

# THE EFFECTS OF UNIVERSAL PRESCHOOL ON GRADE RETENTION

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## **Abstract**

Nationwide, the percentage of four-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 that children are retained at any point between kindergarten and third grade. Using an instrumental variables approach, we leverage local program expansion and detailed student-level data on eight cohorts of children, four of which were of preschool age in the years before VPK was implemented and four of which had access to VPK programs. The results indicate that VPK did not lead to changes in the likelihood that children complete the third grade without ever being retained. We do find, however, that VPK led to a change in the timing of retention. Specifically, the program led to a drop in the likelihood that 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.

[https://doi.org/10.1162/edfp\\_a\\_00248](https://doi.org/10.1162/edfp_a_00248)

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## 1. INTRODUCTION

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 four-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 allocated roughly one billion dollars to twenty 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 (Schweinhart et al. 2005; Campbell et al. 2012). Today's state pre-kindergarten programs, however, differ from the “model” preschool programs that operated 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 and Phillips 2005; Wong et al. 2008; Weiland and Yoshikawa 2013). 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 (Fitzpatrick 2008; Cascio and Schanzenbach 2013; Ladd, Muschkin, and Dodge 2014; Muschkin, Ladd, and Dodge 2015).

However, a recent experimental study of Tennessee's Voluntary Pre-kindergarten Program, a full-day public preschool, yielded less encouraging results (Lipsey, Farran, and Hofer 2015). Although program participants saw significant benefits at the end of the preschool year, by the end of the second grade, nonparticipants 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 (VPK), and focuses on the program's impact on on-time grade progression.

In 2005, Florida introduced 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 four-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 more than three quarters of four-year-olds in the state. Although the program is in its eleventh year, there has been no rigorous evidence published examining the program's 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 that 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 are particularly policy-relevant to states expanding their public preschool offerings by leveraging their existing early childhood infrastructure to provide universal access.

## 2. 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 that 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 considered longer-term outcomes focus on administrative data collected at third grade (Ladd, Muschkin, and Dodge 2014) or later (Fitzpatrick 2008). This is because state-wide standardized tests typically begin at third grade. Although both the immediate outcomes and the results from third grade and beyond are important, because of 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 (Puma et al. 2012; Lipsey et al. 2013). It is essential to understand the experiences of preschool participants and nonparticipants 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 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 (Pagani et al. 2001; Jimerson, Anderson, and Whipple 2002; Hammond et al. 2007; Ou and Reynolds 2010). For instance, Eide and Showalter (2001) reported that the raw difference in dropout rates between black men who were retained and those who were not was 30 percentage points, and similarly, black men who were not retained had

earnings that were 31 percent higher. Relatedly, McCoy and Reynolds (1999) demonstrated that children retained between first and seventh grades had significantly lower reading and math achievement at age 14 years, 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 utilized, the grade in which a child was retained, the presence of remedial supports, and the outcomes considered (Alexander, Entwisle, and Dauber 2003; Hong and Raudenbush 2005; Jimerson et al. 2006; Allen et al. 2009). 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 and Lefgren 2004, 2009; Winters and Greene 2012; Mariano and Martorell 2013; Schwerdt, West, and Winters 2015), 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 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 and Showalter 2001). Eide and 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 the private costs of retention are high as well. They argue that even if retention led to a sizeable (0.25 standard deviation) 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 the 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 suggests that preschool participation substantially reduced grade repetition. At age 15 years, 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 and Ramey 1995). Similarly, female Perry preschool participants saw a 20 percentage point drop in retention relative to nonparticipants, though no drops in retention were seen among male participants (Anderson 2012).

Findings from some quasi-experimental studies of larger-scale preschool programs echo the experimental results. For instance, children who participated in the Chicago

Child Parent Centers, which provided intensive preschool interventions for Title 1–eligible children in the 1980s, had retention rates that were about 15 percentage points lower than their comparison group (Reynolds et al. 2002). Similarly, several studies have documented drops in retention for children who participated in the Federal Head Start program (Currie and Thomas 1995; Deming 2009). In addition, using nationally representative data, Magnuson et al. (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 and Loeb 2015). Because 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, and Kuhne 2012; Barnett et al. 2013; Dodge et al. 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).

## Florida Background

### *The VPK Program*

Florida’s VPK program 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 four-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 et al. 2006).

The 2005 VPK statute created a large, flexible program that emphasized parental choice. Parents could enroll their four-year-old child in a VPK program either during the school year or during the summer prior to kindergarten entrance.<sup>1</sup> 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 (fewer 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 thirty-fifth of thirty-eight 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

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

per child, and ten 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, which evaluates state preschool programs on a host of quality dimensions, noted that Florida met only four of ten benchmarks for high-quality programs. For instance, Florida did not require that teachers have a bachelor's degree, hold specialized training in how to teach pre-kindergarten, or clock at least 15 hours a year in professional development.

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 four and twenty students. Instructors must hold a Child Development Associate certificate or equivalent, complete 10 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 in many respects, including class size, accreditation, staff characteristics, and professional development.

### *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 in reading would repeat third grade and receive a number of remedial services.<sup>2</sup> 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 policy's first year, this figure rose to 13.5 percent (Schwerdt, West, and Winters 2015). The policy may have also led to changes in retention rates in kindergarten, first grade, or second grade, though the direction of this effect is ambiguous. Teachers may have opted to retain children earlier in the hopes of bolstering their reading abilities before the high-stakes third-grade tests. Alternatively, teachers may have been more likely to socially promote students prior to the third grade with the hope that 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

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

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 of which were preschool-age in the years before VPK was implemented and four of which 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, however, that VPK led to a change in the timing of retention. Specifically, the program led to a drop in the likelihood that 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.

## 3. METHODS

### Data and Measures

We obtained data from the Florida Department of Education's PK-20 Education Data Warehouse (EDW) that allow us to track 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, whereas 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.<sup>3</sup>

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 nontraditional, noncharter 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

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.

the end of the school year. Our models are estimated on the remaining children, who 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 third grade if they were never retained.

### *VPK Participation and Expansion*

Florida's Department of Education provided child-level VPK enrollment data through a data sharing agreement with the Florida Office of Early Learning, 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 and Brooks-Gunn 1991; Johnson and 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 four-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 ten-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.<sup>4</sup> We estimate the size of the four-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 divided by the number of kindergarteners enrolled at schools in this community in 2006.

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

Ideally, we would use the families' home addresses when the child was four years old 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 one third of elementary and middle school children nationally lived

4. We assembled information on the exact location and enrollment of the VPK programs from Florida Office of Early Learning's VPK Program Provider Kindergarten Readiness Rate Web site. 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 fifteen children. Under VPK rules, all fifteen children can be in one classroom. We assume this classroom had capacity for eighteen 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 twenty-five children. VPK rules require this provider have at least two classrooms, so we assume the provider had thirty-six slots available.



within a mile of their school, and roughly 50 percent lived fewer than two miles from the school they attended (McDonald et al. 2011; National Center for Safe Routes to School 2011). In Florida, residential proximity to elementary schools is particularly likely given that all Florida districts use geographic attendance zones to assign students to schools.<sup>5</sup>

Further, earlier studies have shown that when choosing child care and preschool programs (Johansen, Leibowitz, and Waite 1996; Herbst and Barnow 2008) as well as public schools more broadly (Cullen, Jacob, and Levitt 2005; Hastings, Kane, and 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 child care among the programs located in the community or any census tract within two miles (Bowman et al. 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 who 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, he is considered promoted and is 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 that we

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, socioeconomic, academic, and other equity concerns.

could only examine 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-Level 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.

Using data on their kindergarten school and county from the year they were 4 years old, 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 4 years old. These characteristics do not vary within a student across time. School characteristics come from the National Center for Education Statistic's annual Common Core of Data: total student enrollment, racial/ethnicity composition (percent Asian, black, Hispanic, white, and other race), free or 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 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.<sup>6</sup>

#### **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 grade, kindergarten through third. These probabilities are known as *survival rates* in language of survival analysis (Singer and Willett 2003):

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

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

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 4 years old, and local community fixed effects ( $\eta_l$ ).

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 4 years old ( $V_{cl}$ ) (equation 2):

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

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 and 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 described earlier, 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.

## 4. 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.** Voluntary Pre-Kindergarten Program (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.

**Table 2.** Percent of Students Retained in Grade at Least Once Before the Completion of the Grade by Grade, Cohort, and Period

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

Notes: Students are weighted by their inverse propensity to be observed in the given school year. VPK = Voluntary Pre-kindergarten Program.

(table 1).<sup>7</sup> 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.

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 point (12 percent) drop in the likelihood of being retained before completing the third grade (table 2).<sup>8</sup> 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.

Notably, retention rates in Florida are among the highest in the nation (Warren and Saliba 2012). In 2007, approximately 10 percent of kindergarteners through eighth graders nationwide had ever been retained (Planty, Hussar, and Snyder 2009). Florida's

- 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 four-year-olds, whereas we observe everyone in our denominator. Finally, the state's rates reflect participation among four-year-olds whereas ours reflects participation among five-year-olds (of whom some were ineligible to participate). Any student who 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.
- Although the outcome variable is calculated by looking at subsequent school years, we can interpret them as grade-levels so that year  $\gamma + 1$  is first grade,  $\gamma + 2$  is second grade, and  $\gamma + 3$  is third grade. If a student is retained in first grade, even though in year  $\gamma + 3$  they are not in third grade, they have been retained at least once before completing the third grade.

**Table 3.** First-Stage Fitted Parameters Predicting Voluntary Pre-Kindergarten Program (VPK) Participation

	Kindergarten	1 <sup>st</sup> Grade	2 <sup>nd</sup> Grade	3 <sup>rd</sup> 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 September	-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)
<i>N</i> students	1,422,504	1,365,840	1,319,422	1,090,367
<i>N</i> communities	2,206	2,202	2,202	2,144
R <sup>2</sup>	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 <sup>2</sup> 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 age 18 years poverty rate, unemployment rate, and home sale prices), and other measures (student-teacher ratio and household size).

\* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$ .

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 a strong predictor of VPK participation. As shown in table 3 (fitted parameters from the first-stage model), an increase in VPK availability within ten miles of the student’s kindergarten school from 0 slots to 1 slot per four-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<sup>2</sup> of 0.053 and 0.058 indicate

**Table 4.** Fitted Parameters from Two-Stage Least Squares (2SLS) Models of the Probability of Being Retained at Least Once by the Completion of Kindergarten through Third Grade

	Kindergarten	1 <sup>st</sup> Grade	2 <sup>nd</sup> Grade	3 <sup>rd</sup> 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)
<i>N</i> students	1,422,504	1,365,840	1,319,422	1,090,367
<i>N</i> communities	2,206	2,202	2,202	2,144
R <sup>2</sup>	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 age 18 years poverty rate, unemployment rate, and home sale prices), and other measures (student-teacher ratio and household size). OLS = ordinary least squares.

\*  $p < 0.05$ ; \*\*  $p < 0.01$ ; \*\*\*  $p < 0.001$ .

that local VPK availability alone accounts for 17 to 18 percent of the total variance in VPK participation explained by the first-stage model (i.e., 0.306 to 0.316).

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 nonparticipants to have been retained. This is a 25.8 percent reduction relative to the predicted retention rate of 6.6 percent for nonparticipants.<sup>9</sup> 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 nonparticipants to have been 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 nonparticipants.<sup>10</sup>

Comparing these effects with estimates from an ordinary least squares specification suggests that our two-stage least squares (2SLS) models are removing a considerable amount of bias generated by self-selection into VPK. The ordinary least squares estimates (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. Although 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 ten miles as an approximation. However, some families—for instance, those without reliable access to transportation—may consider ten miles too far. Others may be willing to travel farther. 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 nonrural counterparts.

We test the sensitivity of our results to these varying choice sets by reestimating our models instrumenting VPK participation with availability within five and twenty 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 five miles than at ten miles and about 23 percent lower at twenty miles relative to ten miles).

The key results from our 2SLS models are presented in table 6. The ten-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 four-year-old is somewhat smaller for five-mile availability relative to ten-mile availability (37 versus 49 percentage points) and slightly

9. The base retention rate is predicted from the two-stage least squares 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.
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 grade.

**Table 5.** Average Local Voluntary Pre-Kindergarten Program Availability (VPK) 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.

larger for twenty-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.

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 twenty miles produces nearly identical results. The effect estimates when instrumenting VPK participation with the narrower choice set at five miles also tell a similar story; VPK reduces a student's likelihood of being retained in kindergarten, and this 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 free or reduced-price lunch than ineligible students, and higher for rural and city students than suburban students (table 7).<sup>11</sup> 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 with 32 percent of black children. Similarly, 12 percent of children who are ineligible for a free or reduced-priced lunch were retained at least once compared with 33 percent of children eligible for a free lunch.

Earlier studies have shown that the impacts of preschool initiatives are often most pronounced among low-income, nonwhite, and rural children (Gormley and Phillips 2005; Fitzpatrick 2008; Bassok 2010; Weiland and 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 whether there were greater reductions for rural and city students compared with suburban students.

11. The National Center for Education Statistics's urban-centric locale codes are used to classify communities as rural, suburban, and city. We collapse town and rural schools together as fewer than 4 percent of schools are located in towns.



**Table 6.** Key Fitted Coefficients from Two-Stage Least Squares (2SLS) Models of the Voluntary Pre-Kindergarten Program (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 <sup>st</sup> Grade	2 <sup>nd</sup> Grade	3 <sup>rd</sup> Grade
<b>First-stage effects of VPK availability on VPK participation</b>				
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 <sup>2</sup>	0.302	0.299	0.298	0.308
Shea's partial R <sup>2</sup> 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 <sup>2</sup>	0.310	0.308	0.306	0.316
Shea's partial R <sup>2</sup> 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 <sup>2</sup>	0.312	0.310	0.309	0.318
Shea's partial R <sup>2</sup> for instrument	0.056	0.056	0.056	0.060
<b>Second-stage effects of VPK participation on retention</b>				
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 <sup>2</sup>	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 <sup>2</sup>	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 <sup>2</sup>	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* < 0.01; \*\*\**p* < 0.001.

VPK participation varies meaningfully 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, respectively) and free-lunch eligible students participate at a lower rate than students ineligible or eligible for reduced-price lunch (42 versus over 50 percent, respectively). 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,

**Table 7.** Rates of Being Retained at Least Once by the Completion of Each Grade by Student Subgroup and Period

Group	Kindergarten			1 <sup>st</sup> Grade			2 <sup>nd</sup> Grade			3 <sup>rd</sup> 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

Notes: Students are weighted by their inverse propensity to be observed in the given school year. VPK = Voluntary Pre-Kindergarten Program.

**Table 8.** Voluntary Pre-Kindergarten Program (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.

suburban, and city students yet the difference between rural and city VPK availability is 41 percent of the overall standard deviation.

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 nonparticipants for any group, and by the completion of the third grade we actually see that black VPK participants are more likely to be retained at least once relative to black children who did not

**Table 9.** Effects of Voluntary Pre-Kindergarten Program (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 <sup>st</sup> Grade	2 <sup>nd</sup> Grade	3 <sup>rd</sup> Grade	
<b>First-stage effects of VPK availability on VPK participation</b>					
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 <sup>2</sup>	0.335	0.332	0.330	0.334	
Shea's partial R <sup>2</sup> 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 <sup>2</sup>	0.282	0.281	0.279	0.294	
Shea's partial R <sup>2</sup> 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 <sup>2</sup>	0.300	0.299	0.299	0.313	
Shea's partial R <sup>2</sup> for instrument	0.047	0.047	0.046	0.051	
<b>Second-stage effects of VPK participation on retention</b>					
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 <sup>2</sup>	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 <sup>2</sup>	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	
% of base	28.4	12.9	3.9	4.0	
R <sup>2</sup>	0.025	0.041	0.046	0.049	
White	<i>N</i> Students	622,133	593,538	570,678	480,202
	<i>N</i> Communities	2,159	2,157	2,153	2,083
Black	<i>N</i> Students	318,905	309,614	301,221	244,430
	<i>N</i> Communities	2,152	2,148	2,145	2,086
Hispanic	<i>N</i> Students	394,658	380,723	369,358	302,089
	<i>N</i> 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.

\*\* $p < 0.01$ ; \*\*\* $p < 0.001$ .

participate in VPK. This is a puzzling result given research that suggests black children may benefit more from preschool than other children (Bassok 2010; Bassok, Gibbs, and Latham 2018).

We also find that students who are ineligible for free or reduced-priced lunch are the ones who show the greatest drops in retention. Ineligible students who participate

**Table 10.** Effects of Voluntary Pre-Kindergarten Program (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 <sup>st</sup> Grade	2 <sup>nd</sup> Grade	3 <sup>rd</sup> Grade	
<b>First-stage effects of VPK availability on VPK participation</b>					
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 <sup>2</sup>	0.352	0.347	0.346	0.345	
Shea's partial R <sup>2</sup> 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 <sup>2</sup>	0.356	0.355	0.352	0.359	
Shea's partial R <sup>2</sup> 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 <sup>2</sup>	0.262	0.262	0.261	0.278	
Shea's partial R <sup>2</sup> for instrument	0.045	0.045	0.045	0.051	
<b>Second-stage effects of VPK participation on retention</b>					
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 <sup>2</sup>	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 <sup>2</sup>	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 <sup>2</sup>	0.027	0.041	0.042	0.041	
Not Eligible	<i>N</i> Students	639,780	614,590	592,086	504,392
	<i>N</i> Communities	2,176	2,177	2,177	2,114
Reduced-Price	<i>N</i> Students	126,568	121,657	117,596	98,929
	<i>N</i> Communities	2,111	2,111	2,109	2,060
Free	<i>N</i> Students	656,156	629,593	609,740	487,046
	<i>N</i> 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.

\*  $p < 0.05$ ; \*\*\*  $p < 0.001$ .

in VPK have significantly lower retention rates than ineligible nonparticipants 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 nonparticipants.

**Table 11.** Effects of Voluntary Pre-Kindergarten Program (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 <sup>st</sup> Grade	2 <sup>nd</sup> Grade	3 <sup>rd</sup> Grade	
<b>First-stage effects of VPK availability on VPK participation</b>					
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 <sup>2</sup>	0.264	0.262	0.261	0.275	
Shea's partial R <sup>2</sup> 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 <sup>2</sup>	0.331	0.330	0.329	0.336	
Shea's partial R <sup>2</sup> 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 <sup>2</sup>	0.305	0.302	0.300	0.311	
Shea's partial R <sup>2</sup> for instrument	0.052	0.051	0.052	0.059	
<b>Second-stage effects of VPK participation on retention</b>					
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 <sup>2</sup>	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 <sup>2</sup>	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 <sup>2</sup>	0.033	0.050	0.055	0.065	
Rural	<i>N</i> Students	281,067	267,582	257,835	211,530
	<i>N</i> Communities	480	478	478	461
Suburb	<i>N</i> Students	790,311	762,461	736,582	610,922
	<i>N</i> Communities	1,112	1,111	1,111	1,086
City	<i>N</i> Students	351,126	335,797	325,005	267,915
	<i>N</i> Communities	614	613	613	597

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.

\* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$ .

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 nonparticipants 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 nonparticipants within any of these groups at the completion of second or third grade.

## 5. DISCUSSION AND CONCLUSION

This study examines 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 who 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, although 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 with similar nonparticipants.

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, and 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 showing that large-scale programs yield initial benefits, but that those benefits fade quickly as children progress through elementary school (Puma et al. 2012; Lipsey, Farran, and Hofer 2015). It is worth noting that 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 et al. 2016; Kline and Walters 2016).

Bassok, Miller, and 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 nonparticipants may be relatively modest. It may be the case that highly regulated programs, such as Boston's Pre-kindergarten 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 earlier, 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 et al. 2017; Bassok, Gibbs, and Latham 2018). The current paper speaks to that by exploring not only the impact of VPK on the likelihood that 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 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 how the long-term impacts of retention varies with the timing of retention decision. The limited evidence that exists suggests that retaining children earlier might be more beneficial (or less detrimental) than later retention. For instance, Jacob and Lefgren (2004) found that retention had a modest positive impact on third graders' but not sixth graders' subsequent test scores. Ou and Reynolds (2010) find that late retention (between fourth and eighth grades) has far more negative effects than early retention (between first and third grades).

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 socioemotional development (Hong and Raudenbush 2005; Hong and Yu 2008). Hong and Yu (2007) provide 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, and 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 socioemotional 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.

### **Policy Implications and 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 a decreased 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 and 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 affects young children's learning trajectories.

#### ACKNOWLEDGMENTS

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.

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