and Children's Reading and Math Learning in Elementary Years. *Educational Evaluation and Policy Analysis, 29*(4), 239–261.
<https://doi.org/10.3102/0162373707309073>
- Hong, G., & Yu, B. (2008). Effects of kindergarten retention on children's social-emotional development: An application of propensity score method to multivariate, multilevel data. *Developmental Psychology, 44*(2), 407–421. <https://doi.org/10.1037/0012-1649.44.2.407>
- Jacob, B. A., & Lefgren, L. (2004). Remedial education and student achievement: A regression-discontinuity analysis. *Review of Economics and Statistics, 86*(1), 226–244.
- Jacob, B. A., & Lefgren, L. (2009). The Effect of Grade Retention on High School Completion. *American Economic Journal: Applied Economics, 1*(3), 33–58.
- Jimerson, S. R., Anderson, G. E., & Whipple, A. D. (2002). Winning the battle and losing the war: Examining the relation between grade retention and dropping out of high school. *Psychology in the Schools, 39*(4), 441–457.
- Jimerson, S. R., Pletcher, S. M., Graydon, K., Schnurr, B. L., Nickerson, A. B., & Kundert, D. K. (2006). Beyond grade retention and social promotion: Promoting the social and academic competence of students. *Psychology in the Schools, 43*(1), 85.
- Johansen, A. S., Leibowitz, A., & Waite, L. J. (1996). The Importance of Child-Care Characteristics to Choice of Care. *Journal of Marriage and Family, 58*(3), 759–772.
<https://doi.org/10.2307/353734>
- Johnson, A. D., & Herbst, C. M. (2013). Can we trust parental reports of child care subsidy receipt? *Children and Youth Services Review, 35*(6), 984–993.
<https://doi.org/10.1016/j.childyouth.2013.03.005>
- Kline, P., & Walters, C. R. (2016). Evaluating public programs with close substitutes: The case of Head Start. *The Quarterly Journal of Economics, 131*(4), 1795–1848.

EFFECTS OF PRESCHOOL ON RETENTION

- Ladd, H. F., Muschkin, C. G., & Dodge, K. A. (2014). From birth to school: Early childhood initiatives and third-grade outcomes in North Carolina. *Journal of Policy Analysis and Management*, 33(1), 162–187. <https://doi.org/10.1002/pam.21734>
- Lipsey, M. W., Farran, D. C., & Hofer, K. G. (2015). *A Randomized Control Trial of a Statewide Voluntary Prekindergarten Program on Children's Skills and Behaviors through Third Grade* (Peabody Research Institute). Nashville, TN: Vanderbilt University.
- Lipsey, M. W., Hofer, K. G., Dong, N., Farran, D. C., & Bilbrey, C. (2013). Evaluation of the Tennessee voluntary prekindergarten program: Kindergarten and first grade follow-up results from the randomized control design. *Vanderbilt Peabody College*, August. Retrieved from https://my.vanderbilt.edu/tnprekevaluation/files/2013/10/August2013_PRI_Kand1stFollowup_TN-VPK_RCT_ProjectResults_FullReport1.pdf
- Magnuson, K. A., Meyers, M. K., Ruhm, C. J., & Waldfogel, J. (2004). Inequality in preschool education and school readiness. *American Educational Research Journal*, 41(1), 115.
- Manacorda, M. (2010). The Cost of Grade Retention. *Review of Economics and Statistics*, 94(2), 596–606. https://doi.org/10.1162/REST_a_00165
- Mariano, L. T., & Martorell, P. (2012). The Academic Effects of Summer Instruction and Retention in New York City. *Educational Evaluation and Policy Analysis*, 0162373712454327. <https://doi.org/10.3102/0162373712454327>
- McCoy, A. R., & Reynolds, A. J. (1999). Grade Retention and School Performance:: An Extended Investigation. *Journal of School Psychology*, 37(3), 273–298. [https://doi.org/10.1016/S0022-4405\(99\)00012-6](https://doi.org/10.1016/S0022-4405(99)00012-6)
- McDonald, N. C., Brown, A. L., Marchetti, L. M., & Pedroso, M. S. (2011). US school travel, 2009: an assessment of trends. *American Journal of Preventive Medicine*, 41(2), 146–151.

EFFECTS OF PRESCHOOL ON RETENTION

- Muschkin, C. G., Ladd, H. F., & Dodge, K. A. (2015). Impact of North Carolina's Early Childhood Initiatives on Special Education Placements in Third Grade. *Educational Evaluation and Policy Analysis*, 0162373714559096. <https://doi.org/10.3102/0162373714559096>
- National Center for Safe Routes to School. (2011). *How Children Get to School: School Travel Patterns from 1969 to 2009*. North Carolina.
- National Survey of Early Care and Education Project Team. (2013). *National Survey of Early Care and Education: Summary Data Collection and Sampling Methodology* (OPRE Report No. #2013-46). Washington, D.C.: Office of Planning, Research and Evaluation, Administration for Children and Families, U.S. Department of Health and Human Services.
- Ou, S.-R., & Reynolds, A. J. (2010). Grade Retention, Postsecondary Education, and Public Aid Receipt. *Educational Evaluation and Policy Analysis*, 32(1), 118–139. <https://doi.org/10.3102/0162373709354334>
- Özek, U. (2015). Hold Back To Move Forward? Early Grade Retention And Student Misbehavior. *Education Finance and Policy*, 10(3), 350–377. https://doi.org/10.1162/EDFP_a_00166
- Pagani, L., Tremblay, R. E., Vitaro, F., Boulerice, B., & McDuff, P. (2001). Effects of grade retention on academic performance and behavioral development. *Development and Psychopathology*, 13(02), 297–315.
- Phillips, D., Lipsey, M. W., Dodge, K. A., Haskins, R., Bassok, D., Burchinal, M. R., ... Weiland, C. (2017). *Puzzling it out: The current state of scientific knowledge on pre-kindergarten effects: A consensus statement*. Washington, DC: Brookings Institute.
- Planty, M., Hussar, W. J., & Snyder, T. D. (2009). *Condition of education 2009*. Government Printing Office. Retrieved from <https://books.google.com/books?hl=en&lr=&id=hICEyj7R6cIC&oi=fnd&pg=PR3&dq=>

EFFECTS OF PRESCHOOL ON RETENTION

- The+condition+of+education+2009&ots=gpi0GOFfKkN&sig=YmqofFyZSWU0LZyja7b3
XXWwr2g
- Puma, M., Bell, S., Cook, R., Heid, C., Broene, P., Jenkins, F., ... Downer, J. (2012). *Third grade follow-up to the Head Start impact study* (No. 2012–45). Administration for Children & Families. US Department of Health and Human Services.
- Puma, M., Bell, S., Cook, R., Heid, C., Shapiro, G., Broene, P., ... Spier, E. (2010). Head Start Impact Study. Final Report. *Administration for Children & Families*, 611.
- Reynolds, A. J., Temple, J. A., Robertson, D. L., & Mann, E. A. (2002). Age 21 Cost-Benefit Analysis of the Title I Chicago Child-Parent Centers. *Educational Evaluation and Policy Analysis*, 24(4), 267–303. <https://doi.org/10.3102/01623737024004267>
- Schweinhart, L. (2005). Summary, Conclusions, and Frequently Asked questions. *Lifetime Effects: The High Scope Perry Preschool Study Through Age, 40*.
- Schwerdt, G., West, M. R., & Winters, M. A. (2015). *The effects of test-based retention on student outcomes over time: Regression discontinuity evidence from Florida*. National Bureau of Economic Research. Retrieved from <http://www.nber.org/papers/w21509>
- Singer, J. D., & Willett, J. B. (2003). *Applied longitudinal data analysis: Modeling change and event occurrence*. New York: Oxford University Press.
- Stock, J. H., & Yogo, M. (2005). Testing for weak instruments in linear IV regression. *Identification and Inference for Econometric Models: Essays in Honor of Thomas Rothenberg*. Retrieved from http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1734933
- Warren, J. R., & Saliba, J. (2012). First- Through Eighth-Grade Retention Rates for All 50 States A New Method and Initial Results. *Educational Researcher*, 41(8), 320–329. <https://doi.org/10.3102/0013189X12457813>

EFFECTS OF PRESCHOOL ON RETENTION

Weiland, C., & Yoshikawa, H. (2013). Impacts of a prekindergarten program on children's mathematics, language, literacy, executive function, and emotional skills. *Child Development*, 84(6), 2112–2130.

Winters, M. A., & Greene, J. P. (2012). The Medium-Run Effects of Florida's Test-Based Promotion Policy. *Education Finance and Policy*, 7(3), 305–330. https://doi.org/10.1162/EDFP_a_00069

Wong, W. S., Cook, T. D., Barnett, W. S., & Jung, K. (2008). An effectiveness-based evaluation of five state pre-kindergarten programs. *Journal of Policy Analysis and Management*, 27(1), 122–154.

EFFECTS OF PRESCHOOL ON RETENTION

Table 1. VPK participation rates and average local VPK availability

	2006	2007	2008	2009	Total
VPK participation rate (%)	40.9	43.9	49.9	53.1	46.9
Local availability of VPK (slots per child)	0.681 (0.168)	0.807 (0.163)	0.913 (0.161)	0.982 (0.167)	0.845 (0.200)

Note: The standard deviation of local availability appears in parentheses.

EFFECTS OF PRESCHOOL ON RETENTION

Table 2. Percent of students retained in grade at least once before the completion of the grade by grade, cohort, and period

	Cohort								Pre- VPK	Post- VPK	Total
	2002	2003	2004	2005	2006	2007	2008	2009			
KG	7.5	7.8	7.8	7.3	6.6	5.6	4.8	4.1	7.6	5.3	6.4
1 st Grade	15.9	16.2	15.4	14.6	13.0	11.2	10.0	8.9	15.5	10.8	13.1
2 nd Grade	20.7	20.5	19.5	18.1	16.4	14.4	13.1	12.5	19.7	14.1	16.9
3 rd Grade	24.8	25.6	23.7	21.9	19.9	18.4	18.3		24.0	18.9	21.8

Note: Students are weighted by their inverse propensity to be observed in the given school year.

EFFECTS OF PRESCHOOL ON RETENTION

Table 3. First-stage fitted parameters predicting VPK participation

	Kindergarten	1 st Grade	2 nd Grade	3 rd Grade
Local VPK availability	0.491*** (0.009)	0.487*** (0.009)	0.486*** (0.009)	0.492*** (0.008)
Linear cohort trend (centered on 2006)	0.003 (0.002)	0.003 (0.002)	0.003 (0.002)	-0.003 (0.002)
Month of birth (centered on Sept.)	-0.003*** (0.000)	-0.003*** (0.000)	-0.003*** (0.000)	-0.002*** (0.000)
Female	0.013*** (0.001)	0.013*** (0.001)	0.013*** (0.001)	0.011*** (0.001)
Asian/Pacific Islander	0.006* (0.002)	0.006* (0.002)	0.007** (0.002)	0.005* (0.003)
Black	0.004** (0.001)	0.004** (0.001)	0.004** (0.001)	0.006*** (0.001)
Hispanic	-0.002 (0.001)	-0.002 (0.001)	-0.002 (0.001)	0.000 (0.001)
Other race	0.004* (0.002)	0.004* (0.002)	0.003 (0.002)	0.005* (0.002)
Immigrant	-0.034*** (0.003)	-0.036*** (0.003)	-0.036*** (0.003)	-0.027*** (0.003)
First generation	0.025*** (0.003)	0.023*** (0.004)	0.024*** (0.004)	0.020*** (0.004)
Speaks non-English language at home	-0.016*** (0.002)	-0.016*** (0.002)	-0.015*** (0.002)	-0.012*** (0.002)
Parents speak non-English language at home	-0.031*** (0.004)	-0.030*** (0.004)	-0.031*** (0.004)	-0.027*** (0.004)
Free lunch eligible	-0.032*** (0.001)	-0.030*** (0.001)	-0.030*** (0.001)	-0.023*** (0.001)
Reduced-price lunch eligible	0.018*** (0.001)	0.019*** (0.001)	0.018*** (0.001)	0.016*** (0.001)
Constant	0.000 (0.000)	-0.005*** (0.000)	-0.006*** (0.000)	-0.006*** (0.000)
N students	1,422,504	1,365,840	1,319,422	1,090,367
N communities	2,206	2,202	2,202	2,144
R-squared	0.310	0.308	0.306	0.316
F-statistic for instrument	3,094.46***	3,115.23***	3,189.60***	3,497.52***
Shea's partial R ² for instrument	0.053	0.053	0.053	0.058

Notes. Students are weighted by their inverse propensity to be observed in a given school year. Robust standard errors in parentheses account for community clusters. Parameters for community characteristics omitted due to space limitations but include demographic measures (school and community racial/ethnic composition and school enrollment), economic measures (school free/reduced-price lunch eligibility, median household income, under 18 poverty rate, unemployment rate, and home sale prices), and other measures (student-teacher ratio and household size).

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

EFFECTS OF PRESCHOOL ON RETENTION

Table 4. Fitted parameters from 2SLS models of the probability of being retained at least once by the completion of kindergarten through third grade

	Kindergarten	1 st Grade	2 nd Grade	3 rd Grade
VPK Participant (instrumented)	-0.017*** (0.004)	-0.016** (0.006)	-0.009 (0.006)	0.009 (0.006)
Linear cohort trend (centered on 2006)	-0.001 (0.001)	-0.006*** (0.001)	-0.008*** (0.001)	-0.009*** (0.001)
Month of birth (centered on September)	0.007*** (0.000)	0.011*** (0.000)	0.012*** (0.000)	0.014*** (0.000)
Female	-0.034*** (0.001)	-0.060*** (0.001)	-0.070*** (0.001)	-0.085*** (0.001)
Asian/Pacific Islander	-0.018*** (0.001)	-0.040*** (0.002)	-0.052*** (0.002)	-0.064*** (0.002)
Black	0.018*** (0.001)	0.032*** (0.002)	0.041*** (0.002)	0.066*** (0.002)
Hispanic	0.006*** (0.001)	0.011*** (0.001)	0.012*** (0.001)	0.018*** (0.002)
Other race	-0.001 (0.001)	-0.002 (0.002)	-0.003 (0.002)	-0.002 (0.002)
Immigrant student	-0.000 (0.002)	-0.008** (0.003)	-0.011*** (0.003)	-0.023*** (0.004)
First-generation student	-0.010*** (0.002)	-0.019*** (0.003)	-0.021*** (0.004)	-0.020*** (0.004)
Speaks language other than English at home	0.007*** (0.001)	0.010*** (0.002)	0.019*** (0.002)	0.035*** (0.002)
Parents speak non-English language at home	0.003 (0.002)	0.006 (0.003)	0.007 (0.004)	0.007 (0.005)
Free lunch eligible	0.061*** (0.001)	0.107*** (0.002)	0.129*** (0.002)	0.159*** (0.002)
Reduced-price lunch eligible	0.018*** (0.001)	0.032*** (0.001)	0.040*** (0.001)	0.050*** (0.002)
Constant	0.000 (0.000)	0.000* (0.000)	0.000*** (0.000)	0.000*** (0.000)
N students	1,422,504	1,365,840	1,319,422	1,090,367
N communities	2,206	2,202	2,202	2,144
R-squared	0.032	0.050	0.056	0.064
2SLS base rate	0.066	0.125	0.156	0.199
2SLS treatment effect as % of base	25.8	12.8	5.8	4.5
OLS-estimated VPK Participant (observed) coefficient	-0.019*** (0.001)	-0.030*** (0.001)	-0.033*** (0.001)	-0.038*** (0.001)
OLS base rate	0.067	0.130	0.164	0.212
OLS treatment effect as % of base	28.4	23.1	20.1	17.9

Notes. Students are weighted by their inverse propensity to be observed in a given school year. Robust standard errors in parentheses account for community clusters. Parameters for community characteristics omitted due to space limitations but include demographic measures (school and community racial/ethnic composition and school enrollment), economic measures (school free/reduced-price lunch eligibility, median household income, under 18 poverty rate, unemployment rate, and home sale prices), and other measures (student-teacher ratio and household size).

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

EFFECTS OF PRESCHOOL ON RETENTION

Table 5. Average local VPK availability by post-VPK cohort

	2006	2007	2008	2009	Total
5 miles	0.675 (0.240)	0.804 (0.254)	0.909 (0.263)	0.974 (0.271)	0.840 (0.281)
10 miles	0.680 (0.168)	0.807 (0.163)	0.913 (0.161)	0.982 (0.167)	0.845 (0.200)
20 miles	0.668 (0.120)	0.793 (0.105)	0.896 (0.101)	0.962 (0.099)	0.829 (0.154)

Note: The standard deviation of local availability appears in parentheses.

EFFECTS OF PRESCHOOL ON RETENTION

Table 6. Key fitted coefficients from 2SLS models of the VPK participation effect on being retained at least once by the completion of kindergarten through third grade instrumenting VPK participation with VPK availability within 5, 10, and 20 miles

	Kindergarten	1 st Grade	2 nd Grade	3 rd Grade
1st Stage Effects of VPK Availability on VPK Participation				
5 miles	0.368*** (0.012)	0.364*** (0.013)	0.366*** (0.011)	0.382*** (0.009)
F-statistic for instrument	873.11***	831.77***	1,030.47***	1,986.86***
R-squared	0.302	0.299	0.298	0.308
Shea's partial R ² for instrument	0.042	0.041	0.042	0.047
10 miles	0.491*** (0.009)	0.487*** (0.009)	0.486*** (0.009)	0.492*** (0.008)
F-statistic for instrument	3,094.46***	3,115.23***	3,189.60***	3,497.52***
R-squared	0.310	0.308	0.306	0.316
Shea's partial R ² for instrument	0.053	0.053	0.053	0.058
20 miles	0.558*** (0.005)	0.553*** (0.005)	0.551*** (0.005)	0.550*** (0.005)
F-statistic for instrument	14,412.71***	14,072.54***	14,156.51***	11,984.26***
R-squared	0.312	0.310	0.309	0.318
Shea's partial R ² for instrument	0.056	0.056	0.056	0.060
2nd Stage Effects of VPK Participation on Retention				
5 miles	-0.025*** (0.005)	-0.025*** (0.006)	-0.020** (0.007)	-0.003 (0.007)
Base rate	0.069	0.128	0.159	0.202
Effect as % of base	36.2	19.5	12.6	1.5
R-squared	0.032	0.050	0.057	0.065
10 miles	-0.017*** (0.004)	-0.016** (0.006)	-0.009 (0.006)	0.009 (0.006)
Base rate	0.066	0.125	0.156	0.199
Effect as % of base	25.8	12.8	5.8	4.5
R-squared	0.032	0.050	0.056	0.064
20 miles	-0.019*** (0.004)	-0.016** (0.005)	-0.006 (0.005)	0.008 (0.006)
Base rate	0.067	0.124	0.154	0.199
Effect as % of base	28.4	12.9	3.9	4.0
R-squared	0.032	0.050	0.056	0.064
N students	1,422,504	1,365,840	1,319,422	1,090,367
N communities	2,206	2,202	2,202	2,144

Notes. Separate models were estimated for each grade-VPK availability measure combination. Students are weighted by their inverse propensity to be observed in a given school year. Robust standard errors in parentheses account for community clusters.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

EFFECTS OF PRESCHOOL ON RETENTION

Table 7. Rates of being retained at least once by the completion of each grade by student subgroup and period

Group	Kindergarten			1 st Grade			2 nd Grade			3 rd Grade		
	Pre-VPK	Post-VPK	Total	Pre-VPK	Post-VPK	Total	Pre-VPK	Post-VPK	Total	Pre-VPK	Post-VPK	Total
Overall	7.6	5.3	6.4	15.5	10.8	13.1	19.7	14.1	16.9	24.0	18.9	21.8
Race/ethnicity												
White	6.5	4.8	5.7	13.0	9.7	11.4	16.2	12.1	14.2	18.9	15.0	17.3
Black	10.3	7.2	8.7	21.1	14.9	18.0	27.1	19.9	23.5	34.8	28.0	31.9
Hispanic	7.7	4.8	6.2	15.8	10.0	12.7	20.4	13.6	16.8	25.1	19.2	22.4
Free/reduced-price lunch eligibility												
Not eligible	3.9	2.8	3.4	8.7	6.0	7.4	11.2	7.7	9.5	13.4	10.2	12.0
Reduced	6.0	4.0	5.0	13.1	8.7	10.9	17.3	11.6	14.4	21.6	16.2	19.2
Free	11.7	7.8	9.6	23.1	15.7	19.3	29.1	20.6	24.7	35.7	28.7	32.7
Community Type												
Rural	9.5	6.8	8.0	18.3	13.0	15.4	22.6	16.3	19.2	26.1	20.3	23.4
Suburb	6.6	4.4	5.5	13.8	9.3	11.6	17.8	12.4	15.1	21.9	17.1	19.9
City	8.5	5.8	7.1	17.3	12.2	14.8	21.9	16.1	19.0	27.0	21.7	24.8

Note: Students are weighted by their inverse propensity to be observed in the given school year.

EFFECTS OF PRESCHOOL ON RETENTION

Table 8. VPK participation and availability within 10 miles by student subgroups, 2005-06 to 2008-09

	VPK Participation (%)	VPK Availability (slots/student)
Overall	46.9	0.845 (0.200)
By race/ethnicity		
White	49.1	0.836 (0.226)
Black	44.1	0.859 (0.175)
Hispanic	45.7	0.846 (0.178)
By eligibility for Federal Meals Program		
Ineligible	50.9	0.835 (0.204)
Reduced-price lunch	52.9	0.838 (0.200)
Free lunch	42.1	0.855 (0.197)
By community type		
Rural	46.1	0.799 (0.271)
Suburb	48.1	0.847 (0.175)
City	45.0	0.881 (0.171)

Note: The standard deviation of local availability appears in parentheses.

EFFECTS OF PRESCHOOL ON RETENTION

Table 9. Effects of VPK Participation (instrumented with VPK availability within 10 miles) on being retained at least once by the completion of each grade by race/ethnicity

	Kindergarten	1 st Grade	2 nd Grade	3 rd Grade	
1st Stage Effects of VPK Availability on VPK Participation					
White	0.475*** (0.015)	0.470*** (0.015)	0.470*** (0.015)	0.483*** (0.014)	
F-statistic for instrument	946.92***	953.73***	1,009.35***	1,229.07***	
R-squared	0.335	0.332	0.330	0.334	
Shea's partial R ² for instrument	0.056	0.055	0.055	0.061	
Black	0.510*** (0.007)	0.505*** (0.007)	0.503*** (0.007)	0.498*** (0.008)	
F-statistic for instrument	5,478.81***	5,280.52***	5,290.30***	4,309.81***	
R-squared	0.282	0.281	0.279	0.294	
Shea's partial R ² for instrument	0.052	0.051	0.051	0.055	
Hispanic	0.554*** (0.007)	0.547*** (0.007)	0.546*** (0.007)	0.543*** (0.008)	
F-statistic for instrument	5,678.11***	5,511.37***	5,434.46***	4,863.32***	
R-squared	0.300	0.299	0.299	0.313	
Shea's partial R ² for instrument	0.047	0.047	0.046	0.051	
2nd Stage Effects of VPK Participation on Retention					
White	-0.021*** (0.005)	-0.022*** (0.006)	-0.010 (0.007)	0.004 (0.008)	
Base rate	6.0	10.9	12.9	15.7	
% of base	35.0	20.2	7.8	2.5	
R-squared	0.034	0.053	0.058	0.062	
Black	-0.010 (0.008)	-0.007 (0.011)	0.007 (0.012)	0.038** (0.014)	
Base rate	8.6	16.4	21.1	28.7	
% of base	11.6	4.3	3.3	13.2	
R-squared	0.030	0.045	0.049	0.053	
Hispanic	-0.019*** (0.004)	-0.016** (0.005)	-0.006 (0.005)	0.008 (0.006)	
Base rate	0.067	0.124	0.154	0.199	
Effect as % of base	28.4	12.9	3.9	4.0	
R-squared	0.025	0.041	0.046	0.049	
White	N Students	622,133	593,538	570,678	480,202
	N Communities	2,159	2,157	2,153	2,083
Black	N Students	318,905	309,614	301,221	244,430
	N Communities	2,152	2,148	2,145	2,086
Hispanic	N Students	394,658	380,723	369,358	302,089
	N Communities	2,136	2,136	2,136	2,074

Notes. Separate models were estimated for each grade-student subgroup combination. Students are weighted by their inverse propensity to be observed in a given school year. Robust standard errors in parentheses account for community clusters.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

EFFECTS OF PRESCHOOL ON RETENTION

Table 10. Effects of VPK Participation (instrumented with VPK availability within 10 miles) on being retained at least once by the completion of each grade by Federal Meals Program eligibility

	Kindergarten	1 st Grade	2 nd Grade	3 rd Grade	
1st Stage Effects of VPK Availability on VPK Participation					
Not Eligible	0.520*** (0.012)	0.515*** (0.012)	0.514*** (0.011)	0.520*** (0.011)	
F-statistic for instrument	1,874.08***	1,949.22***	2,056.48***	2,337.13***	
R-squared	0.352	0.347	0.346	0.345	
Shea's partial R ² for instrument	0.063	0.061	0.061	0.064	
Reduced-Price	0.549*** (0.014)	0.544*** (0.014)	0.540*** (0.015)	0.539*** (0.014)	
F-statistic for instrument	1,526.08***	1,429.46***	1,321.07***	1,395.29***	
R-squared	0.356	0.355	0.352	0.359	
Shea's partial R ² for instrument	0.064	0.063	0.063	0.064	
Free	0.459*** (0.007)	0.456*** (0.007)	0.455*** (0.007)	0.458*** (0.007)	
F-statistic for instrument	4,120.65***	4,048.23***	4,030.11***	3,785.47***	
R-squared	0.262	0.262	0.261	0.278	
Shea's partial R ² for instrument	0.045	0.045	0.045	0.051	
2nd Stage Effects of VPK Participation on Retention					
Not Eligible	-0.014*** (0.003)	-0.017*** (0.005)	-0.013* (0.005)	-0.003 (0.006)	
Base rate	0.038	0.073	0.088	0.109	
% of base	36.8	23.3	14.7	2.8	
R-squared	0.015	0.024	0.027	0.029	
Reduced-Price	-0.018* (0.008)	-0.020 (0.011)	-0.008 (0.012)	0.018 (0.015)	
Base rate	0.054	0.107	0.132	0.175	
% of base	33.3	18.7	6.1	10.3	
R-squared	0.021	0.033	0.037	0.036	
Free	-0.014 (0.008)	-0.007 (0.010)	0.003 (0.010)	0.024* (0.011)	
Base rate	0.094	0.178	0.226	0.300	
% of base	14.9	3.9	1.3	8.0	
R-squared	0.027	0.041	0.042	0.041	
Not Eligible	N Students	639,780	614,590	592,086	504,392
	N Communities	2,176	2,177	2,177	2,114
Reduced-Price	N Students	126,568	121,657	117,596	98,929
	N Communities	2,111	2,111	2,109	2,060
Free	N Students	656,156	629,593	609,740	487,046
	N Communities	2,186	2,182	2,179	2,118

Notes. Separate models were estimated for each grade-student subgroup combination. Students are weighted by their inverse propensity to be observed in a given school year. Robust standard errors in parentheses account for community clusters.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

EFFECTS OF PRESCHOOL ON RETENTION

Table 11. Effects of VPK Participation (instrumented with VPK availability within 10 miles) on being retained at least once by the completion of each grade by community type

	Kindergarten	1 st Grade	2 nd Grade	3 rd Grade
1st Stage Effects of VPK Availability on VPK Participation				
Rural	0.364*** (0.025)	0.359*** (0.025)	0.360*** (0.025)	0.388*** (0.025)
F-statistic for instrument	211.40***	213.98***	216.30***	246.01***
R-squared	0.264	0.262	0.261	0.275
Shea's partial R ² for instrument	0.032	0.032	0.032	0.040
Suburb	0.539*** (0.007)	0.534*** (0.007)	0.532*** (0.007)	0.531*** (0.008)
F-statistic for instrument	5,513.52***	5,585.00***	5,646.65***	4,992.27***
R-squared	0.331	0.330	0.329	0.336
Shea's partial R ² for instrument	0.061	0.062	0.060	0.063
City	0.520*** (0.008)	0.515*** (0.008)	0.514*** (0.008)	0.519*** (0.008)
F-statistic for instrument	4,536.42***	4,449.81***	4,420.61***	4,452.90***
R-squared	0.305	0.302	0.300	0.311
Shea's partial R ² for instrument	0.052	0.051	0.052	0.059
2nd Stage Effects of VPK Participation on Retention				
Rural	-0.046*** (0.012)	-0.042** (0.015)	-0.021 (0.017)	-0.003 (0.016)
Base rate	0.090	0.152	0.182	0.220
% of base	51.1	27.6	11.5	1.7
R-squared	0.039	0.060	0.067	0.075
Suburb	-0.007 (0.005)	-0.006 (0.007)	-0.004 (0.007)	0.015 (0.008)
Base rate	0.058	0.111	0.137	0.178
% of base	12.1	5.4	2.9	8.4
R-squared	0.029	0.047	0.054	0.060
City	-0.023* (0.010)	-0.024* (0.011)	-0.012 (0.012)	0.005 (0.012)
Base rate	0.077	0.143	0.177	0.230
% of base	29.9	16.8	6.8	2.2
R-squared	0.033	0.050	0.055	0.065
Rural	N Students	281,067	267,582	257,835
	N Communities	480	478	478
Suburb	N Students	790,311	762,461	736,582
	N Communities	1,112	1,111	1,111
City	N Students	351,126	335,797	325,005
	N Communities	614	613	613

Notes. Separate models were estimated for each grade-community type combination. Students are weighted by their inverse propensity to be observed in a given school year. Robust standard errors in parentheses account for community clusters.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$