Technical Report

THE PROVISION OF PUBLIC PRE-K IN THE ABSENCE OF CENTRALIZED SCHOOL MANAGEMENT

EDUCATION RESEARCH ALLIANCE FOR NEW ORLEANS

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Updated December 22, 2017
Published December 7, 2017

EducationResearchAllianceNOLA.org

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Abstract

Using both administrative data and qualitative interviews, we investigate how decentralization affects the supply of optional educational services using the example school-based pre-Kindergarten (pre-K) in New Orleans during the transition to a majority-charter system. Although charter school leaders are aware of the benefits of pre-K, charter schools face unique obstacles to funding classrooms. We find that the number of pre-K seats fell substantially as decision-making was decentralized. Charter schools that did offer pre-K experienced few internal benefits in terms of future enrollment or test performance, as pre-K graduates are highly mobile. This provides initial evidence that decentralization without off-setting financial incentives can lead to reduced investments in programs that advance the broader social goals of education.

Keywords: charter schools, pre-Kindergarten, decentralization, accountability

Introduction

Many urban school districts are undergoing a decentralization process by increasing the number of independently managed charter schools. In theory, charter schools provide healthy competition for traditional public schools, while offering expanded options for parents. However, decentralization can also mean that broad social goals of education are neglected relative to the goals of individual schools. In addition to meeting the requirements of compulsory education laws, school districts provide numerous other educational, enrichment, and support services, which individual schools may not be motivated to provide with limited resources, low economies of scale, and strict accountability policies.

In this study, we investigate how the growth of charter schools in a district affects the supply of optional services by examining the supply of pre-Kindergarten classes (pre-K) in New Orleans, as the city transitioned from a centralized system to a majority-charter district. We use the example of pre-K because of a large research literature, as well as state and federal policy, that recommends pre-K as an important and cost-effective educational intervention with both private benefits for students and social benefits for schools and communities (i.e., Phillips et al., 2017; Yoshikawa et al., 2013). Louisiana school districts and charter schools can opt into offering state-subsidized pre-K classrooms for low-income and special-needs students, but as in many states, the per pupil subsidy level is far below the average cost of educating a pre-K student (National Institute for Early Education Research, 2014). In a typical district setting, the gap between state funding and actual pre-K costs is filled at the district-level, and any benefits of pre-K are retained within the district. In a decentralized setting, this gap must be filled at the school-level. Charter schools will offer pre-K only when operators perceive an internal benefit (either economic, social, or political) that exceeds the gap between the actual cost and the state

subsidy, which potentially leads to a reduction in pre-K seats as an unfortunate and unintended consequence of decentralization. To explore this topic, we address two research questions.

First, we ask how the transition from a centralized school district to a majority-charter setting affected the supply of public-school pre-K seats in the city. We examine how pre-K enrollment changed as the majority of New Orleans schools transitioned from local district control, to state takeover, and finally to contracted control by autonomous charter management organizations. We find that this transition was associated with a substantial drop in pre-K seats at New Orleans elementary schools that is not explained by changes in the city's population. Second, using a mixed-methods approach, we ask whether charter schools that do offer pre-K programs expect and experience a competitive advantage over those that do not. Information on expected advantages for schools was gathered through interviews with school leaders, followed by empirical analysis of student data to test school leaders' assumptions.

Though we cannot measure the causal effects of pre-K attendance on student performance, we can identify whether offering pre-K is associated with higher test scores. Benefits of pre-K could occur through two pathways: early selection of higher-ability students or early intervention that improves test performance. Either way, schools that offer pre-K can only benefit from pre-K advantages (either based on selection or intervention) if pre-K students persist at the school in the long-term. We examine whether offering school-based pre-K is associated with higher standardized test scores by estimating effects on student persistence and performance. Through regression analysis of student- and school- data from 2007 to 2015, we find little empirical evidence that New Orleans schools benefited from offering pre-K in the ways that school leaders predict.

While the focus of our study is relatively small, it makes a large contribution to the literature on the effects of charter schools. Most prior literature focuses on how students who attend charter schools perform relative to other school settings (e.g., Abdulkadiroglu et al., 2009; Ballou et al., 2009; Buddin and Zimmer, 2005; CREDO 2009, 2015; Harris and Larsen, 2016; Hoxby et al., 2009; Sass, 2006; Sass et al., 2016; Zimmer at al. 2009, 2011), or how competitive pressures from charter schools influence traditional public schools (e.g., Bettinger, 2005; Betts, 2009; Buddin and Zimmer, 2005; Zimmer et al. 2009). Decentralization is theoretically a threat to minority and high-need populations (Parry, 1997; Carnoy et al, 2005), and there is evidence of differential effects of charter schools on minority and special education students. For example, Bifulco and Ladd (2007) find larger negative effects of charter enrollment on black students than white students in North Carolina, and Sass (2006) finds that Florida charter schools that target at-risk and special education students have lower performance that those that do not.

However, there is little research on how the expansion of charter schools has rebalanced investment in private versus social benefits of public education. Theoretically and anecdotally, charter school expansion may have the unintended consequence of reducing services for many populations by decentralizing administration of mental health services, special education, behavioral health, and many other programs. Initial evidence comes from Winters (2015) and Winters, Carpenter, and Clayton (2017) who focus on documenting the gap in special education enrollment and identification between charter and traditional public schools. These studies provide initial evidence that vulnerable groups are treated differently by charter schools in ways that align with the financial incentives of charter managers. Our study adds to this work in several ways. First, we systematically examine the changes in a beneficial but optional service that charter operators can choose not to provide at all. Second, we investigate the benefits that

charter schools expect in return for their investments. Finally, we empirically test specific incentives for charter schools to provide (or not provide) the service.

Our results suggest that decentralization in New Orleans was accompanied by a large reduction in public-school pre-K in the city, and that this drop was driven by school incentives, rather than changes in city or state policy. School leaders consistently report that high costs and low subsidies are obstacles to providing pre-K, but leaders of schools that do provide pre-K expect internal benefits in terms of higher enrollment and student retention and improved performance on standardized tests. Contrary to these expectations, we find that pre-K and kindergarten students are highly mobile in this system-wide choice setting, leaving little incentive for schools to offer pre-K as a means to keep enrollment up or to meet the accountability goals of their charter contracts. As a result, many of the private and social benefits of pre-K were lost in the decentralization.

We begin by describing the background of school reform in New Orleans, which included the transition of almost all district-run schools to non-profit charter schools. In section 3, we describe our method and data for addressing our two research questions. In section 4, we present results for the changing availability of pre-K seats during New Orleans' period of school reform and the estimation of student persistence and performance benefits related to pre-K offerings. In section 5, we discuss school leaders' views on the challenges and benefits of offering pre-K. We conclude with discussion and policy implications in section 6.

2. Background

Decentralization in New Orleans

In 2005, the Orleans Parish School Board (OPSB) operated almost all schools in Orleans Parish alongside a small number of charter schools. The city's schools, which served a majority

black and low-income population, were among the lowest-rated in the state, and the local school district was plagued by inefficiency and corruption (Harris, 2015). Most schools in the city were low-performing, while a small group of high-performing schools maintained academic entry requirements (Public Impact, 2015). When the city was evacuated in the wake of Hurricane Katrina, all public schools were closed for several months. During this time, local and state advocates of school reform saw the temporary school system closure as an opportunity to shift the traditional public school system to a market-based model. Before schools reopened, Louisiana's Recovery School District (RSD), a state agency empowered to take over and reconstitute failing schools, took over all the failing schools in the city – 102 of the city's 126 schools.[1] The local OPSB retained control over only 24 non-failing schools, a few of which immediately converted to charter schools under OPSB oversight (Harris, 2015). In the initial post-Katrina years, the RSD re-opened some of the 102 former OPSB schools under its direct control, but the long-term objective was to decentralize most components of school management. Over time, the RSD contracted management of these schools to independent charter managers. OPSB also transferred some of its remaining schools to charters and contracted to open new charter schools under its authority. By 2014-15, only six schools remained under the direct control of the OPSB school district, while 76 charter schools were managed by over 40 different operators (Cowen Institute, 2014).

The role of a central school district changes in a decentralized system, and choices must be made about what schools can and cannot control at the site level (Parry, 1997; Bulkley, Henig, and Levin, 2010; Hill, Campbell, and Gross, 2012). With only six schools under its control, OPSB lost, among other powers, its authority and capacity to implement a district-wide

[1] The RSD had already taken over five schools prior to Hurricane Katrina.

pre-K strategy. In New Orleans, school managers enjoy a high degree of autonomy of school programs and missions, including selection of grade levels served, school hours, and even the number of school days. They also control most aspects of human capital. Charter schools are subject to a centralized student enrollment lottery, standardized testing, and laws governing the treatment of federally identified special populations (such as special education students). Schools have full control over any non-mandatory educational services they might provide, including, for the purposes of this study, the decision to offer pre-K classrooms, but also programs such as physical education, afterschool enrichment, arts, socio-emotional supports, discipline strategies, and special classrooms or programs for high-need populations. Anything that is not required to be offered by law or students' individualized education plans (IEPs) is offered at the discretion of the school manager.

New Orleans is an extreme case of a type of decentralization and removal of school board control that is increasingly popular in education reform. Decentralization in education involves devolving authority from the central district government to lower levels – including schools and charter management organizations. Other U.S. cities (e.g., Detroit, New York, San Francisco, Washington, D.C.) have also reduced local school board control and expanded the role of independently managed charter schools in recent years. Devolving administrative and fiscal control to the school level is intended to improve education by allowing administrators the freedom and flexibility to respond quickly to their schools' and students' needs (Chubb and Moe, 1990; Finn, Manno, & Vanourek, 2001; Finn, Manno, & Wright, 2016; Hill and Lake, 2002). Additionally, the introduction of school choice through charter schools and open enrollment across neighborhoods introduces quasi-market competition into public education systems in an attempt to benefit from market efficiency (Gordon & Whitty, 1997; Jones, 1992). In theory,

when schools compete for students and the funding that follows them, schools should push each other to improve in aspects that make them desirable to families, including academic performance, thus meeting the goals of state and local education boards.

However, decentralization also reduces government control over the social goals of education, including equity for and support of local families. Local school districts have responsibility for improving outcomes for all children residing within their boundaries – a goal that is difficult to write into charter contracts. Independent charter operators, which are only responsible for the children attending their schools, are incentivized to focus on school-centric outcomes, such as enrollment counts (to ensure adequate funding) and high-stakes test scores (to meet contract requirements). School districts often provide support services outside of the requirements of compulsory K-12 education, including physical and mental health services, after-school care, community outreach, and early childhood programs. It is unclear where these supports would come from in a decentralized setting.

Pre-K in New Orleans

In this study, we focus on 4-year-old, school-based pre-K, an optional education service that is often undersupplied, despite a substantial research base demonstrating positive effects on students (Phillips et al. 2017; Yoshikawa et al., 2013). On average, preschool programs lead to an estimated 0.35 standard deviations in immediate academic gains for children, an effect size that translates to about a third of a school year of growth (Yoshikawa et al., 2013), and high-quality programs can produce gains of up to a full standard deviation (Gormley, Gayer, Phillips, & Dawson, 2005; Weiland & Yoshikawa, 2013). A substantial body of work documents numerous long-term private and public benefits of model pre-K programs, including workforce participation benefits for parents, a reduction in costly school-based interventions in kindergarten

and beyond for schools, and higher graduation rates, post-secondary attainment, improved workforce outcomes, and reduced reliance on public assistance and crime for participants (Barnett, 1996; Heckman et al., 2010; Belfield, Nores, Barnett, and Schweinhart, 2006; Reynolds et al., 2011).

The state of Louisiana has funded state pre-K classes since 2001, through its LA4 program. LA4 strives to provide high-quality pre-K to high-need students. Funding is provided only for students who are either low-income or eligible for special education services. LA4 standards require smaller class sizes, lower student-teacher ratios, and higher teacher qualifications than most state-funded pre-K programs. In 2014-15, over 16,000 children were enrolled in LA4 programs statewide, and an additional 2,200 were enrolled in state pre-K through a similar block grant program known as 8(g) (Barnett et al., 2017)[2].

The state initially allocated LA4 seats prior to 2005, across local districts and districts allocated seats to schools. Two characteristics of LA4 are important for this study. First, state funding for LA4 has never been sufficient for schools to meet the quality requirements. For example, in 2014-15 the state subsidy for LA4 was $4,580 per child, while NIEER estimated that the cost of educating a pre-K student in a high-quality program in Louisiana was over $7,700 (Barnett et al., 2013). A recent estimate by a local organization places the local cost of pre-K at $11,500 per pupil (Stand for Children, 2016). Although Louisiana regulates the quality of LA4 at the state level, financing must be shared at the state and local levels. Second, once a school was

[2] Louisiana has an additional state funding stream for pre-K, known as the Non-public Schools Early Childhood Development program, or NSECD. These funds go to private schools to enroll low-income children in their pre-K programs. The state funded 1,300 students through this program in 2014-15. NSECD seats are not included in our analysis, as they are not in public schools.

allocated LA4 seats, those seats would remain at the school year after year, unless a district voluntarily offered its seats back to the state.

Prior to Hurricane Katrina, OPSB combined multiple funding sources[3] with state LA4 funds to operate a robust early childhood program with pre-K seats at most elementary schools across the city. Primarily, the district supplemented state funds with federal Title I dollars to operate its pre-K program. From a district perspective, the goal was to enroll as many high-risk children as possible in pre-K seats to increase kindergarten readiness[4]. As long as most pre-K students enrolled in kindergarten somewhere in OPSB, any non-private benefits of pre-K remained in the school district.

When OPSB lost control of its schools, it also lost the capacity to fund and implement a citywide pre-K strategy. Previously allocated LA4 seats remained at the schools as new management took over, so most new elementary school charter operators inherited state-subsidized pre-K seats in the schools they took over. With operator autonomy over educational programs and grade configurations, there was no requirement for operators to fill the seats and accept the state LA4 funds. Additionally, though charter schools received proportionally the same federal Title I allocations as the district had prior to Katrina, schools would decide internally how to spend those funds.

While the public and private benefits of pre-K are not unique to a particular school governance structure, there are several reasons why charter contracting might inadvertently lead to a reduction in pre-K seats. First, charter schools are unable to take advantage of economies of

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[3] Districts can also use state 8(g) block grant funds, as mentioned above, to fund pre-K, and federal IDEA funds cover students with special needs. Beyond these sources, districts can choose to use their Title I funds or other local sources for pre-K costs.

[4] Information of OPSB's pre-Katrina pre-K programs were obtained from conversations with individuals employed by OPSB before and after the hurricane. Conversations took place in 2015.

scale and braid together multiple funding streams in the same ways a district can (Buerger & Harris, 2017). Second, individual schools and charter networks are only accountable for the children they serve. In a test-based accountability system, charter schools can only capture the benefits of pre-K for students who remain at their schools long enough to take high-stakes standardized tests, which begin in third grade. In the New Orleans system of city-wide choice, students have no geographic ties to a neighborhood school, enabling them to attend pre-K at any school in the city and then easily switch for kindergarten. Even pre-reform, New Orleans students were highly mobile, switching schools at roughly the same rate in the pre- and post-reform systems (Maroulis, Santillano, Harris, & Jabbar, 2015). Student mobility reduces the potential benefits of pre-K to any individual school, as pre-K graduates are less likely to benefit the school in later years, either through improved kindergarten readiness or through higher test scores. As a result, we expect that charter schools will be less able and likely to provide an optional, under-funded program. However, if schools can capture some benefits, either in the competitive market or in the accountability system, they may be incentivized to make this investment. In this study, we first document the reduction in pre-K in New Orleans as charter schools expanded, and we then investigate and empirically test school motivations for providing pre-K.

Empirical Strategy

We employ a mixed-methods approach to analysis of the provision of pre-K in New Orleans'. Our data include both longitudinal student enrollment and performance records, provided by the Louisiana Department of Education, and original qualitative data gathered through ten case studies. First, we use enrollment data from 2001 through 2015 to track the number of pre-K students enrolled in public schools in New Orleans as most schools shifted to

charter management, including efforts to account for the overall reduction in the student population following the citywide evacuation. We next explore the motivation for charter schools to provide pre-K in a system of school choice. Using qualitative evidence from interviews with school leaders, we identify two tangible, school-oriented motivations for providing pre-K in this system: 1) a belief that early education will eventually lead to higher third-grade test scores for the school, and 2) a belief that early recruitment of families with younger children will improve student retention and enrollment numbers. We then test these two motivations with regression analysis. To examine the effects on test-based accountability, we estimate the effects of having offered pre-K to a student cohort on the school's average third-grade test scores four years later (i.e. when the pre-K cohort is first tested in third grade). Finally, to estimate the effects of offering pre-K on student retention, we estimate a hazard model of student exit from kindergarten to third grade – comparing student persistence for schools without and without pre-K and for students who did and did not attend pre-K.

Changes in Pre-K Offerings Post-Katrina

Figure 1 illustrates the change in school governance and pre-K offerings between 2004-05 (prior to Katrina) and 2014-15. In 2004, almost all schools were operated by OPSB and pre-K seats were offered across the city. By 2014, almost all schools were operated by charter managers, and despite maintaining the option to enroll children in the same LA4 slots, fewer than half of schools were enrolling any pre-K students. Figure 2 illustrates the reduction in pre-K enrollment in New Orleans over time from 2000 to 2015. Because the population of students fell dramatically immediately after Hurricane Katrina, and then grew steadily, we control for population changes by focusing on the ratio of pre-K enrollments to kindergarten enrollment in each year. Immediately prior to Hurricane Katrina, New Orleans schools enrolled 67 pre-K

students for every 100 public-school kindergartners. In 2006, New Orleans schools re-opened, half under the direct control of OPSB or RSD and half charter, with approximately 60 pre-K students per 100 kindergartners. As the district transitioned to a majority-charter system, we see a sharp decline to a low of 44 pre-K seats in 2011-12. As illustrated in Figure 2, pre-K enrollment in the rest of Louisiana remained steady over the same period.

We further test these descriptive results in a difference-in-difference (DID) regression model comparing pre- and post-Katrina Orleans Parish (NOLA) pre-K enrollment to pre- and post-Katrina pre-K enrollment in the other 68 parishes in Louisiana. We estimate Y_{jt}, the number of pre-k seats per 100 kindergartners in year t in parish j, as a function of whether the seats are in New Orleans or elsewhere in Louisiana, whether it is a post-reform year (post-2004-05), and the interaction between the two. Standard errors are clustered by parish.

$$Y_{jt} = \alpha + \beta_1 \cdot NOLA_j + \beta_2 \cdot post\ reform_t + \beta_3 \cdot \left(post\ reform_t \cdot NOLA_j\right) + e_{jt} \quad (1)$$

DID results, displayed in Table 1, indicate that New Orleans's post-reform drop in pre-K enrollment was significantly and substantially different from state trends. New Orleans's pre- to post-Katrina levels dropped nearly 25 percentage points relative to the state difference over the same time period ($p<.001$; see Table 1). Because the state's LA4 program is intended to provide pre-K to low-income children, we also tested the effect of the reform on pre-K enrollment of low-income students, relative to low-income kindergartners with nearly identical results (not tabled).

Figure 3 further breaks down the reduction in pre-K in New Orleans by school sector. The drop in pre-K enrollment coincides with the expansion of the charter sector and decline in the number of district schools between 2009-10 and 2011-12. During that time, an additional 11 charter elementary schools opened. While the number of kindergarten seats in these schools

increased by more than 1,000, we do not see the same growth in pre-K seats at charter schools. As direct-run schools closed or were taken over by charters, more than 300 state-allocated pre-K seats, which could have been filled by charter operators, were not enrolled.

Why do charter schools offer pre-K?

Although many New Orleans charter schools allowed their allocated pre-K seats to remain empty, between 40 and 65% of charter schools continued to offer pre-K in post-Katrina years. Our qualitative analysis addresses the underlying mechanisms that drive charter school decisions regarding pre-K. To investigate school motivations and perceptions of costs and benefits, we conducted multiple exploratory case studies of New Orleans school managers. Using a purposive stratified sampling design, we interviewed ten administrators who oversaw 19 New Orleans charter schools[5], including nine schools that have offered pre-K since opening, four that have added pre-K since opening, three that had operated and then discontinued pre-K programs, and three that never offered pre-K. Each school leader participated in a one-on-one, semi-structured interview during the summer of 2016. Interviews were audio-recorded, transcribed, and coded using NVivo software. The data were analyzed through the framework of economic and other motivations for providing pre-K in a decentralized system.

The results provide two important levels of insight. First, although leaders wanted to provide pre-K, they stated that the costs of offering pre-K seats far exceeded the level of the state subsidy. The need to make up this funding gap is a salient obstacle to implementation identified by all school leaders. In order to offer pre-K, leaders reported supplementing LA4 funds using per pupil revenue for higher grades, raising private funds, and patching together other funding

[5] The school sampling strategy considered: charter authorizer (OPSB or RSD), CMO structure (oversight or a single school or network of schools), and whether pre-K seats are currently offered or were offered in the past.

sources. Schools that do provide pre-K in this setting cited mission-based, academic, and strategic or competitive motivations for making the extra investment. Second, charter schools are also implementing alternative delivery strategies for pre-K, designed to reduce internal costs. These include partnering with an external early childhood agency and combining subsidized pre-K with a tuition-based program.

As mentioned above, Louisiana's LA4 places costs on schools by combining high quality standards with low per-pupil subsidies. Across the four cases in which interviewees oversaw schools that do not offer pre-K, funding and classroom space were consistently cited as the reasons for that decision. School leaders of sites that do offer pre-K also acknowledged these financial challenges but cited a belief that investments in pre-K would pay off in terms of increased kindergarten readiness, future ability to work at grade-level, and higher test scores in third grade – when student performance starts to matter for charter contracts and state accountability.

In addition to potentially improving test scores, many school leaders cited strategic reasons for offering pre-K, based in beliefs that it improved kindergarten recruitment and retention of students over time in New Orleans' choice-based system. All seven leaders of pre-K schools mentioned the "kindergarten pipeline," increased student retention through subsequent grades, or both, as reasons for offering pre-K at their schools. However, leaders also recognized the risk that pre-K investments might not be retained at their schools. Some schools employed specific recruitment strategies to actively encourage pre-K families to remain for kindergarten and to enroll older siblings in the school as well.

Beyond internal academic or strategic benefits, the majority of school leaders also discussed their pre-K programs as vital to the school's mission in a way that transcends costs.

Without exception, those overseeing schools with pre-K programs mentioned the academic and socio-emotional benefits of pre-K to the students they serve, using phrases like, "it's good for the kids," and, "it's just the right thing to do." Five of the seven school leaders overseeing schools with a pre-K added a sense that pre-K provision was part of the school's mission to serve a community in need of early childhood education options. Overall, interviews with school leaders suggest that charter schools provide pre-K based on a combination of commitment to a mission to provide services for younger children and beliefs that there will be later benefits for the school in test scores, early recruitment, and persistent student enrollment.

We also found that these schools are employing new strategies to deliver pre-K services at lower short- and long-term cost. Schools receiving LA4 funds have the option of offering in-house pre-K, or contracting with an outside early childhood center to provide the LA4 seats. Four of the seven interviewees who oversaw schools with LA4 pre-K programs had schools that delivered pre-K by contracting with outside preschool or early childhood providers. This is a strategy that further distances pre-K from a coordinated, centralized strategy, since provider subcontracts are beyond the regulatory scope of charter school authorizers. Three of seven interview participants oversaw schools that offered some tuition-based pre-K seats. Louisiana law allows schools to charge tuition to students who are ineligible for LA4 funds, as long as the tuition does not exceed the state subsidy amount.[6] Because the tuition cannot exceed the state subsidy, schools still incur the same internal per-pupil cost for tuition students, but schools viewed it as a way to offer pre-K to a more diverse, and potentially more advantaged, group of students – including children who were neither eligible for subsidized lunch nor designated as in need of special-education services. Thus, families able to pay tuition might be viewed as a

[6] This policy changed in 2017, allowing New Orleans schools to set their own tuition rates for unsubsidized pre-K beginning in 2017-18.

desirable long-term investment for charter schools, through both lower long-term education costs and higher future test scores.

Empirical Evidence of Benefits to Pre-K Schools

Pre-K and Test Scores

We used quantitative data from 2008 to 2015 to investigate whether school leaders' expectations of benefits are supported by evidence. Ideally, we could identify the causal effect of pre-K participation on a school's test performance. However, we are faced with two types of selection bias – in the New Orleans setting, schools sort non-randomly into offering pre-K classrooms, and students sort non-randomly into pre-K enrollment. Is it possible, and expected by school leaders, that pre-K participation alters both a student's future test performance and his parents' preferences toward school choice. We focus on a descriptive analysis that tests the incentives identified by school leaders. Specifically, we estimate whether offering pre-K is associated with better test performance, at the school level, and whether attending pre-K is associated with higher test scores at the student level, in non-selective charter schools. This approach can provide empirical evidence of the benefit of offering pre-K without addressing the underlying student selection problem. Our data are not adequate to disentangle the causal mechanism of how pre-K affects outcomes, but our results speak to whether the benefits expected by school leaders, regardless of whether they occur through selection are not, are supported by empirical evidence. In the analysis, we attempt to control statistically for other factors that may influence performance and persistence, including whether a school's pre-K students would have attended the school for kindergarten even in the absence of the pre-K program.

Beginning with the association between pre-K and test scores, we simultaneously estimate student and school pre-K associations with math and English language arts (ELA) scores in a multilevel model (Equation 2), where *i* indicates student, *j* cohort (each school is observed for up to four years), and *k* school. Student-level controls (X_{ijk}) include student race (black, white or other), free/reduced-price lunch (FRPL) eligibility, special-education and gifted status, gender, and English-Language Learner (ELL) status. School cohort controls (Z_{jk}) include school size, the percentage of FRPL, white, other-race, special-education, and gifted students in the third-grade cohort, the percent of K-2 students suspended, whether the school was open pre-Katrina, and whether it was in its last year of operation before being closed or taken over by another operator. The pre-K student variable is an indicator for whether the student attended public pre-K in Louisiana; the pre-K school variable indicates whether the third-grade cohort could have attended pre-K at their school four years prior. Results for both student and school pre-K effects were similar in separate student- and school-level models, and when restricting student characteristics to include only students who entered the school as new kindergartners.

$$Y_{ijk} = \alpha_j + \beta_1 \cdot preK\ student_{ijk} + \beta_2.preK\ school_{jk} + \beta_3 \cdot X_{ijk} + \beta_4 \cdot Z_{jk} + \mu_j + e_{ijk} \quad (2)$$

Descriptive statistics for these schools and students are provided in Table 2. These students, who represent 122 cohorts from 44 schools, are majority black and low-income. Twenty percent of cohorts were in schools that pre-dated Hurricane Katrina, 7% were in schools closing at the end of the year, and 43% were in schools that had offered pre-K in the cohort's pre-K year. Offering pre-K had no significant association with schools' math or ELA test scores in any specification (see Table 3). However, individual students who attended public pre-K outperformed non-pre-K students in math by a small margin (β_1=0.038; p<.10).

Pre-K and Student Persistence

The second perceived benefit for providing pre-K was early recruitment of students who would persist in the school in kindergarten and beyond. In this way, pre-K can generate future revenue through increased and consistent per-pupil enrollment. To examine whether offering pre-K benefits schools through improved persistence, we conduct a hazard analysis of the New Orleans students who entered kindergarten in fall of 2008 through fall of 2011. We estimate:

$$h_{ijt} = {}^{1}/_{(1 + e^{-\gamma})}$$
$$\gamma = \alpha_t \cdot period_t + \beta_1 \cdot prek\ school_{jt} + \beta_2 \cdot prek\ student_{ijt} + \beta_3 \cdot X_{ijt} + \beta_4 \cdot Z_{jt} \quad (3)$$

where h_{ijt} is the probability that student *i,* who attended kindergarten at school *j,* exits school *j* at the end of period *t.* We estimate Equation 3 as a discrete time hazard model that allows time-period effects (α_t) to vary across years post-kindergarten. Our coefficient of interest is β_1, which indicates the differential probability of exit for a student who attends kindergarten at a school that offered pre-K in his pre-K year. Because pre-K is optional and under-supplied in New Orleans, selection into pre-K is likely non-random. Selection of students into kindergarten is also non-random, and pre-K students had the choice to attend kindergarten at their pre-K school or many other schools. β_2 estimates the association between having attended pre-K and a student's hazard probability, controlling for whether his kindergarten school offered pre-K. In additional specifications, we add both student observable characteristics (X_{ijt}) and school average characteristics (Z_{jt}). We estimate Equation 3 as a proportional logistic hazard model. Results reported here are robust to alternative specifications including logistic models with student random effects, complementary log-log link estimation, allowing school and student characteristics to vary by period, and restricting student characteristics to include only students who entered the school as new kindergartners.

We estimate Equation 3 for an analytic sample of students enrolled in kindergarten in New Orleans' district-run and charter schools from fall 2008 to fall 2011. Students are assigned to their cohort year based on initial entry into kindergarten and can exit or re-enroll in their school for up to three subsequent years. This analysis follows students with normal grade progression from kindergarten to third grade – the first year when Louisiana students take accountability-linked standardized tests. Students are observed in the data in each period until they either exit ($h_{ijt} = 1$) or enter third grade. To parallel our analysis of test performance, we limit the survival analysis to students in non-selective schools and, to allow persistence through third grade, exclude any observations for students whose kindergarten school closed or stopped enrolling their cohort prior to their third post-kindergarten year. We include in X_{ijt} indicators for student demographics (race/ethnicity, gender, and free-lunch status), indicators of special needs status (special education or gifted), and an indicator if the student repeats the current grade. All but race/ethnicity and gender can vary for a student across periods. We include in Z_{jt} time-varying school-level measures of total enrollment, percent white, percent other races/ethnicities, percent FRPL, percent special-education, percent gifted, and an indicator for whether the school was open prior to Hurricane Katrina. Because parents might respond to strict discipline policies with exit, we also include a measure of the percent of students in grades K-2 who were suspended at least once. Finally, we replicate our analysis at the local education agency (LEA) level. For operators with more than one school, offering pre-K at some schools might be beneficial even if students transfer to a different school within the LEA.

Table 4 displays summary statistics for the analytic sample of 8,067 first-time kindergartners in non-selective charter schools who could continue to third grade in the kindergarten school, and 10,057 who could continue to third grade in their kindergarten LEA.

Approximately half of the sample attended public pre-K in Louisiana and approximately half attended kindergarten at a school that offers pre-K, but mobility between pre-K and kindergarten shuffled many pre-K students into kindergartens at non-pre-K schools. In the cohorts that we follow in this analysis, only 23% of all kindergartners, and 64% of those who attended pre-K, attended pre-K at their kindergarten school. Schools that do not offer pre-K still fill 31% of their kindergarten seats with students who attended school-based public pre-K elsewhere. Overall, 78 percent of kindergartners persisted at their kindergarten school one year later, 66 percent two years later, and 57 percent three years later. Rates of persistence are 4-5 points higher in each period for students who attended pre-K, relative to students who did not attend pre-K. However, persistence rates are similar, on average, for students at schools that offered pre-K and schools that did not. In line with the eligibility guidelines for Louisiana PK4, students who attended pre-K were more likely to be identified as eligible for subsidized lunch or special education services than other students. However, schools that offered pre-K have similar overall student demographics to schools that did not.

Estimated coefficients for several specifications of the hazard function in Equation 3 are displayed in Table 5 as logistic coefficients. Panel A estimates persistence at the student's kindergarten school for up to three post-kindergarten periods. The first specification includes only period indicators and an indicator of whether the school offered pre-K; the next specification adds school controls. With no additional controls (column 1), the coefficient on the school pre-K indicators is negative, suggesting that a child who attends a school with pre-K has, on average, a lower exit probability than a child who attends a non-pre-K school. With added school-level controls (column 2), the coefficients on the school pre-K indicator are positive and statistically significant, suggesting that, among schools with similar student demographics,

students at schools with pre-K actually are more likely to exit before third grade. Persistence may also be related to non-random sorting of students into pre-K and pre-K's potential influence on later persistence. In column 3, we add controls for whether the student attended pre-K at any public school and individual student demographics indicators. Controlling for the types of student, we estimate no difference in persistence based on school pre-K, but students who attended pre-K are less likely to exit. Our final specification (column 4), controls for both student pre-K participation and demographics and school aggregates. Here we see estimate, among similar students in schools with similar characteristics, a student who attended pre-K is significantly less likely to exit. However, we again see a positive and significant coefficient for school pre-K.[7] Overall, there appears to be no direct school-level benefit of offering pre-K on student persistence. These results do not account for potential mobility of students across schools with the same manager. A charter management organization with multiple elementary schools could retain benefits of pre-K as long as students remain in the organization's school. In panel B (columns 5-8), we estimate the probability of exit from the kindergarten LEA, rather than the school. The results are similar to those for school persistence. Students who attend pre-K are less likely to exit their kindergarten LEA, but offering pre-K within the LEA's schools is positively and significantly associated with student exit probabilities.

[7] Our school aggregate demographics are calculated based on the population of students in grades K to 3. Because pre-k eligibility is determined by a student's sped and frpl status, offering pre-K could affect these aggregates in later grades. Based on summary statistics (see Table 4), the overall rates of sped and frpl in later grades were nearly identical in schools with and without pre-K. We also ran specifications where school characteristics reflected the baseline demographics for only those students who entered a school as new kindergartners. The results (not shown) were nearly identical to those with schoolwide control variables in Column 2 and 4 of Table 5.

This association is illustrated in Figure 4, which graphs the estimated probability of remaining in the kindergarten school for up to three years after kindergarten, using the third specification with student and school controls. The student depicted in Figure 4 is a black male who is eligible for subsidized lunch, not identified as special-education or gifted, and who did not repeat any grades. We set his school-level measures at the mean for all kindergartners across cohort years. Figure 4 illustrates that students in schools that do not offer pre-K have a higher probability of survival (i.e. continued enrollment at the kindergarten school) than similar students in schools that do offer pre-K seats. This advantage for non-pre-K schools exists regardless of whether students did or did not attend pre-K themselves. Further, the higher survival rates for students who attended pre-K apply both at pre-K and non-pre-K schools. Overall, this finding suggests that while pre-K students should be attractive to schools that value continued student enrollment, there is little value to being the school that offers pre-K. In fact, the greatest benefit may come to schools that are able to enroll student who completed pre-K at a different school – and thus at a cost to a different operator.

Discussion

This mixed-methods study provides initial evidence of effects of decentralization on the provision of pre-K classrooms. Market-based school reform and decentralization provide both the incentive and pathway for schools to reduce services, such as pre-K, where benefits to students might not transfer to school operators. We find that, as the share of charter schools increased, the number of school-based pre-K seats dropped, even as kindergarten enrollments were rising. This drop is not explained by state policy changes, as the availability of pre-K subsidies to New Orleans remained constant, and public pre-K expanded statewide. Instead,

these results suggest that schools under charter management were less likely to use their allocated pre-K subsidies.

At charter schools that continued to offer pre-K in this setting, leaders offered two school-centered motivations – pursuit of higher test scores through kindergarten readiness and early recruitment of families committed to sticking with the school for the long-run – in addition to more mission-focused commitments to providing early education for the benefit of students and the community. In empirical investigation, we found that schools that offer pre-K programs fill only half of their kindergarten seats with existing pre-K students, whereas schools that do not offer these programs must fill all kindergarten seats with new students – a substantial benefit in a system where schools compete for students and the funds that follow them. However, this benefit was only short-term, as offering pre-K did not increase a school's kindergarten-to-third-grade persistence rate, relative to schools without pre-K. Students who attended pre-K anywhere were more likely to persist at their kindergarten school, but since many pre-K students don't attend kindergarten at their pre-K school, benefits of their persistence often accrued to a school other than the school that subsidized their pre-K year.

Children who attended pre-K also slightly outperformed children who did not attend pre-K on third-grade math tests, either as a result of program effectiveness or of the selection of particular families into the program. Either way, charter schools do not ultimately benefit from this small test-score boost for children – offering pre-K had no association with school-level test score performance. This lack of an association at the school level is likely due to the low retention of pre-K students through tested grades – only 40% stayed in their pre-K school through third grade – not enough for a small individual increase to translate to the school level.

All of this comes at a substantial cost for schools that offer pre-K. The gap between the state subsidy level and the actual per-pupil cost of pre-K is approximately $3,300 per student, and likely higher for special education students, who are one of target populations for the Louisiana pre-K program. While charter school leaders in New Orleans agree that pre-K is important and effective, the policy setting in Louisiana, with a combination of low funding levels, high standards, and high-need target populations, is not conducive to pre-K implementation at charter schools.

In an effort to coordinate efforts, facilitate parents' access to programs, and increase program quality, the Louisiana legislature recently passed a requirement for centralized oversight of all publicly funded early childhood education (ECE) programs, including LA4. As a result, the New Orleans Early Education Network (NOEEN) was established in 2013 to coordinate the city's publicly funded early care and education programs. However, these efforts are not meant to address the problem of school-based pre-K incentives, and state funding for pre-K programs has not increased. As of 2016-17, and the number of school-based pre-K seats remains low (44 per 100 kindergartners).

Limitations

A limitation of our public-school enrollment data is that we can only observe actual enrollment, rather than the supply of offered seats. As a result, an alternate explanation for our finding that pre-K seats decreased over time could be that parent demand for public-school pre-K decreased over this time period, resulting in unfilled seats. However, we find little evidence to support this conclusion. First, the child poverty rate in Orleans Parish is virtually unchanged between 2009 and 2012, and thus the share of families eligible for and in need of public pre-K seats is constant (U.S. Census Bureau, American Community Survey, 2009-2012). Additionally,

our administrative data show a steady increase in the number of low-income kindergartners over this period, indicating a likelihood of increased demand. Finally, our interviews with school leaders also revealed confidence that demand exceeds supply and few concerns that programs would be undersubscribed.

Another possible explanation is that parents chose to shift to other pre-K sectors; however, we do not see enough of an increase in other sectors that provide free publicly funded pre-K seats for low-income children to offset the loss of school-based seats. The other free public pre-K options for low-income families during this time were Head Start and Louisiana's Non-Public Schools Early Childhood Development Program (NSECD). Between 2009-10 and 2011-12, enrollment in NSECD was virtually unchanged (KIDS Count Data Center, 2017). Four-year-old enrollment in Head Start increased by 319 seats (Office of Head Start Program Information Report, 2010-2012), but with a loss of 179 school-based seats, coupled with an estimated increase of roughly 700 eligible children (based on enrollment of FRPL-eligible kindergartners), a shift to Head Start could only explain a small portion, if any, of the loss in school-based seats.

We are also limited by the non-causal nature of our test score and mobility analyses. To identify the causal effect of offering a pre-K program, we would ideally like to have examined changes in outcomes for schools that decide to switch from offering a pre-K to not offering one, or vice versa. However, only six schools in our sample made such a switch during the time period we examine, making such an analysis infeasible. Additionally, we do not have student addresses, preventing us from using distance to pre-K as an instrument for pre-K attendance. As a result, we are only able to statistically control for the potential confounding factors that may affect student mobility and test scores, and our findings may not precisely reflect the causal effect of a school's decision to offer pre-K on subsequent student mobility and test outcomes.

Conclusion

Although our study focuses on pre-K only, the results have important implications for other educational programs as well. Pre-K is an example of an optional educational program that has proven cost-effectiveness for society across a broad range of students (Bartik, Gormley, & Adelstein, 2012; Heckman, Moon, Pinto, Savelyev, & Yavitz, 2010), and it is relatively uncontroversial that schools can expect some benefit – either through improved school readiness or student selection. Even under these positive conditions, it appears that the mechanism of decentralization, absent financial incentives or central oversight, leads to a reduction in public-school pre-K services. Other services with less clear benefits may be at even greater risk in a decentralized system. Although there is little academic research at this time, anecdotally, New Orleans has also had problems with decentralization of authority over truancy prevention, student expulsions, and dropout recovery. All of these responsibilities have recently been recentralized to the RSD, which continues to reconsider its role in governance. Policymakers in other settings must consider how and where decentralization might lead to the reduction or elimination of services that are useful for subgroups of students. Our study provides evidence that decentralization without off-setting financial incentives can lead, as expected by theory, to reduced investments in programs that advance the broader social goals of public education.

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Table 1. Effects of School Decentralization on Pre-K Availability in New Orleans

	Pre-K/K Seats
New Orleans	2.112
	(3.421)
Post-Reform	14.584*
	(3.013)
New Orleans x Post-Reform	-24.855*
	(3.013)
Constant	60.092*
	(3.421)
Observations	886
Parishes	69

Note: Estimated coefficients (robust standard errors) from difference-in-differences model comparing pre-K seats in the pre and post-Katrina periods (2001-2005 and 2007-2015) in New Orleans to the same periods in all other Louisiana parishes. Pre-K seats are measured by total student enrollment.

* $p<0.05$

Table 2. Third-Grade Students in New Orleans Charter Schools, 2012-2015

	All	Student Attended PK		School Offers PK	
Pre-k Exposure		Yes	No	Yes	No
Student attended pk	0.45	1.00	0.00	0.53	0.39
Kindergarten school offers pk	0.45	0.53	0.39	1.00	0.00
Student Demographics					
Black	0.90	0.94	0.87	0.88	0.92
White	0.03	0.02	0.04	0.05	0.02
Other race/ethnicity	0.06	0.03	0.09	0.07	0.06
Male	0.52	0.52	0.52	0.53	0.52
Special education	0.10	0.11	0.09	0.09	0.11
Gifted	0.03	0.03	0.02	0.04	0.01
Free/reduced lunch	0.88	0.91	0.86	0.88	0.89
English Language Learner	0.04	0.02	0.06	0.05	0.03
Math z-score	-0.21	-0.22	-0.21	-0.20	-0.22
ELA z-score	-0.19	-0.20	-0.19	-0.11	-0.26
School Characteristics					
Third-grade enrollment	71.92	71.38	72.35	75.46	68.97
Primary grade suspension rate	0.07	0.06	0.07	0.05	0.08
Open pre-Katrina	0.18	0.17	0.19	0.22	0.15
In last year of operation	0.06	0.06	0.06	0.03	0.08
Number of students	7697	3483	4214	3498	4199
School-level Descriptives					
School offered pre-K	0.43			1.00	0.00
Third-grade enrollment	66.07			69.87	63.24
Primary grade suspension rate	0.07			0.05	0.09
Open pre-Katrina	0.20			0.23	0.17
In last year of operation	0.07			0.04	0.10
Number of cohorts	122			52	70

Note: Table displays mean values calculated from student-level data. Test scores were normed relative to the state distribution in each year.

Table 3. Estimated Associations between Student and School Pre-K and Third-Grade Test Scores

	(1) Math	(2) ELA	(3) Math	(4) ELA	(5) Math	(6) ELA
School offered pk	0.056	0.108	0.002	0.087	0.093	0.073
	(0.089)	(0.099)	(0.088)	(0.094)	(0.090)	(0.113)
Student attended pk					0.038	0.006
					(0.020)	(0.022)
White					0.589*	0.424*
					(0.063)	(0.070)
Other race/ethnicity					0.240*	0.119
					(0.061)	(0.067)
FRPL					-0.138*	-0.142*
					(0.026)	(0.036)
Special education					-0.637*	-0.737*
					(0.054)	(0.044)
Gifted					0.669*	0.638*
					(0.099)	(0.110)
Male					-0.046	-0.209*
					(0.024)	(0.019)
ELL					-0.111	-0.289*
					(0.086)	(0.087)
3rd-grade enrollment			0.115	-0.028	-0.255*	-0.352*
			(0.142)	(0.142)	(0.122)	(0.116)
% White			1.067	1.917*	0.116	1.242*
			(0.585)	(0.575)	(0.579)	(0.549)
% Other race/ethnicity			-0.182	-0.150	-0.326	-0.475
			(0.332)	(0.377)	(0.390)	(0.388)
% FRPL			0.262	0.415	0.022	0.282
			(0.388)	(0.345)	(0.298)	(0.318)
% Special education			0.141	0.005	0.505	0.837
			(0.774)	(0.715)	(0.950)	(0.757)
% Gifted			-0.226	0.026	-1.914	-0.915+
			(0.959)	(0.926)	(1.329)	(0.540)
K-2 suspension rate			0.019	-0.175	0.299	0.047
			(0.451)	(0.456)	(0.730)	(0.616)
Pre-Katrina school			0.337*	0.233	0.350*	0.271+
			(0.128)	(0.149)	(0.135)	(0.159)
School closing			-0.274*	-0.272*	-0.228*	-0.165
			(0.129)	(0.122)	(0.053)	(0.097)
Constant	-0.280*	-0.298*	-1.027	-0.591	0.833	1.088
	(0.058)	(0.066)	(0.774)	(0.748)	(0.723)	(0.716)
N	122	122	122	122	7692	7692

Note: OLS coefficients (standard errors) estimated for specification of equation 2.
* $p<0.05$

Table 4. Kindergarten Students in New Orleans Charter Schools, 2009-2012

	All	Student Attended PK		School Offers PK	
Pre-k Exposure		No	Yes	No	Yes
Student attended pk	0.49	0.00	1.00	0.31	0.65
Kindergarten school offers pk	0.53	0.37	0.70	0.00	1.00
Persistence post-kindergarten					
Year 1	0.78	0.76	0.80	0.78	0.78
Year 2	0.66	0.63	0.68	0.65	0.66
Year 3	0.57	0.55	0.59	0.56	0.58
Student demographics					
Black	0.91	0.89	0.94	0.91	0.91
White	0.04	0.05	0.03	0.03	0.05
Other race/ethnicity	0.05	0.07	0.03	0.06	0.04
Male	0.52	0.53	0.52	0.51	0.53
Special education	0.08	0.07	0.10	0.08	0.08
Gifted	0.02	0.02	0.03	0.01	0.03
Free/reduced lunch	0.90	0.87	0.92	0.89	0.90
Repeated a grade	0.04	0.05	0.04	0.05	0.03
School characteristics					
Enrollment	542.31	525.92	559.40	485.43	593.06
Primary grade suspension rate	0.06	0.07	0.05	0.08	0.04
Open pre-Katrina	0.21	0.19	0.22	0.15	0.25
Number of students	8067	4119	3948	3804	4263

Note: Table includes mean values calculated from student-level data.

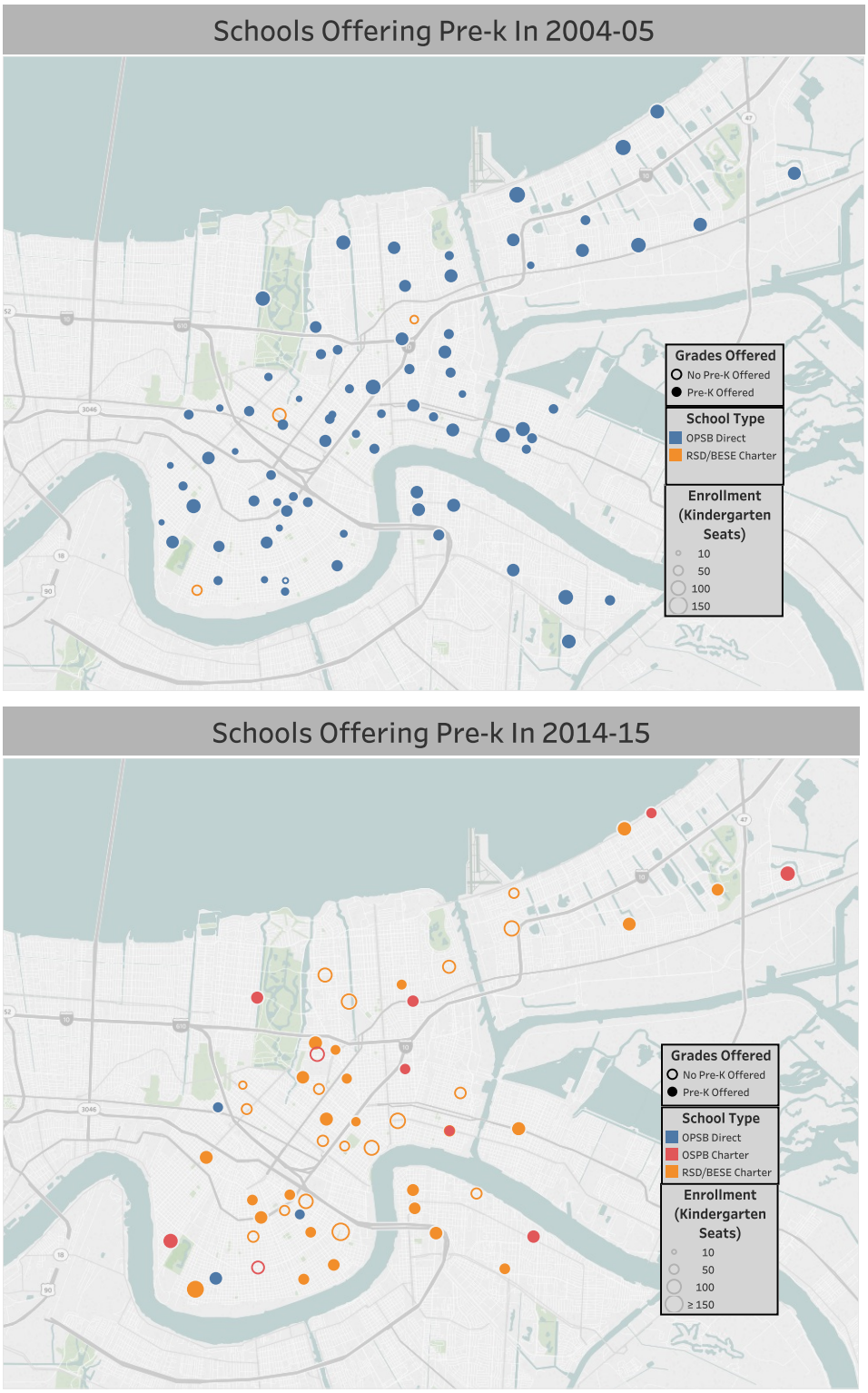
Table 5. Estimated Associations between Student and School Pre-K and Student Persistence in the Same School

	Charter Schools				Charter Management Organizations			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
t=1	-1.287*	6.553*	-0.834*	6.566*	-1.232*	5.592*	-0.794*	5.587*
	(0.035)	(0.443)	(0.075)	(0.450)	(0.034)	(0.431)	(0.073)	(0.437)
t=2	-1.628*	6.286*	-1.158*	6.332*	-1.472*	5.423*	-1.017*	5.451*
	(0.041)	(0.446)	(0.079)	(0.453)	(0.039)	(0.433)	(0.076)	(0.440)
t=3	-1.838*	6.108*	-1.367*	6.161*	-1.684*	5.236*	-1.226*	5.271*
	(0.047)	(0.447)	(0.082)	(0.454)	(0.045)	(0.434)	(0.079)	(0.441)
School offered pk	-0.113*	0.410*	-0.075	0.460*	-0.226*	0.122*	-0.195*	0.163*
	(0.041)	(0.055)	(0.044)	(0.058)	(0.040)	(0.051)	(0.043)	(0.054)
Student attended pk			-0.121*	-0.196*			-0.095*	-0.156*
			(0.044)	(0.046)			(0.042)	(0.044)
White			-0.053	0.495*			-0.070	0.447*
			(0.115)	(0.135)			(0.113)	(0.131)
Other race/ethnicity			-0.029	0.228*			0.026	0.224*
			(0.093)	(0.104)			(0.088)	(0.098)
FRPL			-0.015	-0.032			-0.004	-0.018
			(0.041)	(0.042)			(0.040)	(0.041)
Special education			-0.485*	-0.440*			-0.511*	-0.446*
			(0.087)	(0.090)			(0.085)	(0.087)
Gifted			-1.365*	-1.075*			-1.332*	-1.189*
			(0.240)	(0.246)			(0.235)	(0.240)
Male			-0.376*	-0.764*			-0.376*	-0.747*
			(0.069)	(0.080)			(0.067)	(0.077)
ELL			-0.606*	-0.616*			-0.653*	-0.649*
			(0.115)	(0.117)			(0.113)	(0.115)
3rd-grade enrollment		-1.275*		-1.274*		-1.092*		-1.090*
		(0.064)		(0.065)		(0.062)		(0.063)
% White		-1.688*		-2.193*		-1.992*		-2.412*
		(0.366)		(0.406)		(0.368)		(0.404)
% Other race/ethnicity		-0.356		-0.748*		-0.679*		-1.019*
		(0.346)		(0.380)		(0.331)		(0.362)
% FRPL		-0.073		0.771*		0.082		0.900*
		(0.208)		(0.226)		(0.204)		(0.221)
% Special education		-2.357*		-2.165*		-4.233*		-3.981*
		(0.753)		(0.755)		(0.735)		(0.737)
% Gifted		0.007		0.366		1.281*		1.686*
		(0.677)		(0.690)		(0.648)		(0.661)
K-2 suspension rate		3.257*		3.357*		2.617*		2.703*

		(0.292)		(0.296)		(0.289)		(0.293)
Pre-Katrina school		-0.101		-0.115		0.081		0.066
		(0.074)		(0.074)		(0.069)		(0.069)
Student x period observations	16977	16977	16977	16977	17614	17614	17614	17614
Unique students	8067	8067	8067	8067	10057	10057	10057	10057

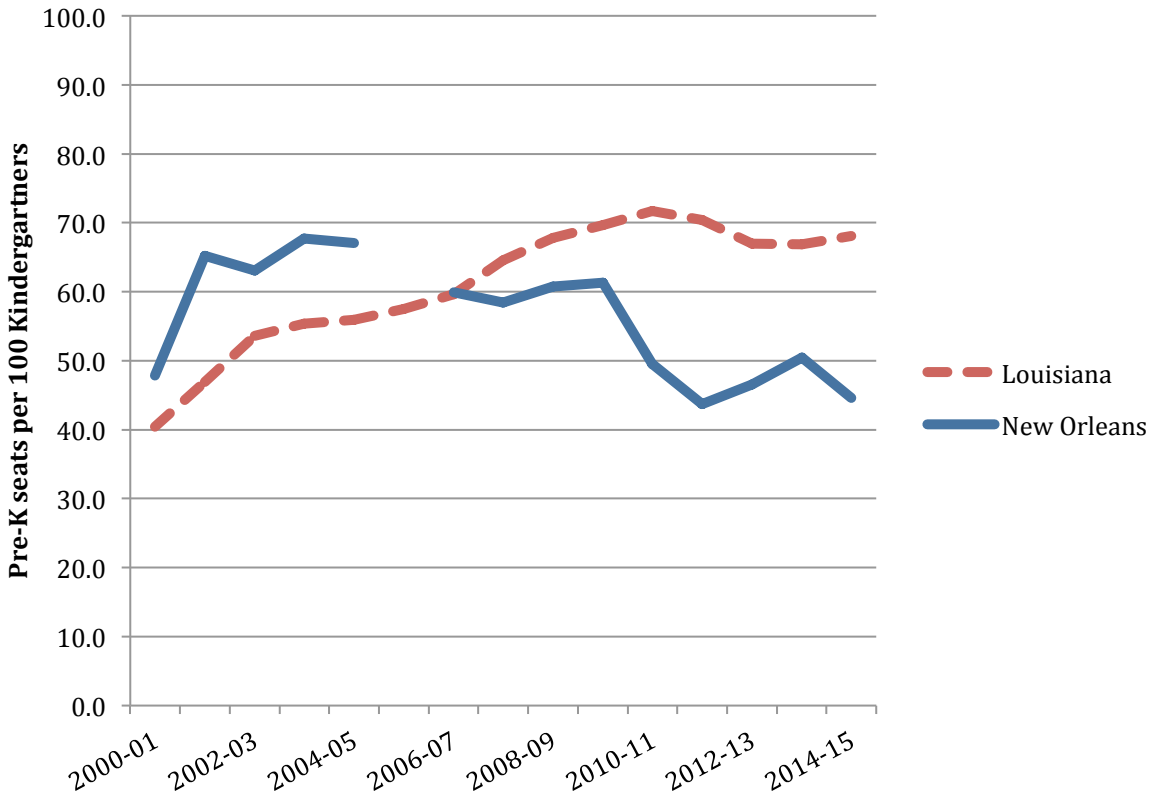
Note: Estimate coefficients (standard errors) from specifications of equation 3. Model predicts conditional logistic hazard of exit for kindergarten school through grade 3.
* $p<0.05$

Figure 1. New Orleans Elementary Schools Offering Pre-K, 2004-05 and 2014-15



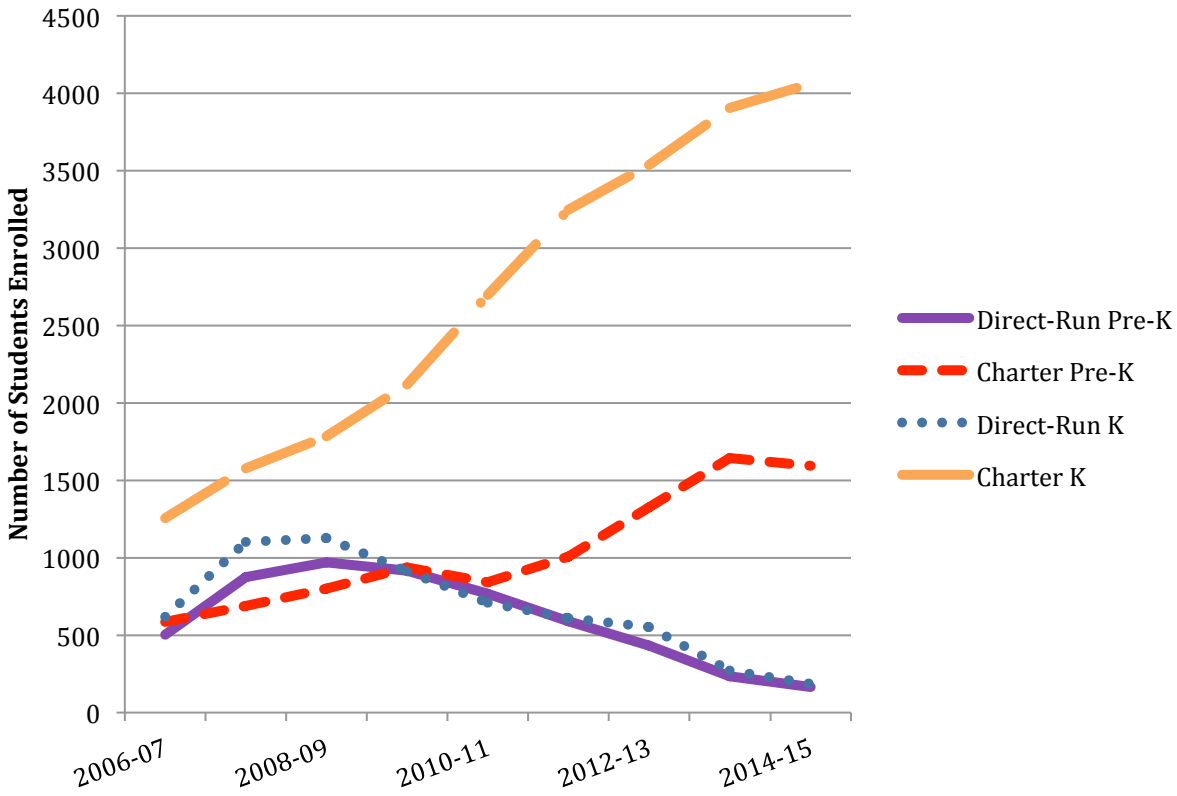
Note: In 2004-05, New Orleans had 80 elementary schools, 3 of which were charters, and 95% operated a pre-K program. In 2014-15, New Orleans had 56 elementary schools, 53 of which were charters, and 63% operated a pre-K program.

Figure 2. Change in Pre-K Seats in New Orleans and Other Louisiana Parishes 2001 to 2015



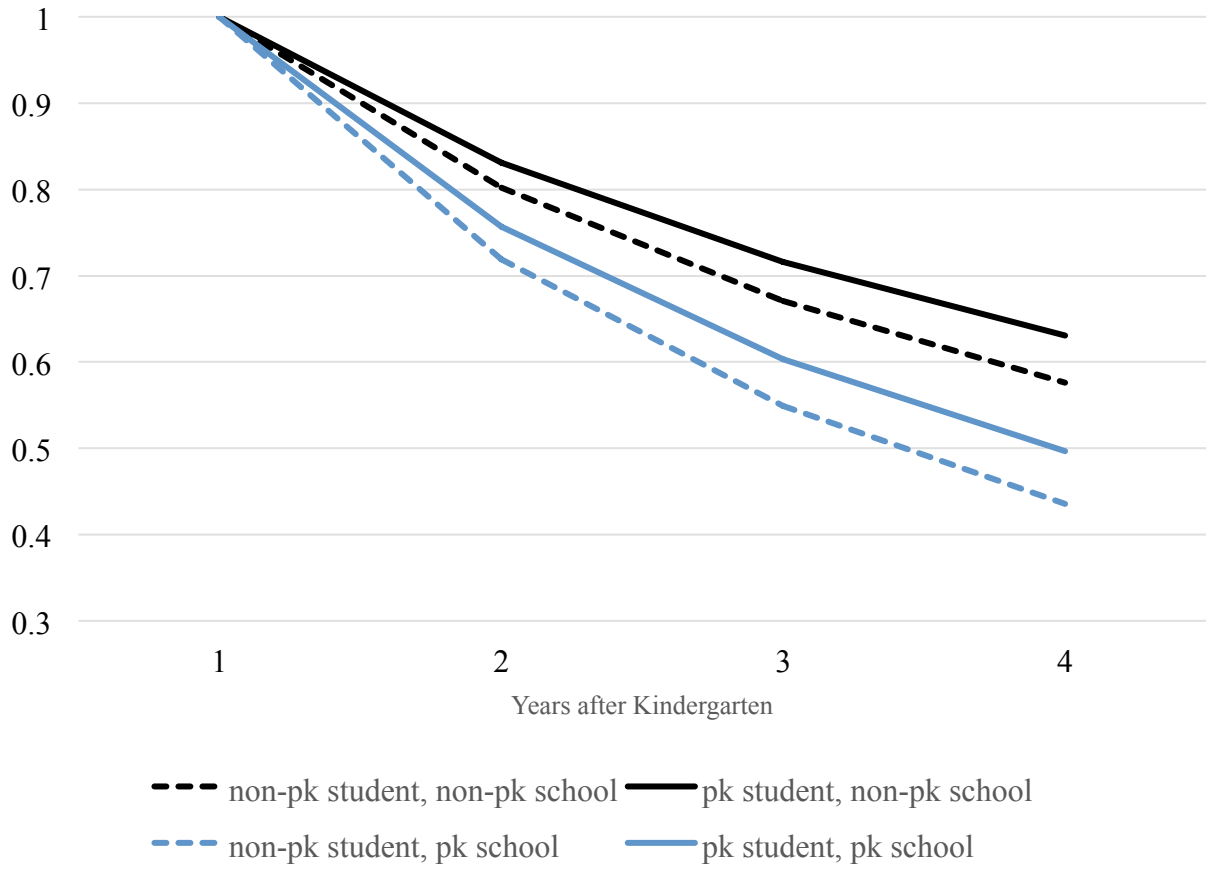
Source: Author calculations from student enrollment files. Includes all charter and traditional public schools.

Figure 3. Pre-K and Kindergarten Enrollment in Charter and Direct-Run Schools



Source: Author calculations from student enrollment data. Direct-run schools include schools operated by the OPSB school board and the Louisiana Recovery School District.

Figure 4. Persistence of Pre-K and non-Pre-K Students in Schools that Do and Do Not Offer Pre-K



Source: Estimations from hazard model from equation 3 (full results in Table 5, Column 4). Graph depicts estimated probability of continued enrollment in the kindergarten school for a black, male student who was eligible for free lunch and not identified for special education. School values are set at the means for all kindergarteners. A pk student attended pre-K at a public school. A pk school offered a LA4 pre-K classroom in the student's pre-K year.