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The Effects of Oklahoma's Universal Preschool Policy on Long-Term Educational Outcomes for Students

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Abstract

As states have increased their commitment to early childhood education over the past two decades, a debate on the efficacy of state-sponsored universal preschool has divided policymakers, administrators, and taxpayers. Some critics of these programs argue that universal preschool has a diminishing impact which does not justify the up-front cost, while supporters argue that there are long-term positive effects of high quality, universal early childhood education which outweigh the cost. In this paper, we examine the effect, if any, that the existence of a state-funded universally available preschool program has had on county-level average ACT scores in a before-and-after multivariable regression analysis. This analysis was then expanded to include analysis on the impact of universal preschool on ACT scores for low-income student populations and high-enrollment student populations. We found that the existence of a universally available preschool program had a statistically significant positive effect on students and that the impact on ACT Scores was higher for low-income students.

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Introduction & Purpose

In the past several years, there has been an ongoing debate at the state level surrounding the efficacy of state-sponsored universal preschool, the crux of this debate is whether or not the benefits of offering universal preschool outweigh the upfront costs of implementing a program accessible to all 4-year-olds (Barnett 2000). In 1995, Georgia became the first state to introduced statewide universal preschool, offering free preschool education to all 4-year-old children regardless of family income (Barnett 2008). By the end of the 1990s, New York and Oklahoma had followed suit, with the same plan to offer a free public preschool program to all 4-year-old students (Cross 2008). Though states with universally available preschool have seen high utilization rate, as denoted by the 74% enrollment rate of 4-year-olds in Oklahoma's public preschools (Friedman-Krauss 2017), several states have failed to bring universal preschool bills into fruition due to pushback from legislators and taxpayers surrounding the funding of universal preschool (Williams 2019).

Currently, in states without universal programs, students can enroll in private preschools, at a cost ranging from $4,460 to $13,158 annually with limited financial aid (NACCRA 2017), or public preschools. It is important to note that public preschools in states without state-sponsored programs are not accessible to everyone and often times have long waitlists for students. This current situation results in a lack of early childhood education options for low-income students especially, a student group that already faces increased challenges, only increasing the difference in standardized tests scores in this student group versus their peers. We hypothesize that universal preschool will have a positive impact on ACT scores, graduation rates, and enrollment in college-

level courses as it provides high quality, early education opportunities to students who otherwise would not have access and currently perform significantly worse than their peers on these long-term academic performance metrics.

In this paper, we set out to examine the long-term educational impacts of high quality, universally available preschool. We have chosen to focus our research on Oklahoma's public preschool program as Oklahoma ranks first in the nation in the proportion of 4-year-olds enrolled in pre-kindergarten classes (Kirp 2004). Furthermore, Oklahoma is an optimal case study due to its alignment with the National Institute for Early Education Research's definition of preschool combined with its long history, relative to many states (Friedman-Krauss 2017). We will outline the criteria established for a high-quality preschool further along in our methodology. In order to assess the efficacy of universal preschool programs, we analyzed the results of ACT Scores, graduation rates, and enrollment levels in college-level courses from 1997-2016 as provided by the State Departments of Oklahoma. The purpose of our analysis was to determine if the existence of high quality, universal preschool impacts the outcome of long-term educational measures by comparing Oklahoma's state-wide results before and after the implementation of universal preschool. In order to perform this analysis, we utilized a before-and-after analysis to compare the results of the years before the program was implemented to the years after students who had the opportunity to partake in the universal preschool program matriculated. This analysis took place in the form of a multi-linear regression that controlled for changes in average ACT scores, graduation rates, and enrollment in college-level courses at the National level. Following our initial analysis, we found the most measurable impact took place in ACT Scores. Based off of this finding, we furthered our analysis to include a multi-linear regression for ACT Scores at different

income levels to determine the impact that universal preschool had on different demographic groups. The motivation behind this analysis was the fact that prior to the addition of universal preschool, low-income students had very limited options to receive any early childhood education, which we hypothesized would increased the impact of universal preschool on this demographic. In this analysis, we found that ACT Scores on average increased by 0.1420 points for districts that on average had a median income level less than that of the state median income level. This is higher than the impact of universal preschool on ACT Scores across all districts of a 0.1021-point increase.

This paper reports on the long-term educational impact that high quality, universal preschool has on students through their final year of high school by analyzing both standardized ACT scores and behavioral and motivational factors such as graduation rates and enrollment in college-level courses to provide a holistic picture of the impact of universal preschool on students across of Oklahoma. We found that the availability of universal preschool did not have a statistically significant impact on college-level course enrollment or graduation rates. However, there was a positive impact on ACT Scores which was heightened in low-income districts. The implications from this finding are that universal preschool has a higher impact on students who previously had no access to early childhood education due to their income level than those who were potentially able to pursue alternatives.

Related Literature

Previous research has found that participation in state-funded public preschool programs can boost the cognitive skills of children at school entry, sometimes dramatically (Phillips et al. 2017). Similarly, studies of universal preschool programs in Georgia (Henry et al. 2004), Oklahoma (Gormley et al. 2008), and Boston (Wei-land & Yoshikawa 2013) have documented short-term gains in cognitive growth for students who attend these preschool programs. Earlier studies of some preschool programs in Ypsilanti, MI, Chapel Hill, NC, and Chicago, IL provide evidence that high-quality early childhood programs can have long-term effects on educational attainment, socio-emotional indicators, health, and crime decades after (Campbell et al. 2012, Reynolds et al. 2011, & Schweinhart et al. 2005). However, it is important to note that these programs exclusively served low-income students. When studying elementary school academic outcomes, researchers have found students who attended preschool in states with universal programs have persistent advantages (Bassok & Miller 2014, Fitzpatrick 2008, & Hill et al. 2015). However, when examining Tennessee's targeted preschool program, researchers found that positive effects at the end of preschool disappeared after one year, and estimated effects as of third grade were negative in some case (Lipsey et al. 2015). Though extensive research has been performed on early childhood education, some researchers believe that: "The available evidence about the long-term effects of state pre-K programs offers some promising potential but is not yet sufficient to support confident overall and general conclusions about long-term effects (Phillips et al. 2017)." As more data has been gathered on the impact of universal preschool, researchers have been able to find more consistent results. A 2017 study of the Tulsa Public School System, found universal preschool had diminishing returns on the total impact it had on standardized test scores, however,

there was an improvement in math scores, enrollment in honors courses, and grade retention for middle school students (Gormerly et al. 2017). We hope to further expand on this analysis to determine the prevalence of diminishing returns by looking at long-term educational measures, as detailed in our methodology section.

Methodology

High-Quality Preschool Methodology

To assess the effectiveness of universal preschool, we sought to find a state with a long-standing history of universal preschool, relative to other states, and high-quality preschools. There has been a substantial amount of research done to corroborate the importance of high-quality early childhood education. Researchers have found that the long-term impact of early childhood education is highly correlated with the quality of the program (Cannon et al. 2017). This is an important factor for this study as, based on this research, the effects of universal preschool would be diminished if the program is not in line with these standards, and therefore would not accurately assess the impact of universal preschool. The National Institute for Early Education Research has determined the following criteria to define what is a high-quality preschool, and serve as our definition of a high-quality preschool going forward (Friedman-Krauss 2017). Based off of this benchmark, we determined that Oklahoma's public preschool program is most in line with the definition of a high-quality preschool. The standards for preschools set forth by the National Institute for Early Education Research and the Oklahoma universal preschool bill are as follows:

Policy	**NIEER Benchmark**	**Oklahoma's Policy**
Early learning & development standards	Comprehensive, aligned, supported, culturally sensitive	Comprehensive, aligned with other state standards, supported
Curriculum supports	Approval process & supports	Approval process & supports
Teacher degree	BA	BA
Teacher specialized training	Specializing in pre-K	ECE
Assistant teacher degree	CDA or equivalent	HSD
Staff professional development	For teachers & assistants: At least 15 hours/year; individual PD plans; coaching	75 hours/5 years
Maximum class size	20 or lower	20 (3- & 4-year-olds)
Staff-child ratio	10:1 or better	1:10 (3- & 4-year-olds)
Screening & referral	Vision, hearing & health screenings; & referral	Vision, hearing, immunizations; Support services
Monitoring/ Continuous quality improvement system	Structured classroom observation; program improvement plan	Structured classroom observations; Data used for program improvement

Other states with long-standing universal preschool policies, have failed to meet these benchmarks, or have not been able to meet all demand for preschool enrollment primarily due to a lack of funding, as in the cases of Florida and Georgia (Kirp 2004). These factors considered made Oklahoma the optimal case study for our research.

College-Level Course Enrollment, Graduation Rates, and Standardized Test Scores

We initially examined enrollment rates in college-level courses (Advanced Placement [AP®] and dual credit classes) to serve as an indicator of high school students' readiness to pursue a college-level education. We also examined graduation rates as an indicator of students' ability and desire

to complete their education, and as the only standardized factor that is unrelated to college application, controlling for the proportion of students who are unable to attend college, or those who do not have the desire or need to continue their education past high school.

However, with both of these variables we found there to be inconsistencies in the measurement of data as each dataset was self reported by individual schools. In the college-level course enrollment data, we found there to be inconsistencies of what constituted a college-level course between 1998-2017. Graduation rate data demonstrated similar inconsistencies in regards to how graduation rates were measures such as whether or not they included students who graduated in 5-years or local homeschooled students. We ultimately chose to eliminate both of these data sets from our analysis due to these inconsistencies in data.

Most studies examining the Oklahoma educational system rely on state-level testing data as a measure of academic performance; however, these state-level standards historically were far laxer than national standards, and Oklahoma state testing standards changed in the mid-2000s, making before-and-after comparisons difficult (Bob Harbison, personal communication, March 2019). For this reason, we chose to exclude state-level testing that takes place during primary education and instead examines the newly available longer-term indicators which take place in secondary education. The extended time period between the policy enactment and the realization of these educational indicators as well as a limited number of year-over-year data points collected as the recipients of the universal program age into secondary education limits our ability to draw any definitive conclusions from the experimental results.

ACT Scores

The ACT is a nationally standardized exam taken by students in their 11th grade of high school to act as a college entrance exam. The ACT is most common in the midwest, whereas coastal high schools often rely on the SAT to evaluate college readiness (Oklahomian Editorial Board 2017). The ACT has become increasingly relevant for Oklahoma school districts as they are one of only 17 states in which 100% of high school seniors graduating in 2017 took the ACT during their junior year due to the creation of a program which provided the ACT free of charge to public school students. During the program's pilot year, approximately 80% of high school students took the ACT; before that program, the rate of students who took the ACT hovered at a little over 50% (SDE 2017).

The ACT is valuable as a measurement of college readiness and a student's eligibility to graduate high school; it is listed as a potential graduation requirement by Oklahoma's State Department of Education (HB 3218, 2016) and is almost universally accepted by American universities in their required application materials. Students who first received preschool through Oklahoma's universal preschool policy in 1999 also recently reached 11th grade, meaning that ACT scores after 2013 were taken by students who were recipients of universal preschool, giving us new insight into the potential quantifiable effects of the policy. Importantly, the ACT is also nationally standardized, which controls for any inter-state variation in testing data.

Analysis Methodology

In order to analyze the impact of universal preschool on average county ACT Scores, we sought out an analysis that allowed us to compare these measures in the time before the policy was implemented and after the first class of students who had the option to attend universal preschool matriculated. In our design, "before" refers to the measurement made before the policy was introduced and "after" refers to the measurement made after its introduction. The before-and-after design is most useful in demonstrating the immediate impacts of programs, which we believed to be the most relevant impact due to the infancy of the program. We selected this analysis as it allowed us to directly compare these factors while also controlling for any changes that may have occurred at a national level that would impact these measures. Furthermore, this was the most comprehensive statistically significant analysis we could perform on the available data. Though the before-and-after analysis is commonly used and a reputable to determine the impact of certain programs or policies at a company-wide or economic level, we also acknowledge that there are concerns regarding the internal validity of the model. One of these potential threats to internal validation is the fact that each year we measure allows for more circumstances that could have potentially arisen that may obscure the effects of an intervention. This is especially relevant when analyzing education data as there are thousands of studies detailing the various factors that can have a significant impact on a child's educational outcomes. In order to mitigate this, we sought to use this analysis to provide preliminary evidence for the policy's effectiveness and then supplement with complementary information to further contextualize the implications of our results. Furthermore, we utilized national average ACT scores in our model to control for any changes in these measurements or national trends that could be impacting Oklahoma's data.

The before-and-after analysis results are found by comparing data from the years before the policy was enacted to the years following the implementation of the policy in a multivariable regression. In order to find the before-and-after effects, we compared the years before the policy was enacted (1996-1998), to the year in which students who would have attended preschool in 1998 would either be graduation, taking the ACT, or taking college-level courses, in this example 2012, with a treatment variable (n=0). We compared the years after the policy was enacted (1999-2002) in our analysis to the years in which students who would have attended preschool in 1999-2002 would be taking the ACT, (2013-2016 in this example) with a treatment variable (y=1). Both the treated and untreated data was analyzed for all school districts, who had relevant data as discussed in the data section, in the state of Oklahoma.

The set up of the analysis is as follows:

$$Y_{I,T} = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_{338} X_{338} + \beta_{339} X_{339}$$

Where $Y_{I,T}$ represents the average ACT score in county I in year T; β_0 represents the y-intercept; X_1 represents the binary treatment variable, where X=0 if the test-takers did not have access to universal pre-school and X=1 if the test-takers did have access to universal preschool in year T; $X_2 + \ldots + X_{338}$ represents the binary county-level control variables where X=0 if the county being examined does not match the independent variable county and X=1 if the county being examined does match the independent variable county; and X_{339} represents the average national score in year T.

Our Python dataset was therefore constructed in the setup below:

Academic Measure Analysis Set-up			
District Name	Binary Treatment Variable (X_1)	Binary County-Control Variable ($X_2, \ldots, X_{338}$)	National ACT Average in year T (X_{339})

We utilized Python to perform the multivariable regression to determine the impact of universal preschool on each of these measures, while controlling for any changes at a national level. The outcome of this analysis will be discussed in detail in the results section of this paper. We performed the multivariable regression on three populations: the entire state of Oklahoma (n = 338 counties), low-income counties (n = 219 counties) and high-enrollment counties (n = 12 counties). We defined low-income counties as counties whose median household income fell below the state median income, and high-enrollment counties as counties who showed greater than a 500% increase in preschool enrollment in the two years following the implementation of the program. Given that these populations are ostensibly the demographics that the universal preschool program are intended to serve, we wanted to include population-specific regression analysis to determine whether the enactment of the program had a stronger impact on at-risk counties compare to the state-level impact (if any).

Results

We found the following results indicating that universally available preschool had a statistically significant positive effect on county average ACT scores across the state as well as a larger statistically significant positive effect on average ACT scores in low-income counties. However,

we did not find that universally available preschool had a statistically significant impact on counties in which enrollment sharply increased following the enactment of the program.

	Treatment Variable Coefficient	*P-value*	*Average ACT Score (2017)*
ACT Scores (state-wide)	0.1021	0.0009	20.8
ACT Scores (low income)	0.1420	0.0009	18.4
ACT Scores (high enrollment)	-0.0552	0.434	19.6

Discussion

Although the results show a relatively small impact on ACT scores compared to the score range of the test, we believe these results still provide one of the few long-term indicators of the value of universally available preschool. First, it is important to note that the limited score range of the ACT between 1 and 36 means that population-level score movements are often measured in tenths of points rather than entire points: since 1992, the national average ACT score has only varied by +/- 0.25 points (NCES 1999, NCES 2010 & ACT 2018). Therefore, a 0.1- and 0.14-point matches the magnitude at which population-wide average ACT scores tend to change. Additionally, while most research on the impacts of Oklahoma's preschool program tend to focus on short-term impacts, such as improved performance in elementary school, improve social skills, or grade retention in middle school, there is little evidence of the impact that universally available preschool

has on higher-level educational indicators occurring over ten years after the program because those students have only recently reached the age where those indicators are measured.

The fact that ACT scores were impacted almost 50% more in low-income counties also indicates that the program is serving the population it was intended to serve: although county-level enrollment data in Oklahoma is not comprehensively available before 2006, enrollment rates for children from low-income families tend to fall between 5% and 20% lower than children from high-income families (Magnuson & Waldfogel 2016). Therefore, universally available preschool is most likely to target those families which do not have the logistical or financial resources available to attend a for-profit preschool.

Lastly, one of the most significant challenges to performing a before-and-after study was the availability of consistently recorded data. The data used for this paper was pulled from publically available datasets, government offices, non-government organizations, and interviews with professionals in the field. School districts are often held accountable for reporting data to the State Department of Education using their own system and analysis, meaning that data was sometimes reported incorrectly or, sometimes, not at all. The State Department of Education also did not prioritize storing district- and county-level data until 2006, and pre-2006 data was often lost or destroyed during administration turnovers. Therefore, a more robust analysis of universally available preschool on other educational indicators was not possible because there was simply not a large enough dataset. For example, the dataset gathered for pre-1998 preschool enrollment was skewed towards counties whose median household income is above the state median household income, creating a reporting survey bias. This is likely why there was not a statistically significant

result for high-enrollment counties; there was simply not a wide enough array of differentiated data from which to draw a conclusion.

Conclusion

One important conclusion to draw from this study is the importance of keeping standardized data before and after the implementation of an educational program. Because the importance of data-driven policy decisions has been recognized, measuring the efficacy of policy decisions is dependent on accurate record-keeping, transparency, and accountability. Despite the robust set of qualitative academic research indicating the value that universally available preschool has on students' educational outcomes, statistically significant quantitative data is increasingly necessary to justify the significant expense of implementing a universally available program to policymakers and taxpayers.

An increase in tenths of a point in ACT scores is not reason enough to adopt a universally available preschool program alone. However, this study represents one of the few analyses of long-term educational impact derived from universally available preschool, and the conclusion that universally available preschool can have a positive impact on students' educational performance over a decade after it is experienced is an important argument for the benefits of its existence. As students who had access to universally available preschool continue to matriculate to high school and university, those standardized educational indicators must continue to be studied in order to more robustly evaluate the impact that universally available preschool has on long-term learning outcomes.

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