

Who Benefits from Kindergarten? Evidence from the Introduction of State Subsidization

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Abstract

Over the last 70 years, all states in the United States began to publicly subsidize kindergarten using state revenue. The variation in adoption dates across states allows for a unique opportunity to measure the effectiveness of the largest early education program implemented in recent history. The significant, immediate increase in the availability of kindergarten within a state is used to identify the effect of enrollment in kindergarten. Hispanic children, non-English speakers, children from immigrant households, and children of low socioeconomic status benefit the most from the increased availability of kindergarten. Hispanic children with access to kindergarten are 17% less likely to be below grade for their age and earn wages 5% higher as adults.

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1. Introduction

Over the last 70 years, a massive adoption of kindergarten in the public primary school system occurred in all 50 states in the United States. This resulted in a dramatic increase in the availability of kindergarten. This study assesses how the increased availability of kindergarten programs benefits students and, more specifically, what types of children benefit. Do some groups of children benefit from attending publicly supported kindergarten more than others, based on gender, race, or class? Does publicly supported kindergarten help children who may otherwise face disadvantages in education based on demographic factors?

Frederick Froebel formed the first kindergarten in Germany in 1837. The curriculum emphasized socialization and preparing pupils for primary education. The kindergarten movement later expanded to the United States, taking root in Wisconsin 19 years later. Over the next several decades, many towns and cities started offering kindergarten. Initially, all kindergarten funding came from either private or local sources such as local philanthropic organizations, private tuition payments, or local tax dollars. However, in the 50 years between 1935 and 1986, every U.S. state eventually transitioned to a model in which kindergarten was subsidized using state revenue. Ohio was the first state to subsidize kindergarten in 1935, and Mississippi was the last state in 1986. This subsidization enabled states to provide kindergarten as a part of their public primary school educational system. In most states, this subsidization enabled public schools to count kindergarten students as a part of their enrollment for the purposes of calculating state aid. In other cases, the district or school was given additional state money in the form of a grant or appropriation for providing kindergarten. This decreased the districts' costs of providing kindergarten, thus increasing its availability.

In this analysis, I used nationally representative data from the United States along with information about the beginning of state subsidization to estimate the effects of the availability of publicly subsidized kindergarten on students' progression through school, eventual academic completion, and labor market outcomes. The effect of state-sponsored kindergarten can be isolated by comparing cohorts before and after state subsidization, assuming that outcomes for each cohort would be the same except from the effect of kindergarten attendance. More specifically, changes over time (comparison of children from later cohorts who had access to state-subsidized kindergarten with children from earlier cohorts that did not have access) and variation across states in the timing of the subsidization identify the effects of state-subsidized kindergarten.

This research finds that the increased availability of kindergarten programs decreases the probability that a child is below his/her grade for his/her age. More importantly, there are large differences by different demographic groups. Hispanic male children's rate of being below grade for age is decreased by about 17%, while male white and black children see no measurable benefit. However, female black children along with female Hispanic children also see a statistically significant effect in terms of decreasing the condition of being below grade for age. Non-English-speaking children benefit, along with children whose parents are immigrants. A large gap also exists between groups of different socioeconomic statuses. The poorest children are less likely to be below grade for age after the introduction of state-funded kindergarten, while there is no effect on being below grade for age for rich children. Consistent with these shorter-run differences, positive effects on educational attainment along with increased wages are found for Hispanic individuals.

2. Summary of the Literature

There exists a large literature on kindergarten programs. These programs were originally based on the ideas of Froebel, Dewey, and Piaget. Froebel believed that children need a place in which they can be nurtured and helped to develop through experiences with the natural environment and caring adults. He further stated that play is an essential part of the education process. Dewey emphasized the importance of social context in a child's understanding of self in relation to others. Finally, Piaget believed in learning taking place through problem solving, and in the ability of teachers to facilitate that learning as children move through the stages of development. Despite being based on these theoretical roots, many of the kindergartens of the 1960s and 1970s, as well as the pre-kindergartens of today, show significant differences from the ideas espoused by the early theorists.¹

Much of the work on kindergarten has examined differences in the benefits received from full-day versus half-day kindergarten. Clark and Kirk (2000) surveyed the literature prior to 2000 and found mixed results. Overall, however, the research generally found that children identified as being at-risk benefited academically and socially from full-day kindergarten. A more recent meta-analysis conducted by Cooper et al., (2010) found that full-day kindergarten versus half-day kindergarten has a positive association with academic achievement but that this association generally fades out by grade three.

In particular, Cannon, Jackowitz and Painter (2006), DeCicca (2007) and Walston and West (2004) all used data from the Early Child Longitudinal Study-Kindergarten Class of 1998-1999 to examine the benefits of attending full-day kindergarten versus half-day kindergarten. Walston and West (2004) used a research design which was unable to produce causal estimates

¹ Beatty (1995, p. 116) noted that there was already a disconnect between the original pedagogy proposed by Froebel and the actual practice starting in the early 1900s.

because they were unable to determine if their samples were equivalent prior to the student's kindergarten year. They compared children enrolled in full-day kindergarten versus children that were enrolled in half-day kindergarten, and found that children enrolled in a full-day program scored between 22 and 32 percent of a standard deviation higher in reading and math during the school year. Using a similar methodology, DeCicca (2007) found similar results but also found that the gains dissipated fairly quickly. Finally, Cannon, Jacknowitz, and Painter (2006) used a fixed effect strategy in addition to an instrumental variables strategy. They also found that there were initial benefits for student who attended full-day kindergarten but that these effects dissipated by third grade. In addition, they found that full-day kindergarten increased behavior problems for boys and that full-day kindergarten was found to have no additional benefit for low socioeconomic status students.

Despite this large body of work on full- versus half-day programs, very few studies have examined the overall effect of any kindergarten enrollment, either full or half, on later outcomes. Cascio (2004, 2009a, 2010) found positive effects of the expansion of kindergarten availability, primarily on white students. In contrast, Spiess, Büchel and Wagner (2003) examined the effects of attending kindergarten in Germany. They found no significant relationship between kindergarten attendance and later school track placements for children of native German households. However, they found that children of immigrant households do benefit in terms of track placements from attending kindergarten. In addition, Chetty, et al. (2010) found that children who have more experienced teachers in kindergarten and who have a higher kindergarten class quality, as measured by classmates test scores, have higher earnings as adults.

This research builds upon the work of Cascio (2004, 2009a, 2010) to answer additional questions about the effects of the kindergarten expansion on later academic and labor market

outcomes. In particular, this study uses a similar methodology as Cascio (2004) but examines more outcomes and analyzes the effects of the kindergarten expansion on many different demographic characteristics. Cascio (2009a, 2010) used an event study model and the beginning of state subsidization to investigate the long-term effects of the public investment in kindergarten programs in primarily Southern and Western States. She found that white children are less likely to drop out of high school and less likely to be institutionalized as adults but found no effect for black students.² This research expands this literature by estimating the impact of state-sponsored kindergarten on (1) how males and females respond, (2) how children of different races and ethnicities are affected,³ (3) how children of different socioeconomic status respond, and (4) how immigrants and non-English speakers respond. This research also uses an expanded number of states in the analysis.⁴

3. Empirical Framework

The goal of this research was to estimate the average effect of the availability of kindergarten programs on academic and labor market outcomes. Therefore, a difference-in-difference strategy using pooled cross-section data was used to estimate the intent-to-treat effect. More specifically, the effect of state-sponsored kindergarten was isolated by comparing cohorts before and after state subsidization was introduced, assuming that outcomes for each cohort would be the same if not for the effect of kindergarten attendance.

² Cascio (2009b) also used the kindergarten expansion to examine how these programs affected maternal labor supply. She found a labor supply response for single mothers but not for married mothers.

³ Cascio (2009a) investigated the difference between white and black students. In this analysis, I did the same but also examined the difference between white and Hispanic students.

⁴ This analysis uses an expanded list of states that started to subsidize kindergarten. In addition, this analysis employs a different estimation strategy using all states in the United States, versus the strategy employed in Cascio (2009a) which used a subset consisting of the states in which the changes occurred during the 1960s and 1970s. As noted throughout the paper, most of the main findings in Cascio (2009a) are corroborated with this research strategy.

To estimate the average effect of the increased availability of kindergarten programs, the following equation can be estimated

$$Y_{st} = \alpha_1 + \alpha_2 K_{st} + X_{st} \alpha + S_s + T_t + R_t + \varepsilon_{st} \quad (1)$$

where Y_{st} denotes the average outcome measure, such as being below grade for age, educational attainment, or a labor market outcome, for individuals born in state s and birth year t .⁵ K_{st} is a dichotomous variable that indicates whether the state subsidized kindergarten during that particular year. X_{st} is a vector of controls (see Section 3A), S_s is a vector of state of birth indicators, T_t is a vector of age indicators, R_t is a vector of Census region of birth-specific cohort indicators, and ε_{st} is the usual error term.⁶ Therefore the coefficient α_2 can be interpreted as the average effect of the increased availability of kindergarten.⁷ This estimate measures the effect of increasing the availability of kindergarten above and beyond the existing programs available at that time.

The key assumption in this analysis is that no other changes occurred at the same time that would have affected academic and labor market outcomes of children other than the introduction of state-subsidized kindergarten. For example, if policymakers began to subsidize kindergarten due to other factors that also affect academic and labor market outcomes, the estimates for kindergarten could not be disentangled from those changes. Even though this assumption is non-testable, state-level policies regarding education that may have changed at the same time as kindergarten subsidization can be included as control variables as they may also

⁵ The standard errors of the regression coefficients will be less likely to be biased downward if the average across all individual observations within a group is used instead of the individual data. Therefore, all data will be collapsed to the average of the group. In addition, all standard errors are clustered at the birth state level.

⁶ It is important to include controls for birth year or age, since individuals have a different window of time to affect the outcome measure depending on their age. An alternative approach would be to use a hazard model.

⁷ All standard errors are corrected for heteroskedasticity and are clustered at the birth state level.

affect academic and labor market outcomes. In particular, State Supreme Court rulings on the constitutionality of school-finance systems and school-finance litigation information can be used as control variables.⁸ The first wave of school-finance litigation occurred in California in the 1970s beginning with the landmark case *Serrano v. Priest*. Most states experienced some type of school litigation within the next 25 years. However, only five states had challenges to their school-finance system within a 5-year window of the beginning of kindergarten subsidization. These states are Arizona, Montana, Georgia, Idaho, and Oregon. Murray et al. (1998) showed that school finance reform affects the distribution of educational resources. However, including these changes as controls or dropping the five states out of the analysis does not affect the results or conclusions of this paper.

Aside from policies, other time-varying factors may exist that could be correlated with student outcomes. Specifically, within-state changes in the laws affecting kindergarten need to be uncorrelated with other state-specific changes that might affect student outcomes. The identification of the model comes from state–time variation in the beginning of kindergarten subsidization. If kindergarten subsidization was bundled with other policies that affected academic and labor market outcomes, it would be important to control for these changes. While I am aware of no evidence of other policies being bundled with the beginning of state subsidization, controlling for school exit laws, pupil–teacher ratios, teachers’ salaries, and the school entry cutoff dates does not change the results substantially.⁹ In addition, one may be concerned with large changes in the educational landscape in the Southern States during this time

⁸ This information was collected from Murray, Evans, and Schwab (1998) and the National Center for Education Statistics (1997) at <http://nces.ed.gov/edfin/litigation/index.asp>.

⁹ It is still possible that, if the subsidy did not cover all the costs of expanding kindergarten programs, local districts may have cut other programs that would affect student outcomes. However, including the vector of possible endogenous control variables can help account for this possibility. Including these control variables does not qualitatively change any results of this study. Results using these control variables are available from the author upon request.

period. All results are similar if the analysis is rerun excluding the Southern Census region (available from the author upon request).

In addition to the possibility of policies that may have changed at the same time, one must be concerned with other possible confounders. For instance, if changing incomes levels in the state were correlated with the beginning of state subsidization, the effect of the shifting income levels on academic achievement could not be disentangled from the effect of the beginning of state subsidization. If this occurred, the results presented in this paper may be due to the changing income levels instead of the beginning of state subsidization of kindergarten. Any other factors that could affect child outcomes that may have changed at the same time will confound the results of this research. These factors may include but are not limited to rising expectations for minority children, demographic shifts, shifts in maternal labor supply, shifts in the availability of high quality childcare, and shifts in income levels and health resources.

The estimation of equation (1) is subject to a possible serial correlation problem. Bertrand, Duflo and Mullainathan, (2004) point out that research that employs differences-in-differences estimation strategies, similar to this study, may underestimate the standard deviation of the estimators because of serial correlation. In all specifications, I cluster the standard errors at the state level as recommended by Bertrand, et al. (2004) as a viable solution to compute standard errors that are robust to serial correlation.

To be able to measure an effect of increased kindergarten availability due to the beginning of state subsidization, an increase in kindergarten enrollment must be observed. Data on cohort-level kindergarten enrollment for each state are available in the *Biennial Survey of Education*, later known as the *Digest of Education Statistics*. Due to the absence of data in 1960, 1962, and 1964, these enrollment rates are linear interpolations. The kindergarten enrollment in

year t and the first grade enrollment in year $t+1$ were used to construct an enrollment ratio that approximates the enrollment rate for kindergarten in each year, t .¹⁰

Figure 1A illustrates the aggregated percentage of 5-year-olds enrolled in kindergarten in the 27 states that began to subsidize kindergarten between 1960 and 1980. The largest increase, about a 30 percentage point increase, occurs between the year before the start of state subsidization and the year after the start of state subsidization.¹¹ Figure 1B illustrates the percentage point change in kindergarten enrollment before and after the beginning of state subsidization. To generate these results, kindergarten enrollment rates were regressed on five leads and five lags for the number of years before and after the beginning of state subsidization, plus year and state fixed effects. For example, the fifth lag variable from the regression indicates the change in kindergarten enrollment which was experienced 5 years before kindergarten became state subsidized. The figure shows that the largest increase in enrollment occurred at the same time as kindergarten programs became subsidized, which is consistent with the data presented in Figure 1A.

Figure 1A demonstrates an average increase of roughly 30 percentage points due to the state funding of kindergarten. However, different states may have had different proportions of children enrolled in kindergarten before and after state subsidization. These differences could be due to differences in availability based on the presence of local or private funding, but they could also be due to the difference in timing. States that began to subsidize kindergarten at a later date than other states might have more children enrolled due to increasing trends in enrollment. These differences between states change the marginal group of children who may have been induced to

¹⁰ The kindergarten enrollment ratio can also be constructed using the kindergarten enrollment in year t and birth data for the U.S. natality files from year $t-5$. The results are similar if this alternative measure is used (available from the author upon request).

¹¹ Excluding observations one year before and after the official year of change does not change the conclusions of this paper.

attend kindergarten due to increased availability. More concretely, Figure 2 displays the percentage of 5-year-olds enrolled in the two largest states that began subsidizing kindergarten during the 1960s and 1970s: Florida and Texas. Panel A depicts the change in kindergarten enrollment in Florida 5 years before and after kindergarten became state funded in 1968. The Florida data show a gradual increase in kindergarten enrollment. Before state subsidization, only about 5% of 5-year-olds were enrolled in kindergarten. Five years after state subsidization, 60% of 5-year-olds were enrolled. This translates into a 55 percentage point increase. A slightly different pattern is observed in Texas, represented in Panel B. Panel B depicts the change in kindergarten enrollment in Texas 5 years before and after kindergarten became state funded in 1973. In 1973, the 1st year of kindergarten subsidization by the state, enrollment increased dramatically. Approximately 15% of 5-year-olds were enrolled in kindergarten before it became state subsidized. Five years after state subsidization, approximately 85% of 5-year-olds were enrolled. This corresponds to about a 70-percentage-point increase. The marginal children in Florida—those who were induced to attend kindergarten due to the increased availability and decreased cost—might be different than the marginal children in Texas. Therefore, the estimates from equation (1) can be interpreted only as the average effect of increasing kindergarten availability by state subsidization on later academic and labor market outcomes.

3. Data and Descriptive Statistics

A. Data Sources

The primary data sources used in this study were the United States Decennial Censuses and the American Community Survey (ACS). The first outcome measure, being below grade for age, is examined in Section 4A. This analysis used the 1% sample from the Form 2 state and

metro files from the 1970 United States Decennial Census. These samples make up a 2% sample of the United States in 1970. These data were merged with the 5% sample from the 1980 United States Decennial Census and were restricted to individuals between ages 7 and 15 years old, and who were born and are currently living in the 48 contiguous states in the United States. Section 4B expands the analysis to include longer-run outcomes such as educational attainment and labor market outcomes. This analysis used the 5% sample from the 2000 United States Decennial Census combined with the 2001–2007 American Community Surveys.¹² This sample was restricted to individuals between the ages of 30 and 50 who were born and currently live in the 48 contiguous states in the United States. Therefore, the samples used in this analysis were made up of pooled cross sectional Census and ACS data. All 48 states along with cohorts aged 7-15 years old in the 1970 and 1980 Census were pooled together to make up the short run analysis sample. All 48 states along with cohorts aged 30-50 years old in the 2000 and the 2001-2007 ACS were pooled together to make up the long run analysis sample.

The date at which each state began funding kindergarten as a part of its public primary school education system at the state level was gathered by contacting each state's education department. Some of these dates were verified using information collected by Cascio (2009a, 2009b), Tanner and Tanner (1973), and Steiner (1972).¹³ Table 1 lists the year in which kindergarten first began to be subsidized using state revenue. I am unable to obtain the exact year of the beginning of state funding for 12 states. However, it has been confirmed that these states all began to subsidize kindergarten using state money before 1960 and are indicated in Table 1

¹²The ACS collects data from approximately 1 in every 40 addresses every year, or 250,000 addresses every month instead of the previous decennial census long forms, which were collected from about 1 in every 6 households. Results are similar if only the 2000 U.S. Census is used or if only the 2001–2007 ACS surveys are used. These results are available from the author upon request. Including the ACS allows both age- and cohort-fixed effects to be included in the analysis.

¹³ If conflicting dates were found between sources, the date collected from the state education department was used.

by pre-1960 in the year column.¹⁴ This analysis focused on the time period from 1960 and 1980, when 27 states began subsidizing kindergarten. Therefore, the unconfirmed dates for these 12 states do not affect the analysis, as they began subsidizing kindergarten prior to this time period and will be used only as control states. All states in the United States were used in the analysis. Within the time period, 27 states changed from not subsidizing kindergarten to subsidizing kindergarten, 19 states were already subsidizers, and 2 states were never subsidizers. All specifications include Census-region-of-birth-specific cohort indicators; therefore, these trends were constructed using states that are in the same Census region and all 48 states were used in the analysis.

This study used both short-run and long-run measures of effectiveness or benefit. The first outcome measure was whether the student is below grade for his or her age.¹⁵ This indicator measure of whether the child is below grade for his or her age was used as a proxy for failure or grade repetition. There is an extensive literature documenting the association between grade retention and poor later educational outcomes.¹⁶ For instance, Roderick (1994) reported a large association between being retained and dropping out of high school, and Jacob and Lefgren (2004) showed that the immediate consequence of being retained is increased academic performance, but that there is no effect on later math scores and a negative effect on reading scores.

¹⁴ See Tanner and Tanner (1975) and Steiner (1972).

¹⁵ Cascio (2009a, 2009b), Conley and Glauber (2006), Fitzpatrick (2008), Hauser, Pager, and Simmons (2004), Oreopoulos, Page, and Stevens (2006), Page (2007), Roderick (1994), Rose, Medway, Cantrell, and Marus (1983), and Shepard and Smith (1989) all use this proxy as a measure of educational achievement.

¹⁶ See Holmes (1989) for a review of the literature.

This proxy was constructed from the 1970 and 1980 Census data using information on the child's age, quarter of birth, grade level, and the state's cutoff date for kindergarten entry.¹⁷ If a child was below the grade level he or she should be in for his or her age, he or she was given the value of one for this measure and zero otherwise. For instance, if a child should be 7 years old in second grade in a particular state due to his/her quarter of birth and the state's school entry law, but a 7-year-old is observed in first grade, that child was considered below grade for his or her age. This measure included individuals whose school entry was delayed by their parents as well as individuals who failed a grade and were retained by their teachers. Therefore, the available data cannot disentangle children who failed and children who entered schooling late.

Cascio (2005) examined the validity of using this proxy and found that the misclassification attenuates regression coefficients by 35% when the proxy is constructed using Current Population Survey data, because approximately 20% of the "on-time" children are old for their class and about 10% of the "behind" children are not. The attenuation comes from the fact that many of the children who are indicated to have repeated a grade using this measure have not actually repeated a grade. Therefore, if a decrease in the probability of being below grade for age is found in this analysis, the decrease may not be as large if this proxy perfectly measured grade repetition or failure. In addition, this measure is valid as long as the rules about failing and parents' tendency to hold back their children did not change at the same time as the introduction of subsidies. Fortunately, there is no evidence that rules regarding failure have changed, or that overall standards regarding failing within the public school system have increased over time (Roderick, 1994). However, there is some evidence that parents' tendency to hold their children back by delaying school entry has increased over time. For example, despite only 5 to 6% of first

¹⁷ If the state did not have a uniform cutoff date, the individual is considered to be below grade for his or her age if he or she was older than the average age for a particular grade. This may cause measurement error in the dependent variable for these individuals.

and second graders having repeated kindergarten, 9% entered kindergarten late (National Center for Education Statistics, 1997). In addition, Brent, May, and Kundert (1996) found an increase, from 6 to 16%, in delaying children's entry into school over a 12-year period in a particular middle class suburban district in the 1980s. Therefore, there is evidence that this phenomenon may change over time.

However, parents' behavior regarding on-time entry may not have changed due to the increased availability because kindergarten was not compulsory in most states. If parents did respond at the same time as the policy change, they may have been more likely to hold back their children because the children would be starting school at an earlier age. If this occurred, it would bias the estimates downward. However, it could also be the case that the increased kindergarten availability may have made parents more likely to send their children to school early because of the more developmentally appropriate environment. This, unfortunately, would bias the estimates upward. Due to data limitations, neither hypothesis is testable. However, despite the difficulties of this proxy, it is used because it is the best available short-run education measure available in the existing data. Section 4B will focus on longer-run outcomes that do not have these same issues.

A vector of time-varying controls, X_{st} , is included in all regressions. In the short-run analysis, which focuses on being below grade for age, this vector includes the survey year; the school entry cutoff date¹⁸; an indicator for missing values of the school entry cutoff date; indicator variables for female, black, Hispanic, and other race; and quartiles of socioeconomic status. In the longer-run analysis that focuses on education attainment, additional controls were included such as the statewide gross domestic product (GDP) and unemployment level, an

¹⁸ The results are not substantially different if the years are excluded before and after a school entry cutoff which changed.

indicator for living in a city, and an indicator for being married.¹⁹ Finally, in the labor market analysis, one extra control variable was included in addition to the controls included in the long-run academic analysis: the current region of residence. If potential endogenous control variables—for instance, pupil–teacher ratio, average pupil–teacher ratio, relative teacher salaries, and an indicator for whether plaintiffs have won a school finance case at the state Supreme Court level—are included in the analysis, the results do not change significantly.²⁰

B. Descriptive Statistics

Table 2 displays the summary statistics for the outcome measures. The first outcome measure listed in Panel A is the fraction of a cohort below grade for age, a proxy for grade repetition. The mean value for all individuals, females and males, ages 7–15, was 13%. Males were 5 percentage points more likely to have repeated a grade than were females. White students were 8 percentage points less likely to be below grade than were black and Hispanic students. A similar pattern was observed for both males and females. In addition, the samples were broken into samples in which English is not spoken at home, households in which a parent is an immigrant, and by socioeconomic status quartiles. Children who do not speak English at home and children who are from immigrant households were 5 and 6 percentage points more likely to be below grade for their age, respectively. In addition, children from the lowest socioeconomic

¹⁹ State-level unemployment and GDP data were collected from the Bureau of Labor Statistics.

²⁰ These control variables are calculated in a number of ways. The pupil–teacher ratio is the number of students in each state divided by the number of teachers. Each birth cohort was assigned the average pupil–teacher ratio during their 13 years of available public schooling. The relative teacher salaries are defined as the average wage of teachers divided by the average wage of male 30- to 49-year-old B.A. holders in the 1960–2000 Censuses (inter-census years are linearly interpolated). The number of students, the number of teachers, and the oldest age required by compulsory schooling laws are from the *Digest of Education Statistics*. Information not provided by the *Digest of Education Statistics* on the oldest age required by compulsory schooling is from state statutes and corresponding historical session laws. The small number of cases with missing student and teacher counts is linearly extrapolated. Data on school finance cases comes from the National Center for Education Statistics (1997) and from Murray et al. (1998). All results including these control variables are available from the author upon request.

quartile were 12 percentage points more likely to be below grade for their age than were children from the highest socioeconomic quartile.

Panels B and C display the statistics for the longer-run outcome measures: educational attainment and labor market outcomes for males only. Panel B specifically focuses on the longer-run academic measures. Eighty-nine percent of the sample had completed high school or greater, while only 30% had completed a bachelor's degree or greater. Black and Hispanic males were significantly less likely than white individuals to have completed all the long-run academic outcomes. Panel C includes five labor market outcomes: whether the individual is in the labor force, whether the individual worked last year, usual weeks worked, usual hours worked, and natural log of hourly wage. Overall, white individuals had higher values in all five categories than black or Hispanic individuals.

4. Results

A. Short-Run Outcome

The analysis begins by estimating equation (1) using the pooled cross-section data from the 1970 and 1980 United States Censuses as described in Section 3A. Table 3 contains these results. Column 1 contains the results from the reduced form estimation strategy that estimates the average effect of the increased availability of kindergarten on being below grade for age for the entire sample. A marginally statistically significant point estimate of -0.01 was calculated. The coefficient on kindergarten indicates that the introduction of kindergarten into the public primary school educational system may have decreased children being below grade for their age by approximately 1 percentage point. This translates into a 7.7% decrease in being below grade

for age.²¹ This benefit may be found because kindergarten is a transitional year that readies children for primary schooling. Therefore, this year of schooling is important in terms of laying the groundwork for future academic success (Entwisle & Alexander, 1998).

Column 2 examines the differences between males and females by including an interaction term that is the interaction between the indicator variable for female and the indicator variable for kindergarten subsidization. This specification also includes gender-specific birth-year regional time trends to allow for flexibility in differences in trends over time between genders. The interaction effect was not found to be statistically significant, and therefore there is not a statistically significant difference between males and females in this specification. In addition, the F statistic, which tests the hypothesis of the main effect plus the interaction effect, equals zero and as such is not statistically significant. This indicates that there is no measurable average effect of the increased availability of kindergarten on females being below grade for age. Once again, a marginally significant average effect on males was found and was of a similar magnitude as in Column 1. Overall, this table points to marginally significant positive effects of the increased kindergarten availability in terms of decreasing the rate of being below grade for age for males but finds no average effect for females. These findings are in line with much of the previous literature that found differences between males and females (Cannon et al., 2006).

Much of the literature regarding kindergarten and early childhood programs has shown that specific groups of children may be affected differently than other groups of children by these programs.²² More specifically, many studies have found little to no effect of pre-kindergarten

²¹ This point estimate cannot be directly compared to estimates found in Cascio (2009a), as Cascio (2009a) only estimated the effect of kindergarten subsidization on the subsamples of white and black children.

²² See Cannon et al. (2006), Currie (2001), Gormley and Gayer (2005), and Spiess et al. (2003).

programs on middle-class children.²³ Therefore, it is important to examine which children specifically benefit from the introduction of kindergarten into the public primary school system. I explored the possibility that other demographic characteristics might make a difference in terms of whether individuals were affected by the increased availability of kindergarten.

First, one might want to think about reasons why children of different demographic groups may experience a differential effect of increased availability of kindergarten. There may exist a difference in cognitive and non-cognitive skill levels acquired by children of different demographic groups by a particular age due to differences in social, developmental, and economic conditions. There may also be differences in use of available early childhood programs prior to the introduction of state-subsidized kindergarten.

Different demographic factors may affect the social, developmental, and economic conditions of young children. For instance, disparities between white children versus black and Hispanic children can be found in maternal education, family structure, family income, and neighborhood resources.²⁴ In addition, these conditions are associated with school readiness, both academic and behavioral (Duncan, Brooks-Gunn, & Klebanov, 1994). Therefore, children of different demographic groups may benefit more or less from education programs due to their circumstances. In addition, males and females may mature at different rates. Some researchers in the school readiness literature have found that boys may receive more benefit from being older upon school entry than do girls, due to varying levels of maturity (Crosser, 1991). This once again may affect the benefit that children of different genders gain from the increased availability of kindergarten. In addition, a child who comes from a household whose native language is not

²³ See Bridges, Bassok, Fuller and Rumberger (2007), Magnuson, Ruhm, and Waldfogel (2007) and NICHD Early Child Care Research Network (2005).

²⁴ Other differences occur in terms of low birth weight rates, health, asthma, lead exposure, iron deficiency, attention-deficit/hyperactivity disorder, parenting behavior, nurturance, discipline, teaching, and language. (See Brooks-Gunn, Rouse, and McLanahan (2007) for more details.)

English may benefit more than a child whose native language is English from a program that emphasizes language skills, or that simply allows him or her to use English on a daily basis. For example, using ECLS-K (Early Childhood Longitudinal Study, Kindergarten Class of 1998–99) data, Denton and West (2002) found that Hispanic children are less likely to be read to frequently or to be engaged in early literacy activities in the home. Because home literacy environment has an impact on children’s vocabulary development, children of Hispanic descent may benefit more from kindergarten intervention.

The measurable benefit of state-subsidized kindergarten also rests on the quality and accessibility of other existing programs. If students who need early intervention are already receiving an intervention, the benefit of increasing kindergarten may be smaller than if this early intervention did not previously exist. Unfortunately, good data regarding uptake and participation among children of different demographic groups during this time period are hard to come by. However, there exists some evidence that major differences occurred in child care arrangements along with attendance in preschool programs. For instance, differences existed in types of child care arrangements used between white and black individuals in 1965 and 1977 (Lueck, Orr, & O’Connell, 1982). More white children were cared for at home compared to black children, and more black children were cared for in group care centers compared to white children. In addition, trends in type of child care arrangement by family income actually changed during this time period. In 1965, home care was more common among affluent families than among less affluent families, but this reversed by 1977 (Lueck et al.). Again, these types of arrangements may affect which children benefit from the increased availability of kindergarten.

In addition, differences occurred between different groups in terms of preschool programs and attendance. In 1930, only 1.6% of black children attended nursery school

compared to 6.4% of white children. In addition, more black children attended day nurseries instead of more education-focused preschool programs compared to white children (Beatty, 1995). The quality of these arrangements may affect which children benefited from the increased availability of kindergarten, as kindergarten may be a replacement for another program.

Cascio (2009a) explored the differences between white and black children and found no positive effects for black children and some effects in term of decreased high school dropouts and institutionalization for white children.²⁵ Cascio (2009a) posits that the difference in findings between races is due to the crowding out of participation in Head Start due to the introduction of publicly subsidized kindergarten. Since kindergarten is of a lower intensity than Head Start, black 5-years-olds received no benefit from the increased availability because they transferred out of the high-intensity Head Start programs to the low-intensity kindergarten programs.

The differences in benefit found in Cascio (2009a) make for a compelling reason to extend this analysis to examine other differences using an expanded set of demographic characteristics. Therefore, this research develops the literature by focusing on the following demographic characteristics: gender, race and ethnicity (more specifically, the differences between white, black, and Hispanic children), non-English speakers, immigrants, and socioeconomic status (SES). In Table 4, the analysis is broken up into these demographic subgroups. In Column 1, differences by race and ethnicity are examined. The sample is divided by race and ethnic lines into children who are white, black, and Hispanic.²⁶ In Columns 1 to 4, only male children are included in the sample; and in Columns 5 to 8, only female children are included in the sample. In Columns 1 and 5 for males and females, respectively, the indicator variable of whether the child is of a certain race or ethnicity is interacted with the indicator

²⁵ Cascio (2009a) did not break out ethnicity in her analysis. Therefore, Hispanic children may be included in both categories of race.

²⁶ Individuals from other racial classifications are excluded from the analysis.

variable for state-sponsored kindergarten. More specifically, an indicator variable for a child being black is interacted with the indicator variable for the introduction of state-sponsored kindergarten, and similarly an indicator variable for a child being of Hispanic ethnicity is interacted with the kindergarten variable.²⁷ Using this expanded specification in Column 1, no statistically significant effect was found for white or black males. However, the Hispanic males' rate of being below grade for age decreased by 3.5 percentage points (-0.7 percentage points from the main effect and -2.8 percentage points from the interaction), a 16.7% decline. In addition, the difference between the Hispanic and white males is statistically significant at the 5% level. The bottom of the table reports the F statistic for each race/ethnic group for the hypothesis test of the main effect plus the interaction effect equals zero. In particular, for Hispanic males, this is the F statistic of the test of significance for the coefficient on kindergarten plus the coefficient on the interaction between Hispanic and kindergarten equaling zero. The F statistic indicates that Hispanic males experience a statistically significant effect of decreased rates of being below grade for age due to the increased availability of kindergarten. In Column 5, the same analysis was run as in Column 1 but using the female subsample in place of the male subsample. Interestingly, a statistically significant effect was found for black females and a marginally significant effect for Hispanic females of a 17.5 and 12.5% decrease, respectively. Using a different sample of states and a different estimation strategy, Cascio (2009a) found no effect on grade retention for white or black students. However, she did not specifically examine the effect on black females, and Hispanic students were included in both white and black samples.

The strong effect of the increased availability of kindergarten programs on Hispanic students' academic progression may be due to the fact that Hispanic parents are less likely to

²⁷ Demographic-specific birth-year regional time trends are included in all specifications in Table 4.

select formal preschools than white or black parents and are more likely to use non-center-based care (Fuller, Eggers-Pierola, Holloway, Liang, & Ranbaud, 1996). Therefore, the introduction to formal schooling in a more developmentally appropriate venue prior to the first grade may have been a large factor in the decrease in being below grade for age. In addition, other research has found strong positive effects for Latino children versus white children.²⁸

Columns 2 and 6 examine the differences by home language spoken. One might expect differences by language spoken because of differences in the school readiness. The effects of the increased availability of kindergarten on children who do not speak English at home were calculated by interacting an indicator variable for the subsample of individuals who do not speak English as their home language with the indicator variable for the beginning of state subsidization of kindergarten. I found that non-English-speaking males saw a decrease of being below grade for age by 20% and females by 13.3%. Columns 3 and 7 examine the difference in benefit if one of the parents of the child is an immigrant.²⁹ No reduction in being below grade for age was found for children belonging to non-immigrant families, but a significant reduction was found for children of immigrant families.

A greater benefit to children of lower socioeconomic status has been noted in previous research. Columns 4 and 8 explore the relationship between socioeconomic status (SES) and increased kindergarten availability. Indicator variables were constructed that represent the quartile of socioeconomic distribution to which each student belongs by using the poverty

²⁸ Using the ECLS-K, Loeb, Bridges, Bassok, Fuller, and Rumberger (2007) found that Latino children who were enrolled in preschool scored a 0.23 standard deviation advantage over children who were not enrolled in preschool. These effects were over one third smaller for white children.

²⁹ If this sample is restricted to students whose parents are both immigrants, the results do not change and are available from the author upon request.

measure in the Census.³⁰ The 1st quartile corresponds to the poorest children while the 4th quartile corresponds to the richest children. These indicators of SES quartile were interacted with the indicator for kindergarten to measure the varying effect of the increased availability of state-sponsored kindergarten on children of different SES groups. The omitted category in the regression is the children of the 4th quartile, the richest children. The introduction of state-subsidized kindergarten only affected quartile 1 for both males and females. The effect on quartile 1 was large and significant. The introduction of state-funded kindergarten decreased these children's rate of being below grade for age by 2.1 and 2.7 percentage points, or 9.1 and 15.9%, for males and females respectively. The F statistics for quartiles 2, 3, and 4 are not statistically significant at the 5% level. Therefore, the only measurable effect was for the poorest quartile.

B. Long-Run Outcomes

The remainder of the paper focuses on longer-run outcomes. Table 5 reports the results for the longer-run outcome variables for males only. In this table and Table 6, the analysis focuses on the male subsample because males were less likely to have been affected by the rapid change in labor market opportunities and expectations during the 1960s and 1970s. These changes would be very difficult to control for, and hence the research focused on males only. Panel A focuses on academic outcomes for the sample of males, and Panel B uses the same sample but focuses on the differences by race and ethnicity.

Examining the sample of males, no statistically significant result was found in terms of high school graduation, some college, or earning a B.A. degree. Cascio (2009a) used a sample of

³⁰ The poverty measure from the U.S. Census expresses each family's total income as a percentage of the poverty threshold established by the Social Security Administration. All members of each household receive the same measure. See <http://usa.ipums.org/usa/> for more information.

both males and females ages 21 to 35 years old from the 1980, 1990, and 2000 United States Decennial Census and found that white individuals are 2.5% less likely to be high school dropouts. Using 21- to 35-year-old individuals from the 1980, 1990, and 2000 samples along with estimating equation (1), I found a comparable point estimate of 1.8%.³¹ Using this research's sample and specification, I found no statistically significant relationship between individuals attending some college or earning a bachelor's degree and the beginning of state-subsidized kindergarten. The differences between these results are due to the ages included in the sample and the data samples used. Since this study examines other longer-run outcomes, such as college completion and labor market outcomes, it is more appropriate to use a consistent sample of individuals who have had enough time to finish all schooling and enter the labor market (i.e., individuals who are older than 30 years old).

The earlier results about being below grade for age indicate that there are large differences in the benefit from kindergarten between subgroups which may hold true for longer-run outcomes. Panel B reports the results that include the race and ethnicity interactions.³² Unfortunately, the other demographic characteristics explored in the short-run analysis cannot be used in the long-run analysis because the United States Census does not have information about these characteristics when the individuals were primary school age. Column 1 lists the coefficients from a regression that used high school graduate or higher as the dependent variable. Strangely, a negative result was calculated for black individuals. Therefore, the increased availability of kindergarten has a negative impact on whether black individuals graduate from high school. This result is puzzling, especially due to the lack of effect found for young black

³¹ This point estimate is not robust enough to include birth-region-specific time trends in this analysis. In addition, using the long-run sample from this analysis and using cohort-specific time trends instead of birth-region-specific time trends leads to a statistically significant point estimate that translates into a 0.5% increase in high school graduation.

³² Individuals from other racial classifications are excluded from the analysis.

males in terms of grade progression, but may be explained by the switch from Head Start programs to universal kindergarten programs for black individuals. Cascio (2009a) found no effect on black individuals, but again this may be due to differences in samples and/or specifications.

Column 2 examines the effect of kindergarten availability on going to some college or more. Hispanic males were found to have a 5.2 percentage point gain in attending some college or greater. This translates into a 12% increase. This result is in line with the strong short-run effects found for Hispanic individuals in Section 4A. No statistically significant relationships were calculated in Column 3 which examines the long-run outcome of earning a bachelor's degree or higher.³³ Overall, this study found that increased kindergarten availability has a negative effect for black students in terms of high school graduation but a positive effect for Hispanic males on attending some college or greater.

Table 6 examines the effect of state-subsidized kindergarten on longer-run labor market outcomes. Similar to Table 5, Panel A includes males only and Panel B also includes males only but allows for interaction effects between race and ethnicity indicators and the indicator for state subsidization. Five different outcomes were examined. No statistically significant effect was found for any of these dependent variables using the male subsample. Therefore, on average, there are no effects of the increased availability of kindergarten on male's labor market outcomes. However, in Panel B, positive effects were calculated when differences in race and ethnicity were considered. In Column 1, the dependent variable is whether an individual is in the labor force. I found no significant differential effects for black and Hispanic males. Column 2

³³ Cascio (2009a) estimated a marginally significant increase in college attendance for white individuals and no effect for black individuals. These differences in results may be due to differences in estimate strategy and/or samples. They also could be related to how race and ethnicity are classified in Cascio (2009a). In Cascio (2009a), Hispanic individuals are included in both race categories and are not separated by ethnicity.

lists the coefficients of the regression using an indicator variable for whether an individual worked during the last year as the dependent variable. Once again, there were no statistically significant results for the effects of state-subsidized kindergarten. Columns 3 and 4 examine labor intensity by estimating the effect on the number of weeks worked per year and the number of hours worked per week. I found a marginally statistically significant effect on weeks worked for the Hispanic subgroup. The F statistic for the main effect plus the Hispanic interaction equals zero is statistically significant at the 5% level for weeks worked. Finally, I estimated the effect of kindergarten availability on the natural log of hourly wages. I found a positive effect of approximately 5.7% for Hispanic males. This may be a reflection of the increased labor intensity and/or increased college experience for this ethnic group. The statistically insignificant results for white and black individuals are similar to results found by Cascio (2009a).

These estimates for Hispanic individuals may be considered large. On one hand, it is possible that other policies and changes occurred at the same time that each state started to subsidize kindergarten. In this case, this research design is unable to disentangle the effects of these changes with the changes in increased kindergarten availability. However, the staggered nature of the introduction in different states and the flexible specification makes this explanation less compelling. On the other hand, as the economist James Heckman (2008) said, “skill begets skill.” It is possible that the large effects measured in the short-run analysis in terms of decreasing being below grade for age can have a large long-term effect on these students. In addition, if Hispanic children were not receiving, or were receiving less, kindergarten before states began to subsidize, it is possible that this year of extra education would have a large rate of return. In addition, returns to education may vary with observable characteristics, such as family background and other demographic characteristics (Card, 1999).

5. Conclusion

The introduction and subsidization of kindergarten in the public primary school education system has allowed us a unique opportunity to analyze the benefits of the implementation of kindergarten. The effect of kindergarten on a variety of academic and long-run outcomes can be calculated by using the large increases in enrollment due to state subsidization, assuming that state subsidization influences outcome measures only through its effect on enrollment. The subsidization of kindergarten decreased rates of being below grade for age primarily for low income and Hispanic children and increased the future wages of Hispanic males. One possible explanation for these results is that the children who benefited most were the children who received lower quality care as a substitute for attending kindergarten or who were at a disadvantage at school start and were helped the most by having a transitional year prior to primary school education. In this sense, the subsidization of kindergarten helped level the playing field for those children least likely to receive high quality child care in the absence of state-supported kindergarten.

The large effects of the increased availability of kindergarten on academic and labor market outcomes such as educational attainment and wages highlight the need for further research on the exact causes of these effects. In particular, the negative effect on black males' educational attainment demands further attention with different research designs that can explore the reasons behind this finding. In addition, more research is needed on all longer-term effects of all childhood interventions. Unfortunately, this research design cannot answer these questions. However, more detailed and comprehensive examination of currently and future implemented early education programs will be important.

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Table 1. Year of Adoption of State Subsidization of Kindergarten

State	Year	State	Year
Alabama	1977	Nebraska	pre-1960
Arizona	1971	Nevada	pre-1960
Arkansas	1973	New Hampshire	1968
California	1946	New Jersey	pre-1960
Colorado	1963	New Mexico	1975
Conneticut	1943	New York	pre-1960
Delaware	1968	North Carolina	1973
Florida	1968	North Dakota	1980
Georgia	1978	Ohio	1935
Idaho	1975	Oklahoma	1969
Illinois	pre-1960	Oregon	1973
Indiana	pre-1960	Pennsylvavania	pre-1960
Iowa	pre-1960	Rhode Island	pre-1960
Kansas	1965	South Carolina	1973
Kentucky	1977	South Dakota	pre-1960
Louisanna	1967	Tennessee	1973
Maine	1965	Texas	1973
Maryland	1967	Utah	pre-1960
Massachusetts	1972	Vermont	pre-1960
Michigan	1948	Virginia	1968
Minnesota	1947	Washington	1959
Mississippi	1986	West Virginia	1971
Missouri	1967	Wisconsin	1949
Montana	1971	Wyoming	1974

Table 2. Summary Statistics

	All	Race/Ethnicity			English Spoken at Home		Immigrant Household		SES Quartiles	
		White	Black	Hispanic	yes	no	yes	no	Lowest	Highest
<u>Panel A: Short Run - Below Grade for Age</u>										
<i>Sample:</i>										
Males and Females	0.13 (0.33)	0.11 (0.32)	0.19 (0.39)	0.19 (0.39)	0.12 (0.33)	0.17 (0.38)	0.17 (0.37)	0.11 (0.32)	0.20 (0.40)	0.08 (0.26)
Males Only	0.15 (0.36)	0.14 (0.35)	0.22 (0.41)	0.21 (0.41)	0.15 (0.36)	0.20 (0.40)	0.20 (0.40)	0.14 (0.35)	0.23 (0.42)	0.10 (0.30)
Females only	0.10 (0.30)	0.09 (0.28)	0.16 (0.37)	0.16 (0.37)	0.10 (0.30)	0.15 (0.36)	0.14 (0.35)	0.09 (0.28)	0.17 (0.38)	0.05 (0.22)
<u>Panel B: Long Run - Educational Attainment*</u>										
<i>Dependent variable:</i>										
Completed high school or greater	0.89 (0.32)	0.90 (0.29)	0.82 (0.39)	0.78 (0.41)						
Completed some college or greater	0.55 (0.50)	0.57 (0.49)	0.41 (0.49)	0.43 (0.50)						
Completed B.A. degree or greater	0.30 (0.46)	0.33 (0.47)	0.16 (0.36)	0.17 (0.38)						
<u>Panel C: Long Run - Labor Market Outcomes*</u>										
<i>Dependent variable:</i>										
In the labor force	0.82 (0.38)	0.91 (0.29)	0.79 (0.41)	0.85 (0.35)						
Worked last year	0.86 (0.35)	0.93 (0.25)	0.82 (0.38)	0.89 (0.31)						
Usual weeks worked	40.31 (19.29)	45.27 (14.96)	37.64 (20.95)	42.11 (17.93)						
Usual hours worked	35.77 (18.02)	42.31 (15.33)	34.75 (18.99)	38.70 (16.72)						
Ln hourly wages	2.72 (0.73)	2.91 (0.72)	2.58 (0.70)	2.69 (0.71)						

All statistics are population weighted. Standard deviations in parentheses. *Sample includes males only

Table 3. The Effect of Kindergarten Enrollment on Being Below Grade for Age

	(1)	(2)
Kindergarten	-0.010 (0.006)	-0.012 (0.006)
Kindergarten * Female		0.005 (0.006)
Female	-0.030 (0.015)	-0.029 (0.031)
Black	0.061 (0.034)	0.047 (0.026)
Other Race	-0.009 (0.077)	0.004 (0.049)
Hispanic	-0.013 (0.035)	0.012 (0.031)
1st Quartile SES	0.081 (0.031)	0.083 (0.021)
2nd Quartile SES	0.095 (0.026)	0.073 (0.019)
3rd Quartile SES	0.037 (0.028)	0.020 (0.019)
Cutoff	-0.010 (0.002)	-0.010 (0.002)
<i>F Statistic:</i>		
Main Effect + Female Interaction = 0		1.52
Number of Observations	7512	14593

Heteroskedastic-consistent standard errors are in parentheses and are clustered at the birth state level. Bold coefficients are significant at the 5% level or better, and bold italic coefficients are significant at the 10% level or better. All models include controls for birth-year regional time trends (birth-year regional time trends by gender for column 2), state of birth, age, and a dummy variable for missing cutoff dates.

Table 4. The Effect of Kindergarten Enrollment on Being Below Grade for Age by Race/Ethnicity, English, Immigrant Status, and SES

	Male				Female			
	Race/ Ethnicity	Non- English	Immigrant	SES	Race/ Ethnicity	Non- English	Immigrant	SES
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Kindergarten	-0.007 (0.006)	-0.007 (0.006)	-0.006 (0.006)	-0.004 (0.007)	-0.006 (0.005)	-0.008 (0.005)	-0.007 (0.005)	-0.001 (0.006)
Kindergarten * Black	-0.012 (0.011)				-0.022 (0.008)			
Kindergarten * Hispanic	-0.028 (0.011)				-0.014 (0.011)			
Kindergarten * non-English Speaking		-0.033 (0.009)				-0.012 (0.008)		
Kindergarten * Immigrant			-0.016 (0.007)				-0.010 (0.005)	
Kindergarten * 1st Quartile SES				-0.017 (0.012)				-0.026 (0.011)
Kindergarten * 2nd Quartile SES				-0.005 (0.007)				-0.005 (0.006)
Kindergarten * 3rd Quartile SES				0.001 (0.004)				0.000 (0.003)
<i>F Statistics:</i>								
Main Effect + Black Interaction = 0	2.6				7.8			
Main Effect + Hispanic Interaction = 0	6.7				3.1			
Main Effect + non-English Interaction = 0		14.7				6.3		
Main Effect + Immigrant Interaction = 0			7.39				5.98	
Main Effect + 1st Quartile Interaction = 0				4.32				9.32
Main Effect + 2nd Quartile Interaction = 0				1.64				1.25
Main Effect + 3rd Quartile Interaction = 0				0.18				0.01
Number of Observations	15021	11544	13493	25189	14923	11456	13421	24884

Heteroskedastic-consistent standard errors are in parentheses and are clustered at the birth state level. Bold coefficients are significant at the 5% level or better, and bold italic coefficients are significant at the 10% level or better. All models include controls for state of birth, demographic-group-specific birth-year regional fixed effects, age-fixed effects, the school entry cutoff date, an indicator for missing values of the school entry cutoff date, indicator variables for female, black, Hispanic, other races, and quartiles of socioeconomic status. Models in columns 1 and 5 exclude individuals of other races.

Table 5. The Effect of State-Subsidized Kindergarten on Long-Run Academic Outcomes

	H.S. Grad (1)	Some College (2)	BA Degree (3)
<u>Panel A: Males</u>			
Kindergarten	-0.003 (0.002)	0.003 (0.003)	0.003 (0.003)
Number of Observations	8064	8064	8064
<u>Panel B: Males by Race and Ethnicity</u>			
Kindergarten	-0.001 (0.003)	0.003 (0.003)	0.003 (0.003)
Kindergarten * Black	-0.020 (0.008)	-0.011 (0.010)	-0.010 (0.008)
Kindergarten * Hispanic	0.031 (0.021)	0.052 (0.019)	0.023 (0.018)
Black	-0.048 (0.036)	-0.133 (0.035)	-0.221 (0.035)
Hispanic	-0.132 (0.022)	-0.245 (0.022)	-0.231 (0.019)
<i>F Statistics:</i>			
Main Effect + Black Interaction = 0	6.6	0.6	0.9
Main Effect + Hispanic Interaction = 0	2.3	8.3	2.2
Number of Observations	20445	20445	20445

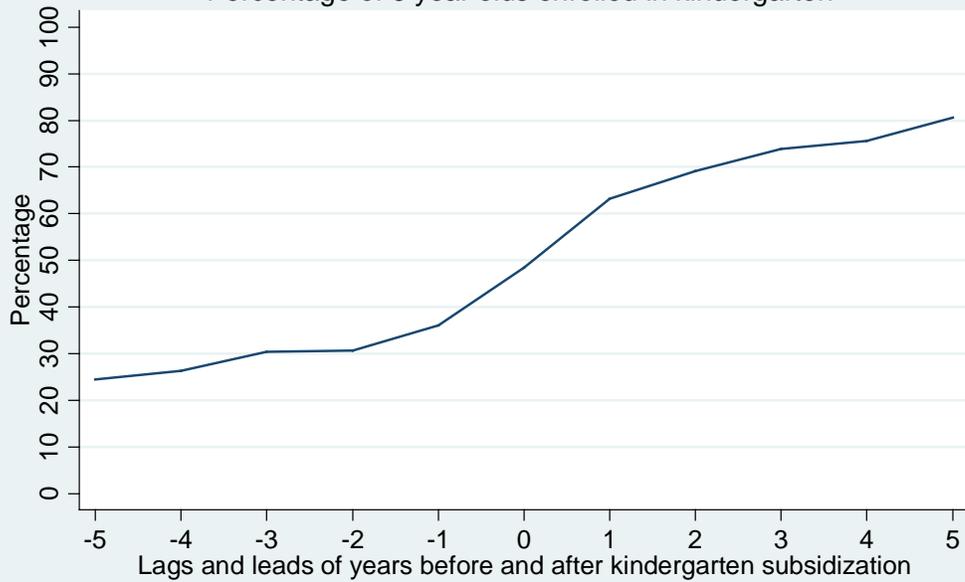
Heteroskedastic-consistent standard errors are in parentheses and are clustered at the birth state level. Bold coefficients are significant at the 5% level or better. All models include controls for census year, state of birth, demographic-group-specific birth-year regional fixed effects, the school entry cutoff date, an indicator for missing values of the school entry cutoff date, indicator variables for female, black, Hispanic, and other race, quartiles of socioeconomic status, GDP and unemployment level, indicator for living in a city, and an indicator for being married. All models in Panel B exclude individuals of other races.

Table 6. The Effect of State-Subsidized Kindergarten on Long-Run Labor Market Outcomes

	Labor Force (1)	Worked Last Yr (2)	Weeks Worked (3)	Hours Worked (4)	Ln Hourly Wage (5)
<u>Panel A: Males Only</u>					
Kindergarten	0.001 (0.002)	0.001 (0.002)	-0.062 (0.110)	-0.320 (0.373)	0.004 (0.003)
Number of Observations	30621	30621	30621	30621	30356
<u>Panel B: Males by Race and Ethnicity</u>					
Kindergarten	0.002 (0.002)	0.002 (0.002)	0.183 (0.124)	-0.014 (0.118)	0.006 (0.004)
Kindergarten * Black	-0.006 (0.006)	-0.008 (0.006)	-0.420 (0.293)	-0.320 (0.373)	-0.018 (0.014)
Kindergarten * Hispanic	0.005 (0.005)	0.000 (0.005)	<i>0.461</i> (0.268)	0.655 (0.464)	<i>0.053</i> (0.030)
Black	-0.194 (0.040)	-0.191 (0.025)	-10.634 (1.090)	-12.926 (1.395)	-0.175 (0.059)
Hispanic	-0.071 (0.013)	-0.056 (0.014)	-4.111 (0.709)	-4.539 (0.553)	-0.299 (0.032)
<i>F Statistics:</i>					
Main Effect + Black Interaction = 0	0.47	0.73	0.66	0.97	0.88
Main Effect + Hispanic Interaction = 0	2.26	0.33	6.43	1.81	3.98
Number of Observations	58639	58639	58639	58639	56596

Heteroskedastic-consistent standard errors are in parentheses and are clustered at the birth state level. Bold coefficients are significant at the 5% level or better, and bold italic coefficients are significant at the 10% level or better. All models include controls for census year, state of birth, demographic-group-specific birth-year regional fixed effects, the school entry cutoff date, an indicator for missing values of the school entry cutoff date, indicator variables for female, black, Hispanic, and other race, quartiles of socioeconomic status, GDP and unemployment level, indicator for living in a city, an indicator for being married, and the current region of residence. All models in Panel B exclude individuals of other races.

Figure 1 Panel A
Percentage of 5 year olds enrolled in kindergarten



Note: Includes all states that began subsidization between 1960-1980.

Figure 1 Panel B
Percentage point change in kindergarten enrollment
before and after the beginning of state subsidization

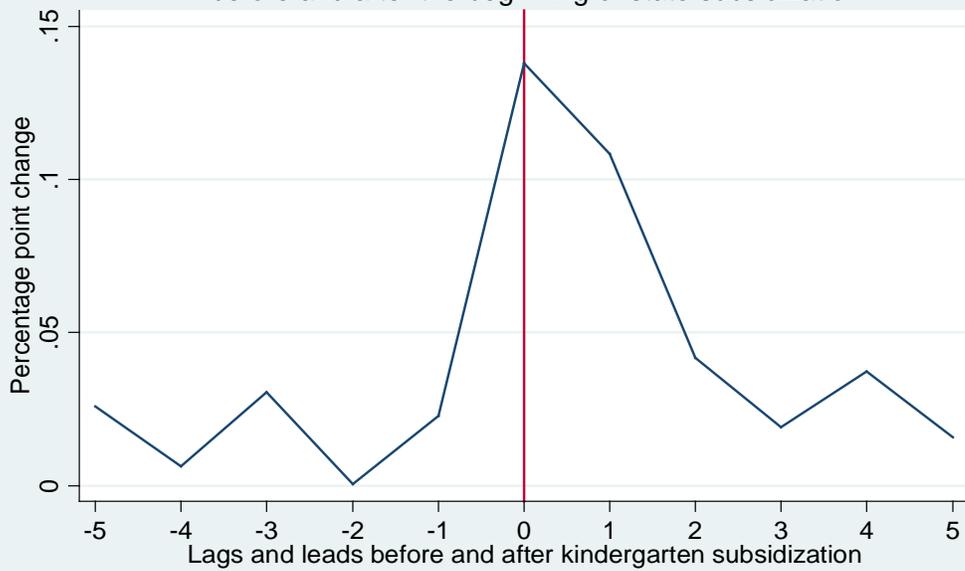


Figure 2 Panel A

Percentage of 5 year olds enrolled in kindergarten in Florida

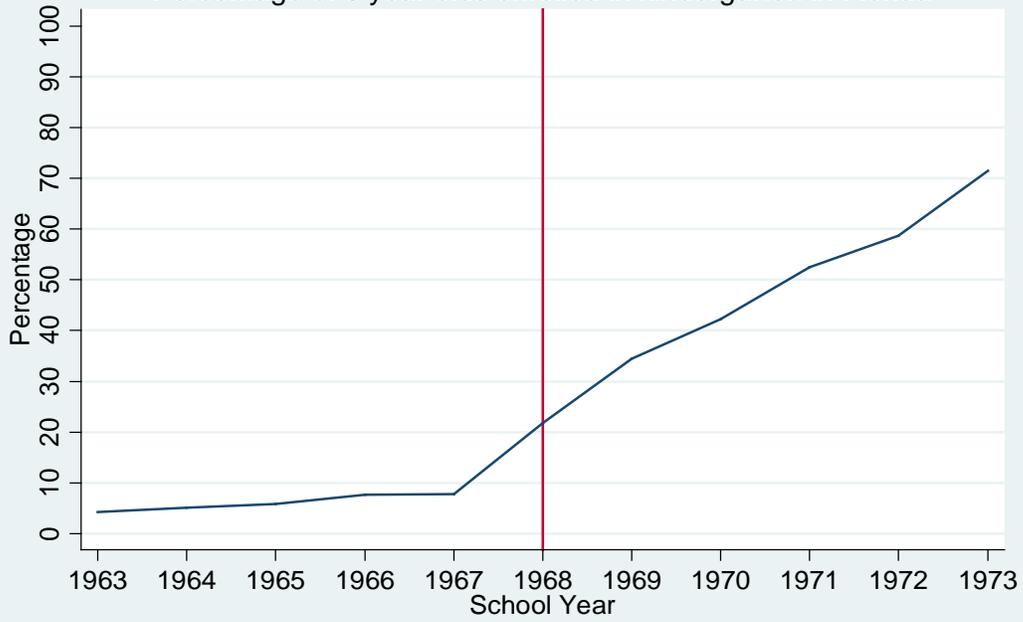


Figure 2 Panel B

Percentage of 5 year olds enrolled in kindergarten in Texas

