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Long-Term Effects of Preschooling on Educational Attainments*

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Abstract

Whether universal preschool education can eliminate the achievement gap among children in the long term has been debated in the United States and elsewhere. This paper offers new evidence from the experience of massive preschool education expansion in Japan. Using prefecture-level panel data, we estimate the effects of preschooling expansion on two measures of long-term educational achievement: high school and college advancement rates. We find that the expansion of both kindergarten and nursery schools have a significant positive impact on high school and college advancement rates, and the effect of attendance in nursery school is stronger than that in kindergarten.

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1 Introduction

Whether universal preschool education can eliminate the achievement gap among children in the long run term has been debated in the United States and elsewhere. This issue attracts the interest of policy makers and academic researchers because it is considered effective in saving children from the intergenerational poverty chain. Many empirical studies have found that family background during early childhood is one of the most important determinants of educational attainment of children (e.g., Bjorklund and Salvanes, 2011). Recent studies, however, also suggest the importance of early childhood intervention such as preschooling and head start programs in determining educational and labor market outcomes later in life (e.g., Cunha, Heckman, Lochner, and Masterov, 2006).

Many studies evaluate the impact of early intervention programs such as the Perry Preschool Project and the Head Start Program on short- and long-term outcomes of children from disadvantaged households (e.g., Garces, Thomas, and Currie, 2002; Barnett, 2004; Belfield et. al. 2006; Heckman et. al. 2010a, b). Overall, these studies find positive effects of early intervention on various outcomes such as wages, educational attainment, and lowering the probability of committing a crime in later life.¹

Although many studies on the long-term effects of early childhood intervention report positive effects on the outcomes of children from disadvantaged households, it is not evident whether such interventions affect the outcomes of children in the population as a whole. Moreover, as these interventions are limited in size (both in number of children and financial resources), it is less obvious whether universal intervention, such as an expansion of kindergarten and nursery schools, will have similar positive long-term effects on children in the larger population.

This study investigates the long-term effects of early childhood intervention in the form of nationwide expansion of preschools. To that end, we present new evidence based on the experience of massive preschool education expansion that occurred in post-war Japan. Compulsory education in

¹Garces, Thomas, and Currie (2002) find that children with the Head Start program experience high wages, high probability of graduating from high school, high probability of going to college, and low probability of committing a crime in their early 20s. Barnett (2004) reports the effects of the Perry Preschool Project on outcomes at age 27; Belfield et. al. (2006) report updates at age 40. Heckman et. al. (2010a, b) find short-and long-term effects of the program based on a rigorous statistical analysis.

Japan starts on April 1st at six years of age. Before elementary schooling, children under six years of age can optionally attend kindergarten or nursery schools for two or more years. Because kindergarten and nursery schools are not compulsory, there were large regional variations in preschool enrollment rates. Using Japan's prefecture-level panel data, we examine the effect of preschooling on long-term educational outcomes such as high school and college enrollment rates.

To identify preschooling's causal effects, we must find any exogenous forces that may influence preschool enrollment rates. We use a national policy implemented in 1966 that triggered the expansion of the kindergarten enrollment rate. In 1966, the central government announced a seven-year plan to increase the enrollment rate of two- or three-year kindergartens to 63.5 % from then 36%. Because the enrollment rate in 1966 varied widely across cities and prefectures, the new policy undoubtedly resulted in varied pressures on local educational authorities. To complicate matters, Japan's unique dual preschool system, where full-time nursery schools also accommodate kindergarten-age children with working mothers, might also have generated a difference in the policy target across prefectures. We use this national policy, applied uniformly to prefectures with different initial conditions, as exogenous forces for preschool expansion.

Using the panel data of Japanese prefectures from 1957 to 1999, we estimate the effects of preschooling expansion on the two measures of long-term educational achievement: high school and college advancement rates. Based on a simple ordinary least squares (OLS) with year and prefecture fixed effects, we find that the expansion of kindergartens has a significantly positive influence on high school and four-years college advancement rates, and the expansion of nursery schools has a significantly positive influence on both high school and all types of college advancement rates. Specifically, we find that a one percentage point increase in the kindergarten attendance rate generates roughly a 0.19 percentage point increase in the high school advancement rate and a 0.03 percentage point increase in the four-year college advancement rate. Similarly, a one percentage point increase in the nursery school attendance rate generates a 0.22 percentage point increase in the high school rate and about 0.03 percentage point increase in the rates of all types of colleges.

The rapid expansion of preschooling was to a large extent driven by exogenous policy changes, but our measures of preschooling may be endogenous due to, for example, heterogenous availability of preschooling among prefec-

tures. To examine how robust our main findings are, we next estimate the model using the number of Buddhist and Christian institutions per capita as instruments for kindergarten and nursery school enrollment. In Japan, religious groups such as Buddhism and Christianity have historically established many kindergartens and nursery schools, and thus these numbers are positively correlated to the preschooling enrollment rates.

Estimating the model with endogenous preschooling measures, we find that our main findings are robust. Moreover, we find even larger effects of preschooling on all the measures of college advancement rates. We find that a one percentage point increase in the kindergarten attendance rate generates roughly a 0.2 percentage point increase in the high school rate and 0.03 to 0.04 percentage point increase in the college rates. And one percentage point increase in the nursery school attendance rate generates a roughly 0.5 percentage point increase in the high school rate and 0.1 to 0.2 percentage points increase in the college rates.

This paper is related to the strand of literature on the effect of early childhood intervention on educational outcomes. Extensive research has been conducted on the short-term effects of early intervention on children from disadvantaged households (e.g., Currie and Thomas, 1995; Currie, 2001) and its long-term effects by Garces, Thomas, and Currie (2002) and Ludwig and Miller (2007). As mentioned, these studies investigate the effects of early intervention only on children from disadvantaged households, whereas the current study examines the effect of a universal intervention on the population as a whole.²

Several recent studies investigate the effects of universal early intervention on the education of children in the entire population. Gormley and Gayer (2005) study the effects of Oklahoma's universal pre-kindergarten program and find that the program increases cognitive scores. Baker, Gruber, and Milligan (2008) study the effect of introducing highly subsidized, universally accessible childcare in Quebec, Canada; they find negative effects on child outcomes such as anxiety, aggressiveness, motor and social skills, child health status, and illness. Berlinski, Galiani, and Gertler (2009) investigate the effects of a large expansion of universal pre-primary education on subsequent primary school performance in Argentina; they find positive effects on test scores and self-control in the third grade. These studies identify the short-

²For extensive surveys on the effects of early interventions, see Currie (2001) and Blau and Currie (2006).

term rather than long-term effects of universal intervention through preschool education.

The paper most closely related to the present study is Cascio (2009), which examines the long-term effects of the expansion of kindergartens on children’s educational achievements in the U.S. Using state-level variation at the time when states introduced subsidies for kindergartens, she finds that white children aged five after the expansion of preschooling were less likely to be high school dropouts and had lower incarceration rates as adults. She also finds that preschool expansion had no positive effect on black children because such intervention crowds out federally-funded interventions such as the Head Start program. Our basic identification strategy is similar to hers, with another instrument for the attendance rates of preschooling.

The rest of the paper is organized as follows. Section 2 briefly explains Japan’s preschool education system. Section 3 discusses the econometric model and identification strategy. Section 4 explains the data, and Section 5 reports the empirical results. Section 6 concludes.

2 Expansion of Preschools in Japan

This section briefly explains the Japanese preschool education system’s institutional background and the 1966 policy implementation for increasing kindergarten enrollment rates.

2.1 Preschools in Japan

All Japanese children, aged six years as on April 1st, must begin attending elementary school. Elementary schools have a six year curriculum, after which children must attend junior high school for three years. Before beginning nine-year compulsory education, though, many children attend preschools. Two or three year part-time kindergartens and full-time nursery schools are Japan’s two major preschool choices; these two types of schools have historically different purposes and characteristics. On one hand, kindergartens originally intended to help pre-school children develop their mind and body by providing a sound educational environment for 3- to 5-year-olds, in one- to three-year courses. Today, the Ministry of Education, Culture, Sports, Science and Technology (MEXT) controls the curriculum of kindergartens, and kindergarten teachers must obtain the Ministry’s certification.

Nursery schools, on the other hand, originally intended to provide care for children whose parents (or equivalents) could not provide childcare because of work or other reasons. The Ministry of Health, Labour and Welfare sets the guidelines for nursery schools, and these childcare providers must obtain the Ministry's certification as a "childcare person." Nursery schools provide educational service as well as childcare for children five years of age and below.

Although these two types of schools have different initial purposes and administrations, their roles overlap in many ways. In particular, both provide education to preschool-aged children, and many consider these two schools as roughly equivalent.³

Japan has both public and private kindergartens and nursery schools. Many private kindergartens and nursery schools were originally established and run by religious organizations such as Buddhism and Christianity. According to the Ministry of Education (1979), private kindergartens comprised of 64% preschools in 1969, 27% of which were established by religious organizations.

2.2 Expansion of Preschooling

Japan has experienced rapid expansion of preschooling since the early 1950s. Figure 1 depicts the evolution of attendance rates in kindergartens and nursery schools from 1957 to 1983 based on our data. Kindergarten attendance rate increased monotonically during these periods until 1975 and, thereafter, remains relatively constant. Nursery school attendance rate exhibits a similar trend with some fluctuations. The overall preschool (i.e., both kindergartens and nursery schools) attendance rate has exceeded 90% since 1970, although it was roughly 40% in 1957.

There were large regional variations in preschool enrollment rates in the 1950s. Figure 2 depicts the kindergarten enrollment rate of five-year-old children in 1955 and 1975 by prefecture, with large variations across prefectures in kindergarten enrollment rates. The lowest and highest enrollment rates in 1955 was 4.2% in Nagano Prefecture, and 72.2% in Osaka Prefecture, respectively.

³In fact, the Japanese government is in the process of integrating these two preschool education institutions into one. MEXT is encouraging the use of a system established in FY2006 called "Center for Early Childhood Education and Care," which provides unified education and childcare and an Action Program for Pre-School Education Promotion.

On an average, the kindergarten enrollment rate surged from 21.8% in 1955 to 64% in 1975. Figure 2 reveals the existence of time-series variations of the kindergarten enrollment rate across prefectures. For example, in 1955, Chiba and Ishikawa had nearly the same kindergarten enrollment of 16%. In 1975, however, the enrollment at Chiba achieved 69% while the enrollment at Ishikawa was 33%.

These large variations in enrollment rate level and growth result partly due to the presence of full-time nursery schools as a substitute for kindergartens. As mentioned, Japan has a unique dual preschool system where full-time nursery schools also accommodate kindergarten-aged children with working mothers. Figure 3 depicts kindergarten and nursery school enrollment rates in 1955 and 1975 by prefecture, clearly demonstrating that parents use kindergartens and full-time nursery schools as substitutes. Although started for different purposes, these two types of preschools today serve very similar purposes for Japanese families, although maintaining different policy objectives and environments. Section 5 examines whether these two types of preschools have different effects.

During the 1960s and '70s, both kindergarten and full-time nursery school enrollment rates increased rapidly. The rise in the kindergarten enrollment rate resulted partially from a Japanese government universal policy intervention implemented in the 1960s. In 1966, the central government announced a seven-year plan to increase the enrollment rate of two- or three-year kindergartens in cities with populations over 10,000 from 36% to 63.5% by building at least one kindergarten in every such city.

We estimate the effects of expansion of preschooling by using this large cross-prefectural variation of preschool enrollment growth. Because the 1966 kindergarten enrollment rate varied widely across cities and prefectures, this government policy clearly resulted in varied pressures on local educational authorities. Japan's unique dual preschool system with full-time nursery schools also accommodating kindergarten-age children with working mothers generated a further difference in the policy target across prefectures. Using these unique institutional backgrounds of preschooling, we seek the long-term effects of preschooling on children's educational outcomes.

3 The Econometric Model

This section discusses the econometric model and the identification strategy. For preschooling's effects on high school and college advancement rates, we estimate the following model with prefecture-specific and year-specific effects:

$$y_{it} = \beta_0 + \beta_1 kind_{it} + \beta_2 nurse_{it} + X_{it}\gamma + c_i + d_t + \varepsilon_{it}, \quad (1)$$

where y_{it} is either the high school advancement rate in year t or the college advancement rate in year t for prefecture i , $kind_{it}$ and $nurse_{it}$ are enrollment rates in kindergartens and nursery schools in year $t - s$ for prefecture i , where $s = 9$ in the high school advancement rate model and $s = 12$ in the college advancement rate model, respectively; X_{it} are other controls such as real gross domestic expenditure per capita and male/female ratio; c_i and d_t are prefecture and year dummies, respectively; and ε_{it} is an error term.

Estimating this equation by the two-way fixed effect model generates the benchmark results. We also provide estimates by the instrumental variable method to determine whether our benchmark results are robust to the potential presence of endogeneity in kindergartens' and nursery schools' past enrollment rates. Endogeneity may arise if we fail to control the unobserved heterogeneity among prefectures and/or preschooling supply factors are not controlled. We control time-invariant, prefecture-specific, unobserved heterogeneity by including prefecture fixed effect in the regression equation to partially, if not completely, eliminate potential endogeneity arising from unobserved heterogeneity.

For the supply factor, the number of Buddhist and Christian institutions in the population are taken into account as an instrument for the enrollment rates in kindergartens and nursery schools. As discussed in Sections 1 and 2.1, these variables are historically determined, and can be used as instrument for the enrollment rates in preschools because many religious groups in Japan, such as Buddhism and Christianity, establish private kindergartens and nursery schools. As we see later, the number of Buddhist and Christian institutions are positively correlated to the kindergarten and nursery school supply capacity, and are considered exogenous to the schooling outcome nine and twelve years later.

4 Data

For the estimation analysis, we construct our data set from several information sources. Our fundamental data source for enrollment rate is the School Basic Survey from 1951 to 1999 by the MEXT, except for the nursery school enrollment rate, which we obtained from the reports by the Ministry of Health, Labor and Welfare.

The School Basic Survey is an annual census survey conducted by the MEXT. The purpose of this survey is to collect basic information on every levels of schools such as the number of students and teachers, students' course after graduation, and current costs and assets of schools. Prefecture-level panel data are publicly available from several volumes of these surveys. We now briefly explain how we construct variables used in our analysis.

Five variables are considered as measures of educational outcomes: High School Rate, College Rate 1, College Rate 2, Public College Rate, and National College Rate. High School Rate is the high school advancement rate defined as the ratio of the number of students in the 10th grade to the number of students in 9th grade, the last year of compulsory schooling, in the previous year.

We construct four measures of college advancement rate, each using different information. The first variable, College Rate 1, is constructed using the information of origin prefecture-information on how many high school graduates in a prefecture advanced to 2- or 4- year college. The second, College Rate 2, uses the information of destination prefecture-information on 4-year college freshmen's home prefecture. Both these college advancement measures are the ratio of the number of college students to the number of students in 9th grade three years earlier.

Although the data used to construct College Rate 2 is limited to 4-year college, it has an advantage in having information of the types of college. We consider two additional outcomes beyond the two college advancement rates: the advancement rates to "national colleges," and to "public colleges," that include both local public colleges and national colleges. These two additional outcome measures are considered because the characteristics of these colleges may be different from those of private colleges.⁴

⁴In Japan, national and local public colleges are generally higher ranked and charge lower tuition fees compared with private colleges. Therefore, the advancement rate to national and public colleges can be viewed as a better indicator of the area's average human capital level than the overall college advancement rate.

We construct the kindergarten enrollment rate at age five from the ratio of the number of pupils aged five in kindergartens in the previous year to the number of students in the first grade of elementary schools. Because elementary school is compulsory, the number of students in the first grade is theoretically the maximum number of children aged five in kindergartens in the previous year.

For the nursery school enrollment rate at age five, we use the 1953-1977 Case Reports of the Welfare Administration (CRWA: Fukushi Gyosei Houkoku Rei), and the 1977-1992 Survey of Social Welfare Facilities (SSWF: Shakai Fukushi Shisetsu Chosa Houkoku), both provided by the Ministry of Health, Labor and Welfare.⁵ The two data sets have complementary strengths and weaknesses. The CRWA records nursery school enrollment on March 1st for four “administrative age” (defined as age on April 1) categories, and the SSWF records nursery school enrollment on October 1st by real (biological) age measured on October 1st. Although the SSWF has an advantage that it records the enrollment for children in each age category, its disadvantage lies in it measuring ages on October 1st and not April 1st, and nearly half of five-year-old enrollment in SSWF should be attributed to “administrative age 4” on the basis of the CRWA records.

To construct a measure of the nursery school enrollment rate relative to the April 1st elementary school enrollment for years before 1977 that CRWA data omit, we construct a proxy measure of the “administrative age” 5 enrollment using the SSWF “real age” total enrollment for the age category of 4 and 5. Although there is no perfect method to achieve this task given the limited data, we simply use weights for each age group obtained from the SSWF average “real age” distribution. In a period of increasing enrollment, our estimates of five-year-olds’ enrollment before 1977, thus, exhibit an upward bias. We assume that this type of measurement error becomes negligible after controlling for year dummies.

As control variables, we include real gross domestic expenditure (GDE) per capita and male/female ratio. We obtain real GDE data from the relevant volumes of the Cabinet Office’s Annual Report on Prefectural Accounts . The real GDE is divided by the prefectural population obtained from the Ministry of Health, Labour and Welfare’s Vital Statistics of Japan. We calculate the

⁵The nursery school data are missing for years 1963-65. We linearly interpolated the missing data for the following analysis. For a robustness check, we did the same estimations using the data after 1964, and obtained virtually the same results.

male/female ratio as the share of girls in the first grade of elementary schools in the School Basic Survey.

The econometric analysis takes into account the potential endogeneity of kindergarten and nursery school enrollment rates. As instruments for these variables, we use the number of Buddhist and Christian institutions. We obtain information on the number of Buddhist and Christian institutions by prefecture from the relevant volumes of the Agency of Cultural Affairs' Annual Report on Religion (data are missing between 1963 and 1967).⁶

Table 1 reports descriptive statistics. The data of kindergarten and nursery school attendance rates used in the analysis spans years from 1957 to 1987 to relate the educational outcomes to the measures of preschooling nine years earlier in the high school rate equation and twelve years earlier in the college rate equations. The average kindergarten attendance rate is roughly 51%, and that for nursery schools is 32%. A large variation is observed in these attendance rates across time and region: for example, nursery schools' minimum attendance rate is 0.1% and the highest is 98%. Kindergartens' standard deviation of attendance rate is 0.21, which is higher than nursery schools' 0.17.

The average advancement rate to high school is 90%, but we observe variation even with this high advancement rate. The minimum advancement rate to high school is 52% and the highest is 99%. The average advancement rate to college is approximately 27% based on the origin measure (College Ratio 1) and 25% based on the destination measure (College Ratio 2). Because the total capacity of national and local public colleges is tightly controlled by the Japanese government, advancement rates to local public colleges or national colleges are much smaller than the overall college advancement ratio. On an average, 7% are in public universities and colleges (including national colleges), and 6% in national universities and colleges, respectively.

⁶The Annual Report on Religion is published by the Agency of Cultural Affairs. The data in this report is based on the results of the Survey of Religion, an annual census survey conducted by the MEXT. The purpose of this survey is to collect basic information such as number of religious groups, the number of those who work for these groups, the number of believers.

5 Effects of Preschooling on Educational Attainments

This section reports the main estimation results based on equation (1). We report the estimates by both OLS and two-stage least squares (2SLS). In the 2SLS, we use the following variables as excluded instruments for the kindergarten enrollment rate, nursery school enrollment rate, and real GDE per capita of the same year as the outcome variable: the number of religious corporations (Christian and Buddhist) per 100 members of the population, one-year lag of the same variable, real GDE per capita of the same year as the preschooling variables, and the kindergarten enrollment rate of the previous year.⁷ The results of the first stage regressions in the 2SLSs are in the Appendix.

Table 2 reports the coefficient estimates in the regression equation. The first two columns display the results for the high school advancement rate. The first column reports the results using OLS, and the second using 2SLS, both indicating that preschool expansion improves high school entrance rate. The coefficient of the kindergarten attendance rate is 0.187 using OLS and 0.228 using 2SLS, and both are statistically significantly different from zero. These coefficients indicate that a one percentage point increase in the kindergarten attendance rate generates roughly a 0.2 percentage point increase in the high school advancement rate.

Similarly, the coefficient of the nursery school attendance rate is 0.221 using OLS and 0.547 using 2SLS, both again statistically significantly different from zero. These coefficients indicate that a one percentage point increase in the nursery school attendance rate generates a roughly 0.2 to 0.5 percentage point increase in the high school advancement rate. The magnitude of the coefficient estimates suggest that attending kindergarten and attending nursery school have roughly a similar impact on the future high school advancement, although the coefficient of nursery school appears larger than that of kindergarten.

Columns 3 to 10 report results for the college. Coefficients of the nursery school attendance rates are always positive and statistically significantly different from zero, irrespective of the estimation method. The magnitude of the coefficients range from 0.026 to 0.032 using OLS, and from 0.128 to 0.240

⁷The 2SLS estimations are performed using the general method of moments (GMM) with optimal weighting matrix. All standard errors are robust to heteroskedasticity.

using 2SLS. The coefficients of the kindergarten attendance rate are statistically significant for College Rate 2 (in both OLS and 2SLS), Public College Rate and National College Rate (in 2SLS only), but insignificant for other outcome measures. The statistically significant coefficients of the kindergarten attendance rate are roughly 0.03. From the coefficients reported in this table, we infer that attendance in nursery schools more strongly affects the long-term educational outcomes than kindergarten attendance.

The coefficients using 2SLS are larger than those using OLS. That is, the OLS underestimates the effects of preschooling on educational outcomes, possibly because of attenuation bias with the OLS in the presence of preschooling variables measurement errors. The larger bias in the estimates of the coefficients on nursery school attendance rate than on kindergarten rate is due to, to some extent, larger measurement errors in the construction of nursery school attendance rates than that for kindergarten. Another reason may be the effects of preschooling on the population segment affected by the availability of religion-provided kindergarten and/or nursery schools are larger than on the average of population.

The coefficients of real GDE per capita is negative and statistically significant in nearly all specifications. Note that all the models contain prefecture fixed effects and year fixed effects without which the coefficients of real GDE per capita are positive and statistically significant. Hence, the coefficients on the real GDE per capita can be interpreted as an effect of relative change of income within prefectures on the decision of high school or college advancement rates. This view is consistent with the interpretation that this variable captures the opportunity cost of advancing to high school or college instead of working.

On the validity of instruments in the 2SLS, the F-test of the excluded instruments in the first stage regression strongly reject the insignificance of these instruments in all specifications. Moreover, the results of the over-identification test for the exogeneity of instruments never rejects these instruments' exogeneity. Therefore, we conclude that our instruments are valid.

In summary, we find that the expansion of both kindergarten and nursery schools has a significant positive impact on high school entrance rate. We also find that the expansion of kindergarten has a significant positive impact on 4-year college, public college, and national college advancement rates, and that the expansion of nursery schools has a significant positive impact on the advancement rates of all types of colleges.

6 Concluding Remarks

This study investigates the long-term effects of universal early childhood interventions such as preschools' expansion. Our estimation results indicate that the expansion of both kindergarten and nursery schools has a significant positive impact on high school and college advancement rates, but kindergarten attendance has no statistically significant impact on the advancement to public and national universities and colleges. We also find that nursery school attendance has a stronger positive effect than kindergarten attendance.

How can we interpret our main result that nursery schools seem to have greater impact than kindergarten on children's later educational achievement? There are at least three factors by which nursery schools may differ from kindergartens in their potential impact on educational achievement. First, the expansion of kindergartens and nursery schools may have influenced children of families at different margins of society. As explained, nursery schools originally intended to provide basic care to children with working mothers, while kindergartens originated as supplementary educational institutions for children before formal schooling regardless of the mother's work status. During the period of rapid expansion of preschooling, married women with children in high-income families increasingly preferred to become housewives, while women in low-income families could not enjoy that luxury. Therefore, children who attended nursery school in the 1960-70s might have had more room for improvement in their educational environment by attending preschool than children who attended kindergarten.

Second, although nursery schools and kindergartens have many common features in their educational contents and care, the length of their service differs; virtually all nursery schools are full-time services beginning at zero years old, whereas, at least until very recently, virtually all kindergartens have been half-day services beginning at ages three or four. Therefore, in prefectures that expanded preschool services primarily through nursery schools, children were exposed to a better educational environment for a longer time than were children in prefectures that expanded primarily through kindergartens. Such a difference in the level of care intensity and educational purpose may explain our results.

Third, teacher quality in kindergartens and nursery schools may be different. Theoretically, however, teacher quality does not answer our questions because kindergarten teacher qualification is considered higher than that for

nursery school teachers. If anything, the relative effectiveness of nursery school compared to kindergarten would be greater than our estimate if the comparison included the teachers' quality. The lack of available data renders disentangling these different factors' contributions to our results beyond the scope of our study. More detailed data with individual level information on the length of preschool attendance and family background would allow us to pursue our research questions further.

A First Stage Regression Results

Here we report the results of the first stage regression in the 2SLS and discuss the validity of the instruments.

Table 3 reports the results of the first stage regression. First, the coefficients of the number of religious institutions per 100 members of the population and its one-year lag in the nursery school attendance rate equation are all positive, as are the coefficients of the same variables in the kindergarten attendance rate equation.

This table also reports the results of the test for the joint hypothesis that the coefficients of these two instruments are zero. The hypothesis is rejected in all equations of the kindergarten and nursery school attendance rates.

In summary, these results demonstrate that the number of religious organizations correlates positively with the kindergarten and nursery school attendance rates.

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Table 1: Descriptive Statistics

| Variable | Sample size | Mean | S.D. | Min | Max | |
|--------------|----------------------------------|------|-------|-------|-------|-------|
| Outcomes | High School Rate | 1164 | 0.901 | 0.100 | 0.521 | 0.989 |
| | College Rate 1 | 1164 | 0.273 | 0.083 | 0.082 | 0.507 |
| | College Rate 2 | 1072 | 0.252 | 0.068 | 0.091 | 0.545 |
| | Public College Rate | 1026 | 0.072 | 0.029 | 0.018 | 0.168 |
| | National College Rate | 1026 | 0.063 | 0.026 | 0.017 | 0.136 |
| Preschooling | Kindergarten Rate at 5 | 1164 | 0.509 | 0.211 | 0.052 | 0.962 |
| | Nursery School Rate at 5 | 1164 | 0.317 | 0.170 | 0.001 | 0.980 |
| Controls | Real GDE per capita (HS) | 1164 | 2.067 | 0.797 | 0.593 | 5.899 |
| | Real GDE per capita (CO) | 1164 | 2.268 | 0.769 | 0.775 | 5.899 |
| | Female Ratio | 1164 | 0.511 | 0.004 | 0.501 | 0.524 |
| Instruments | Religious Corporations (per 100) | 1164 | 0.093 | 0.058 | 0.007 | 0.361 |

For the preschool variables and the instruments, the numbers are averages from 1957 to 1990. For the outcomes and controls, the averages of prefecture-level observations are from 1966 to 1999 for High School Ratio and from 1969 to 1999 for College Ratio. College Ratio 1 is the 2- or 4- year college enrollment rate based on the high school survey. College Ratio 2 is the 4-year college enrollment rate based on the college survey. Religious facilities are the sum of corporations of the Christian and the Buddhism. Years from 1975 to 1980 are not included because the relevant data are not available.

Table 2: Effects of Preschooling on Educational Attainments

| | High School Rate | | College Rate1 | | College Rate2 | | Public College Rate | | National College Rate | | |
|--------------------------------------|-------------------|-----------------------|-------------------|----------------------|-------------------|-----------------------|---------------------|-----------------------|-----------------------|-----------------------|------|
| | OLS | GMM | OLS | GMM | OLS | GMM | OLS | GMM | OLS | GMM | |
| Kindergarten Rate at 5 (se.) | 0.187 (0.014) | *** 0.228 (0.020) | 0.002 (0.012) | 0.022 (0.014) | 0.028 (0.011) | ** 0.030 (0.012) | 0.006 (0.009) | 0.034 (0.014) | 0.008 (0.008) | 0.037 (0.013) | *** |
| Nursery School Rate at 5 (se.) | 0.221 (0.019) | *** 0.547 (0.062) | 0.032 (0.011) | 0.202 (0.040) | 0.026 (0.010) | *** 0.105 (0.033) | 0.028 (0.008) | *** 0.243 (0.039) | 0.029 (0.007) | *** 0.235 (0.036) | *** |
| Real GDE per capita (se.) | -0.046 (0.006) | *** -0.058 (0.008) | -0.001 (0.005) | 0.013 (0.009) | -0.018 (0.005) | *** -0.004 (0.010) | -0.015 (0.003) | *** -0.023 (0.006) | -0.014 (0.002) | *** -0.021 (0.005) | *** |
| Female Ratio (se.) | -0.104 (0.212) | -0.150 (0.240) | -0.361 (0.182) | ** -0.214 (0.197) | 0.089 (0.143) | 0.206 (0.144) | 0.023 (0.100) | 0.063 (0.159) | 0.059 (0.083) | 0.099 (0.147) | |
| Obs. Number | 1164 | 1164 | 1164 | 1164 | 1072 | 1072 | 1026 | 1026 | 1026 | 1026 | 1026 |
| R2 | 0.939 | 0.897 | 0.943 | 0.928 | 0.953 | 0.948 | 0.901 | 0.762 | 0.904 | 0.742 | |
| F-test of the 1st stage (P-value) | | 66.484 0 | | 67.578 0 | | 49.688 0 | | 36.01 0 | | 36.01 0 | |
| Overidentification test (P-value) | | 0.030 0.8636 | | 1.646 0.1995 | | 1.022 0.3121 | | 0.574 0.4487 | | 0.539 0.4628 | |

All equations include prefecture dummy, year dummy and constant term. Standard errors are robust to heteroskedasticity. In GMM, kindergarten, nursery school and Real GDE per capita are instrumented with current and previous year's Religious Corporations per 100, real GDE per capita (of the same year of the preschooling variables) and one-year lagged Kindergarten. Overidentification test shows the Hansen's J test statistics. Robust standard errors are shown in parentheses. p<0.1*, p<0.05, **, p<0.01: ***.

Table 3: Determinants of Preschooling

| Regressoin Equation | College Rate 1 | | | College Rate 2 | | | Public College Rate | | | | | |
|---|---------------------|--------|---------------------|------------------------|---------------------|---------|---------------------|------------------------|-------------------------|----------|---------------------|------------------------|
| | Endogenous Variable | Kinder | Nursery | Real GDE | Kinder | Nursery | Real GDE | Kinder | Nursery | Real GDE | | |
| Female Ratio | | | | | | | | | | | | |
| (s.e.) | -0.1736 (0.0778) | ** | 0.0558 (0.5665) | -1.2102 (1.1421) | -0.1824 (0.0799) | ** | -0.0160 (0.5348) | -1.2400 (1.1647) | -0.1787 (0.0818) | ** | -0.1702 (0.5130) | -1.4069 (1.1864) |
| Religious Corporations | | | | | | | | | | | | |
| (s.e.) | 0.0336 (0.1475) | | 0.8274 (0.6978) | 2.1742 (2.1561) | 0.0845 (0.1236) | | 0.8958 (0.7740) | 2.9242 (2.2266) | 0.0910 (0.1192) | | 1.0569 (0.7684) | 2.4308 (2.1937) |
| Religious Corporations (lagged) | | | | | | | | | | | | |
| (s.e.) | 0.0612 (0.1452) | | 1.1022 (0.7075) | -0.9636 (2.0988) | 0.0079 (0.1215) | | 0.9606 (0.8077) | -2.4637 (2.1266) | 0.0175 (0.1190) | | 0.7660 (0.8008) | -2.3983 (2.0677) |
| Real GDE per capita | | | | | | | | | | | | |
| (s.e.) | -0.0063 (0.0022) | *** | -0.0217 (0.0118) | * 0.7944 (0.0565) | -0.0030 (0.0023) | | -0.0182 (0.0129) | 0.7139 (0.0616) | *** -0.0018 (0.0024) | | -0.0214 (0.0131) | 0.6760 (0.0666) |
| Kindergarten rate at 5 (lagged) | | | | | | | | | | | | |
| (s.e.) | 0.9869 (0.0052) | *** | -0.1733 (0.0375) | *** 0.0828 (0.0795) | 0.9794 (0.0060) | *** | -0.1356 (0.0413) | *** 0.0458 (0.0904) | 0.9751 (0.0068) | *** | -0.1457 (0.0445) | *** 0.0260 (0.1003) |
| F-test of Religious Corporations | 3.490 | | 53.450 | 1.370 | 2.740 | | 40.690 | 0.910 | 3.400 | | 30.810 | 0.670 |
| p-value | 0.031 | | 0.000 | 0.254 | 0.065 | | 0.000 | 0.402 | 0.034 | | 0.000 | 0.510 |

All equations include prefecture dummy, year dummy and constant term. Standard errors are robust to heteroskedasticity. The first stage regressions of High School Rate are identical for College Rate 1. The first stage regressions of National College Rate are identical for Public College Rate. Robust standard errors are shown in parentheses. p<0.1*; p<0.05; **; p<0.01: ***.

Figure 1: Attendance Rates in Preschools



The data for nursery school attendance rate from 1963 to 1965 are imputed using a linear trend.

Figure 2: Changes of kindergarten attendance rate between 1955 and 1975



