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The Importance of Supply and Demand to Policymaking Designed to Alter Preschool Attendance

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Introduction

Preschool education occurs in professionally supervised programs that integrate learning and play with childcare. In the United States it occurs before kindergarten. Duncan and Magnuson (2013, 127) conclude: "[m]ost evaluations of early education programs show that such programs improve children's school readiness, specifically their pre-academic skills. . . ." Bartik (2014) offers evidence drawn from multiple long-term investigations that the improved school readiness garnered from preschool attendance puts a child on a path toward higher lifetime earnings. To justify government involvement in encouraging further preschool attendance, he also documents the positive external effects (beyond the individual to society) from gaining a preschool education in the form of skill spillovers, education peer effects, reduced crime, and less government welfare spending/greater government tax revenue. Bartik (2011) furthermore makes the case that metropolitan areas, and/or states with greater access to early childhood programs, are likely to enjoy greater economic development.

Given these findings regarding the potential benefits of preschool to individuals and society, it is particularly troubling that in 2011 the United States ranked 26th out of the 34 member countries for preschool attendance in the Organization for Economic Cooperation and Development (OECD) among four-year-olds.[1] The 78 percent enrolled in the United States is below the 85 percent OECD average, and far below the near 100 percent participation observed in Spain, Mexico, Netherlands, France, Belgium, and Denmark. Though the likely policy goal for the United States is not full participation of all age-eligible children in preschool because of competing individual and societal values, it is difficult to argue that the relatively low level of participation in the United States is ideal.

Further troubling is the unequal distribution of this lower level of overall preschool attendance in the United States. Preschool attendance falls to 42 percent for eligible Native Americans and to just 37 percent for eligible Latinos.[2] The National Household Education Survey reports that preschool attendance by four-year-olds varies dramatically by income.[3] Only 55 to 64 percent of four-year-olds residing in households with incomes in $10,000 ($10K) increments ranging from less than $10K to $60K attend preschool. Preschool attendance among four-year-olds rises to 77 percent if household incomes between $60K to $75K; 84 percent if household in-

[1] See Organization for Economic Cooperation and Development (2013).
[2] See Kids Count Data Center (n.d.).
[3] See Barnett and Yarosz (2007).

comes between $75K and $100K; and 89 percent for the affluent $100K plus households. Warranting additional concern is the observation that even if the child raised in poverty attends preschool, in the United States they are more likely to attend lower-quality preschool programs.[4]

The California Health Interview Survey (CHIS) offers a web-based tool that summarizes data gathered from a 2011–2012 random sample of California families with children aged three to five that yields similar findings on preschool attendance of 10 or more hours a week. Based on the CHIS, Figure 1 illustrates that only around a quarter (21.9 to 29.4 percent with 95 percent confidence) of California's three- to five-year-olds attended preschool. When subdividing preschool attendance by race/ethnicity, Figure 1 shows that self-identified Latinos of any race, with a little over 17 percent attendance, were below this typical attendance. In addition, African Americans (who are non-Latino) were at just over 38 percent. Figure 1 also illustrates a clear tendency for higher income families to send their three- to five- year-old children to preschool. At a household income of zero to 100 percent of the federal poverty line (FPVL), only 12.5 percent of age-appropriate children attended preschool. While for households at an income of four or more times the FPVL, the percentage of eligible children attending preschool grew to nearly a half.

Policymakers would therefore benefit from further information on the factors that influence a child's participation in preschool. This paper offers evidence on both the supply and demand factors that likely cause observed differences in preschool attendance. Section 2 includes a review of the previous literature on this topic. Sections 3 and 4 contain the regression model/data description and regression results. Section 5 concludes with a summary of primary findings and policy implications drawn from the regression results.

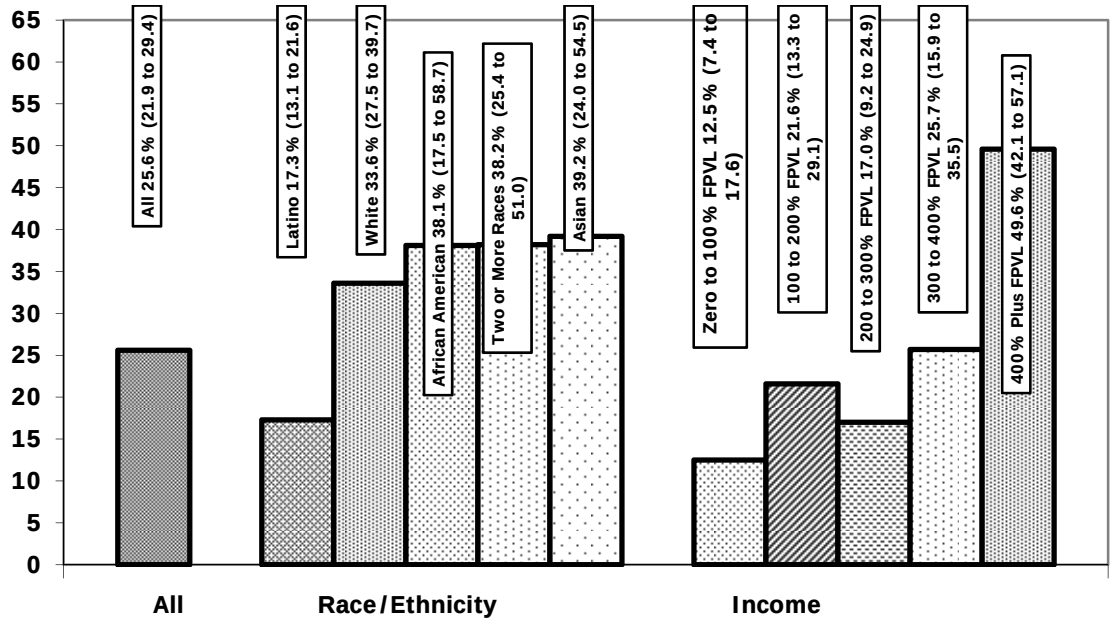
Literature Review

Both qualitative and quantitative forms of research exist concerning the reasons why parents of appropriately aged children decide to use preschool. Barbarin et al. (2008) offers a thorough example of the qualitative approach through its use of interviews conducted in 2001 of 452 families with children enrolled in 40 different preschools in seven different states. The researchers qualitatively coded into nine clusters a household's open-ended responses to a question on "[w]hat knowledge or ability must a child possess to be ready for school"? Only among the poor were racial and ethnic differences detected in the importance of response clusters measuring social competence and self-regulation.

Garcia and Levin (2001) surveyed over three thousand families of children attending Head Start in the United States in 1997. They found that Latinos express greater barriers to preschool enrollment than non-Latinos do, but also that Latinos report greater satisfaction with preschool attendance. Perez and Zarate (2006) gathered one thousand surveys from 10 states, from families with "Latino-sounding" surnames and children of preschool age. The two most frequent responses to why these families did not enroll their children in preschool were they did not know about it (33 percent) and could not afford it (21 percent). The two most frequent reasons why they did

[4] See Chapter 4 of the Pew Charitable Trust (2006) for their definition of high quality preschool and support for the contention that it is lacking in the United States and more likely not delivered to the poor and racial and ethnic minorities attending preschool. Also, Karoly et al. (2013) document that low-income Latinos and African Americans attending preschool in California are far less likely to attend a high-quality preschool than others. They estimate that only about 15 percent of California's children, who would benefit from high-quality preschool attendance, actually receive it.

Figure 1. Preschool Attendance of 10+ Hours a Week for Californians, Age 3–5, in 2011–12 (From CHIS, 95 Percent Confidence Interval in Parentheses)



enroll in preschool were so their children could learn academic skills (47 percent) and better prepare for kindergarten (40 percent). Zucker, Howes, and Garza-Mourino (2007) asked 152 Los Angeles families of Latino descent with four-year-old children, a series of open-ended questions about their child's preschool experiences. Interestingly, 93 percent said they believe children should attend preschool. While half of the respondents noted the primary reason for preschool attendance was better preparation for kindergarten.

Such qualitative studies offer general information on decision processes and choices made by parents regarding preschool attendance. The studies can also indicate differences across racial/ethnic distinctions or income groups in these choices. However, they do not easily quantify the importance of expected reasons for why a difference in preschool attendance occurs. This is possible in a multiple regression analysis of households with preschool-aged children in which some attend and others do not. To conduct such an analysis, indicators must exist for the expected reasons causing these differences. The following categorization of the regression literature is in the economic manner of how parent demand for their child's preschool attendance and the availability of the supply of preschool providers, influence the decision to send a child to preschool.

Demand for Preschool Attendance

Clear distinctions emerge after subdividing households by race/ethnicity or income in California or the United States, and then calculating the rate of preschool attendance. To understand these distinctions, it is helpful to think of a parent(s)' (or guardian(s)') decision to send their

child to preschool using an economic model based on demand.[5] In this case, the service purchased by the parents is assumed to increase their child's pre-kindergarten human capital (in the form of increasing the ability to learn) so they have a better chance at greater human capital gains in later education. As with any service, the demand for preschool attendance fluctuates with the direct and indirect prices paid for it, household income, preference for it, and the availability of substitutes for it.

Income: Chiswick and DebBurman (2004) found that an increase in household income, holding other explanatory factors constant, raises the probability of whether an age-appropriate child attends preschool. Relative to parental care, Davis and Connelly (2005) discovered through multinomial logistic regression that an increase in household income increases the likelihood of attending center-based preschool (as compared to informal care). Hirshberg et al. (2005) found that a thousand dollar increase in a family's monthly earnings raises this same likelihood by 81 percent. Crosnoe (2007) reported that those in poverty are 12 percent less likely to choose preschool over parental care. Edwards et al. (1996) concluded that the hours of preschool demanded by households in a United States county rises for every thousand dollars in mean countywide household income. Fuller et al. (2000) determined that households living in a neighborhood with less poverty send their children to preschool at younger ages.

Substitute Availability: Economic theory indicates that the lower the cost of a viable alternative for something considered for purchase, the less likely the purchase to occur. Using regression analysis, Fuller et al. (1996) concluded that the household presence of a grandparent decreases the chance of the grandchild's preschool attendance by about 42 percent. Also relative to parental care, Crosnoe (2007) found that preschool use increases respectively by 162 and 86 if the mother or father is not present. Davis and Connelly (2005) and Fuller et al. (2000), respectively reported a decrease in preschool use if friend/neighbor available and an increase in preschool use if single parent. Finally, the availability of substitutes decreasing preschool use is consistent with the Hirshberg et al. (2005) result that a married couple with spouse present is 76 percent less likely to use preschool in comparison to home childcare.

Preferences: Quantitative analysts who study differences in a household's demand for a service understand that it is essential to account for differences in preferences for the service. The regression studies reviewed here support this and indicate that average cultural preferences (as very roughly approximated by race/ethnicity and/or English proficiency), socioeconomics (as measured by income and education), time availability (as measured by parent work status, number siblings, etc.), and beliefs all exert statistically significant influences on preschool choice. Crosnoe (2007) found that native whites, native African Americans, and native Latinos are respectively 120, 132, and 44 percent more likely (as compared to Mexican immigrants) to choose preschool over parental care. Chiswick and DebBurman (2004) reported a 38 to 45 percent increase in the likelihood of preschool attendance if the only household characteristic to change is from white to African American. Regarding parent employment and preference for preschool, Crosnoe (2007) discovered that the likelihood of preschool attendance, instead of parental care, respectively rises by 163, 67, and 47 percent if a mother works full time, a mother works part time, or a father works full time. Chiswick and DebBurman (2004) also report that an increase in maternal education, from an average of 13.2 years observed in the sample to 16 years, raises the likelihood of preschool attendance from 38 percent to 43 percent. While Greenberg and Kahn (2012) found that once controlling for preexisting characteristics like maternal employment,

[5] See Edwards, Fuller, and Liang (1996), Chiswick and DebBurman (2004), and Davis and Connelly (2005) for specific discussions of the economics of this decision.

household income, and child's age, children in the three- to five-year age group exhibited no difference in preschool attendance due to Latino ethnicity alone.

Supply of Preschool Providers

There have been a limited number of empirical studies on the determinants of preschool attendance that account in some way for the availability of preschool providers. I found three studies that included measures of the type of community that a household lives in as a rough proxy for preschool provider availability. Fuller et al. (2000) found that households in an urban area exhibited a greater likelihood of preschool attendance than those in rural areas. Chiswick and DebBurman (2004) found the same, with the specific decrease in likelihood falling from 33 percent to 30 percent if one relocated from an urban to a rural residence. Crosnoe (2007) uncovered that relative to living in a rural area; those in a city fringe/town or large city are respectively 62 and 83 percent more likely to attend preschool.

Other empirical studies on the determinants of preschool attendance, after controlling for household characteristics, included some measure of the price of this attendance. Including price is an indirect accounting of the supply-side influence of providers because a fall in the direct price of preschool (holding demand for preschool constant) occurs through an increase in providers. Edwards et al. (1996) found that a rise in the average tuition price per hour of preschool attendance in a county reduced (increased) the aggregate preschool hours demanded (supplied) in that county through the regression estimation of separate supply and demand equations.[6] Using a nationwide sample of households with children of preschool age, Greenberg (2010) found that a thousand dollar increase in statewide pre-kindergarten funding per student increased the likelihood of preschool attendance by about 34 percent for the bottom one-third of household incomes, and about 20 percent for the middle one-third.

Summary

A regression analysis identifies the influence of one explanatory variable on a dependent variable, holding the other explanatory variables thought to influence the dependent variable, and included in the analysis, constant. In regression analysis, it is therefore essential to control for as many of the other explanatory factors as possible to measure the independent influence of a specific explanatory variable. A possible concern in much of the previous regression-based research on what determines preschool attendance is a lack of control for the availability of preschool slots relative to a household's exact location. Greenberg and Kahn (2012, p. 52) note that the supply of preschool care are likely to affect attendance and it is unfortunate that previous data sets and/or empirical analyses have not done more to try and account for this important influence.

Regression Model

My research goal is twofold. The first is to determine the relative importance of factors expected to influence a parent's decision to send their age-appropriate child to preschool. For those

[6] Edwards et al. (1996) set out specifically to estimate a separate supply and demand regression equation of aggregate preschool activity at the county level with the same measure of price in both. The price measure is thus endogenously determined and they appropriately accounted for this using a three-stage least squares regression estimation technique.

that do decide to have their child attend, the second goal is a determination of the relative importance of these factors to the number of hours attended per week. Economics offers the important insight that both a parent(s)' demand for their child's preschool attendance, and the availability of preschool slots, work together to determine both the decision to send a child preschool and the decision concerning how many hours a week the child attends. The application of this theory to a regression analysis is contingent on the availability of a database to implement it.[7] For this study, I use the 2011–12 Child Survey of the California Health Interview Survey (CHIS). Although not perfect, it does offer reasonable measurements of relevant demand and supply side factors.[8] The CHIS is also a relevant choice due to California containing about 13 percent of the United States population that is less than age five, and 28 percent of the country's population that considers itself Latino—an ethnicity, as noted earlier, with a relatively low level of preschool attendance.

The CHIS is a telephone interview survey of an intended random sample of California's population collected over a two-year cycle between June 2011 and January 2013. Sample weights included with the survey data allow it to offer a representative sample of California's population for the age groups included in a specific portion of it. The child survey portion interviewed 7,344 California households containing children from the age of newborn to 11 years old. Since preschool attendance occurs for children aged three to five, this study only uses data from the 1,928 respondents with children this age. The CHIS survey asks parents whether they have regular preschool of 10 hours more a week and if so, the number of hours enrolled during a typical week. Responses to these questions allowed for the creation of a preschool hours variable that is zero for the 1,429 respondents not attending preschool, and the average number of hours attended in a week for the remaining 499 respondents (25.9 percent of respondents) attending preschool.[9] Of those attending, the average attendance time in a week is 28.5 hours, with a minimum of 10 and a maximum of 63.

The previously summarized economic theory is the basis of the regression model used here:

(1) Preschool Attendance or Hours_i =

f(Demand for Preschool Attendance_i, Supply of Preschool Providers_i);

where,

[7] See Gordon and Chase-Lansdale (2001) for an earlier discussion of the availability of data to investigate preschool attendance and areas of concern with it.

[8] See UCLA Center for Health Policy Research (n.d. b).

[9] See UCLA Center for Health Policy Research (n.d. c) for details. Specifically, the questions asked of a parent of a three-to-five-year-old child was first: Do you have regular childcare of 10 or more hours per week? If a positive response, then a follow-up question inquired: Tell me the number of hours of childcare during the typical week. Also, those responding positively to the first question were asked the form of childcare and given the options of: (1) Receive childcare from grandparent or other family member; (2) Receive childcare from nonfamily in your home; (3) Receive childcare from childcare center not in someone's home; (4) Receive childcare from nonfamily member in his/her home; (5) Receive childcare from Head State or State Preschool Center; and (6) Receive childcare from preschool or nursery school. I only counted those choosing options (4) or (5) as having a child in preschool.

$i = 1, 2, 3, \ldots 1{,}928$ households with children aged three to five in CHIS survey,

Demand for Preschool Attendance$_i$ = f(Income$_i$, Substitute Availability$_i$, Preferences$_i$);

Supply of Preschool Providers$_i$ = f(Preschool Slots Per Child at Various Distances$_i$)

Substituting variable categories that account for the general factors derived from economic theory, equation (1) becomes:

(2) Preschool Attendance or Hours$_i$ =
f(Household Income and Wealth$_i$, Most Knowledgeable Adult's Education$_i$, Family Characteristics$_i$, Parents Other Characteristics$_i$, Race and Ethnicity$_i$, Child Characteristics$_i$, Neighborhood Characteristics$_i$, Preschool Slots Per Child at Various Distances$_i$).

I base the transformation from the very general expectation that both demand and supply factors influence a parent(s) choice of preschool attendance and hours to attend described in equation (1), to the categories of explanatory variables included in equation (2) on the variables available from the CIHS survey. For instance, the inclusion of measure of household income and wealth clearly map back to the income determinant of demand. The inclusion of measures of preschool slots per child at various radial distances from a respondent's home represents the supply of preschool providers. The inclusion of other categories in equation (2) accounts for all variables available in the CIHS that influence substitute availability and preferences.

Data Description

In Table 1, column one provides the variable name of all the specific explanatory variables included in each of the general explanatory factors on the right side of equation (2). The choice of explanatory variables is constrained by the content in the CHIS survey, but Table 1 reveals a reasonable coverage of necessary causal factors.[10] The second column of this table offers further clarification on the variable creation used in this study and the root variable(s) from the CHIS Public Use Data. The remaining columns in Table 1 list the descriptive statistics for each variable. Pairwise correlation coefficients for all explanatory variables yielded only a few absolute values greater than 0.30 for explanatory variables that were not part of a set of dummy variables or accounted for the different concentric bands that measured preschool supply.

A unique aspect of this analysis is the inclusion of three variables that measure preschool slots per 3-5 year olds in radial distances of 5, 10, and 20 miles from the respondent's home. The

[10]A possible exception to no concern of omitted variable bias being the lack of an explicit measure of the tuition price faced by the household to attend preschool. As in some previous studies, a proxy for this here is the inclusion of explanatory variables measuring community type. Unlike previous studies, a further proxy for differences in price faced by households to attend preschool is the availability of preschool slots per potential demand in radial bands around the household.

Table 1. Variable Descriptions and Descriptive Statistics (1,928 Observations)

Variable Name	Description (Variable ID from 2011-12 CHIS Public Use Data)	Mean	Standard Deviation	Min	Max
Dependent					
Preschool Hours	Hours in Head Start, State Preschool, Preschool, or Nursery School (CG2, CG3B, and CG3C)	7.387	13.993	0	63
Household Income and Wealth					
Below Poverty Line	Federal poverty line used (POVLL)	0.225	0.417	0	1
Poverty Line to Three Times Poverty Line	Federal poverty line used (POVLL)	0.351	0.477	0	1
Owns Home	(SRTENR)	0.523	0.500	0	1
Most Knowledgeable Adult's Education					
Completed High School	For MKA [Most Knowledgeable Adult] (CHEDUCA)	0.180	0.384	0	1
Completed Vocational School	For MKA (CHEDUCA)	0.032	0.176	0	1
Completed Some College	For MKA (CHEDUCA)	0.116	0.320	0	1
Completed Associates Degree	For MKA (CHEDUCA)	0.073	0.260	0	1
Completed Bachelor's Degree	For MKA (CHEDUCA)	0.233	0.423	0	1
Completed Less than Master's Degree	For MKA (CHEDUCA)	0.009	0.096	0	1
Completed Master's Degree	For MKA (CHEDUCA)	0.119	0.324	0	1
Completed Doctorate Degree	For MKA (CHEDUCA)	0.049	0.216	0	1
Family Characteristics					
Married	(FAMT4)	0.854	0.353	0	1
Number of Household Members	(HHSIZE_P)	4.449	1.190	2	7
Parent Other Characteristics					
Age 30 to 49	For MKA (AGEGRP_A)	0.781	0.413	0	1
Age 50 Plus	For MKA (AGEGRP_A)	0.057	0.232	0	1
Does Not Speak English	For MKA (CH18)	0.101	0.302	0	1
Mother in U.S. Less than Four Years	(YRUSM)	0.023	0.151	0	1
Father in U.S. Less than Four Years	(YRUSF)	0.021	0.142	0	1
Mother Non-Citizen	(CITIZ2_M)	0.023	0.151	0	1
Father Non-Citizen	(CITIZ2_F)	0.021	0.143	0	1
Race and Ethnicity					
Latino Mexican	Latino and identified themselves as Mexican subtype (LATIN9TP)	0.377	0.485	0	1
Latino Non-Mexican	CA Department of Finance Classification (RACEDO_P)	0.460	0.498	0	1
African American	CA Department of Finance Classification Non-Latino (RACEDO_P)	0.033	0.179	0	1
Native American	Same as above	0.007	0.085	0	1
Asian	Same as above	0.095	0.293	0	1
Two or More Races	Same as above	0.072	0.258	0	1
Child Characteristics					
Child Female	(SRSEX)	0.493	0.500	0	1
Child Age Four	(SRAGE_P)	0.358	0.480	0	1
Child Age Five	(SRAGE_P)	0.342	0.474	0	1
Parent Believes Child Health Poor	Assessment of general health (CA6)	0.005	0.068	0	1
Parent Believes Limited Ability Child	To do age-appropriate things (CA7)	0.042	0.201	0	1

Neighborhood Characteristics					
Neighborhood People Not Helpful	Strongly disagree or disagree with people in neighborhood willing to help (CG39)	0.026	0.161	0	1
Neighborhood Not Safe	Some or none of the time feel safe in the neighborhood (CG42)	0.018	0.133	0	1
Second City Residence	Census definition based on Census Tract (UR-TRACT)	0.202	0.402	0	1
Suburban Residence	Same as above	0.202	0.402	0	1
Town/Rural Residence	Same as above	0.192	0.394	0	1
Preschool Facilities Various Distances					
Preschool Slots Per 3-5-Year-Olds in 5 Mile Radius	GIS based upon 2010 Census and 2012 State of CA Preschool Data	0.152	0.068	0	0.443
Preschool Slots Per 3-5-Year-Olds in 10 Mile Radius	Same as above	0.165	0.058	0	0.383
Preschool Slots Per 3-5-Year-Olds in 20 Mile Radius	Same as above	0.177	0.052	0.017	0.319

necessary distance to travel to access a reasonable choice of preschool providers may exert an influence on both a parent(s)' decision to send their child to preschool and the average number of hours they attend in a week. The reason being that a greater distance travelled increases the direct (gas and automobile depreciation) and indirect (time) cost imposed upon the parents(s) transporting a child to preschool. The construction of this variable required the use of publicly restricted variables in the CHIS data set that records the latitude and longitude of place of residence. At my request, CHIS used ArcGIS to plot these locations on a map of California that also included 2010 information on the number of three- to five-year-olds in each of its 8,057 census tracts. Also plotted were the 2012 locations of California's 10,527 licensed preschool and Head Start providers with child capacity for each. This process enabled the calculation of measures of preschool slots available, per those who could possibly use them, within the three radial distances. This is a household specific accounting of the supply-side influence on preschool use.

The STATA regression package accounts for the complex sample design of the CHIS using provided survey weights in the calculation of robust standard errors for the calculated regression coefficients. STATA also contains a two-part model (TPM) regression technique to be used with a dependent variable that contains both zero values for deciding not to do something, and positive values for the amount that the something was done by those that decided to do it. I use the TPM regression technique because a parent's decision process about preschool for an age-appropriate child requires these two decisions. The first decision involves whether to have their age-appropriate child attend preschool at all. Individuals with zero values for the dependent variable preschool hours have decided against their child's attendance. The second decision occurs only for those who have decided to attend preschool, but then must determine the number of hours they wish their child to attend in a typical week. Individuals with positive values for the dependent variable preschool hours have made the first decision in the affirmative and the number represents their choice of typical hours to attend in a week.[11]

[11] Cameron and Trivedi (2010, Chapter 16) and Belotti, et al. (2012) offer descriptions of these TPM regression models and the appropriateness of use. The traditional alternative to this model is the Tobit

In STATA's TPM regression technique, a logistic regression analysis is first run with the dependent variable equal to one if the eligible three- to five-year-old child in the household attended preschool and zero if they did not. The regression coefficients resulting from this (when transformed to odds ratios) indicate the change in the expected probability of a typical household in the sample from attending preschool following a one-unit change in a respective variable (holding other explanatory variables constant). Then in STATA's TPM regression technique, a second ordinary least squares (OLS) regression is also run using only the CHIS respondents whose children attended preschool with a dependent variable representing the reported number of hours that they sent their child to preschool during a typical week. The regression coefficients derived from this second analysis indicate the expected change in preschool hours attended for a typical household sending their three- to five-year-old to preschool from a one-unit change in a respective explanatory variable (holding all other explanatory variables constant).[12] The desirability of STATA's TPM regression technique is therefore that it yields information on what causes parents to decide to attend preschool at all, and for those that attend preschool, further distinct information on what causes differences in the hours chosen.

Endogeneity is likely in a regression that attempts to capture elements of both supply and demand. That is a measure of preschool availability to a household is likely to be both a (1) determinant of whether a household attends preschool, and (2) determined by whether the household, and other nearby households (likely to be similar in socioeconomic characteristics) are more likely to desire preschool for their children. Since this research only wishes to tease out the influence of the first determinant, an instrumental variable (IV) technique is appropriate.[13] Without the use of IV, conventional regression estimation suffers from "inconsistency." In statistical terms, this means the measured influence does not converge to the expected effect in the population as the sample size grows.

Crosby et al. summarize the criteria used to consider IV estimation appropriate. First, the chosen instrument(s) must be an exogenous source of variation expected to exert an expected effect on the endogenous variable (relevance) in only one direction. Second, the instrument(s) must be unrelated to the decision to attend preschool except through its influence on the endogenous variable (exogeneity). The instrumental variables used here are Square Feet per California Public Library and Patron Seats per California Public Library (patron seats measuring the number of chairs available within the library). These available measures of public library scale satisfy the relevance criterion because the basis of location and scale of public libraries are government decisions grounded in previous population needs and politics. Their location and scale therefore represent historic central locations, chosen through a political process, and likely exert only a positive influence on the location of preschool providers. These public library instruments are also exogenous to the decision of parent(s) to send their age-appropriate child to preschool. They

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model that assumes the same probability mechanisms generate both the zero and positive values. As Cameron and Trivedi (p. 553) note: "Many applications have shown that an alternative model, the two-part model or the hurdle model, can provide a better fit by relaxing the Tobit model assumptions." Unlike the Tobit model, the TPM allows different impacts on the decision to attend preschool and the hours attended by the same explanatory variable.

[12] I also tried the OLS functional forms of log-linear and log-log and found them to yield less statistically significant regression coefficients than the linear-linear functional form used.

[13] Crosby et al. (2010) offers an accessible summary of the desirability of using IV to account for such endogeneity in a regression analysis of the influence of type of preschool childcare and later external problem behavior, and recommends the need for future analysis of this type to do the same.

only exert an influence on this choice through their expected influence on the location and scale of preschool provision.

Library size information for all of California's 1,107 public libraries in 2011-2012 came from the California State Library (n.d.). The addresses for all libraries are at PublicLibraries.com (n.d.). After geocoding the addresses for these libraries, it was again necessary for the CHIS to construct the desired instrumental variables of public library seats (and square feet) per three- to five-year-olds in radial distances of 5, 10, and 20 miles of a household. Once these were calculated, an estimate of the first stage of the appropriate two-stage least squares regression occurred. The endogenous measures of preschool slots per three- to five-year-olds in a 5-, 10-, or 20-mile radius was first regressed against: (1) Square Feet Per California Public Library per three- to five-year-olds using the respective 5-, 10-, or 20-mile radius; (2) Patron Seats Per California Public Library per three- to five-year-olds using the respective 5-, 10-, or 20-mile radius; and (3) the other exogenous explanatory variables described in equation (2) above. These three first-stage regressions yielded predicted values of preschool slots per three- to five-year-olds in the 5-, 10-, or 20-mile radii desired.[14] The second-stage regression results use the predicted values of these endogenous variables.[15]

Regression Results

Table 2 contains the results of four different TPM regression estimations based on how the explanatory variable (supply side) category of preschool facilities handled: either no accounting for slots per child (numbered 1–2); slots per child within five miles (numbered 3–4); slots per child within 10 miles (regressions numbered 5–6); and slots per child within 20 miles (numbered 7–8). The odd-numbered regression results identify the logistic findings regarding to attend or not. The even-numbered regressions identify the OLS regression results on hours attended.

Two distinct patterns emerge from Table 2. First, different factors affect the decision to attend preschool than those that influence the subsequent decision of how many hours to attend. Second, these patterns of influence are consistent across the different ways of accounting for available preschool slots per potential user. Referring to Table 2, I next consider the logistic regression results (attend or not) and then the OLS regression results (hours attended). Then I discuss the overall marginal effects for a specific explanatory variable on both attendance and hours attended.

[14] As evidence that this choice of instruments is appropriate, the inclusion of public library seats and public library square was always highly statistically significant in the first stage regression used to predict preschool slots per 3-5-year olds for all the measures of radius distance used. Also the correlation between actual and predicted values of preschool slots per 3-5 year old for 5-, 10-, and 20-mile units of radius was respectively 0.72, 0.78, and 0.83. These findings support the relevance of the chosen instruments used here. In addition, since there is only a single endogenous explanatory variable and two instrumental variables a J-statistic test of overidentifying restrictions was possible. With greater than 95 percent confidence, it allowed for the rejection of the null hypothesis that the overidentifying restriction is invalid. This is the desired evidence for the exogeneity of these two instruments.

[15] I also ran the TPM regression model with no account for the likely endogeneity of the preschool provider measures. The results are available upon request.

Table 2. Logit (Preschool Attend or Not) and OLS (Preschool Hours Attended)
Regression Results for Various Measures of Provider Availability (estimated jointly with STATA Two-Part Model)

	No Provider Measure		Provider Measure Within Five Miles		Provider Measure Within Ten Miles		Provider Measure Within Twenty Miles	
Explanatory Variable	Attend or Not 1	Hours Attended 2	Attend or Not 3	Hours Attended 4	Attend or Not 5	Hours Attended 6	Attend or Not 7	Hours Attended 8
Household Income and Wealth								
Below Poverty Line	-55.7%^ -0.814+ (0.446)	-2.958 (2.827)	-54.9% -0.752+ (0.444)	-2.825 (2.832)	-54.3% -0.782+ (0.449)	-3.108 (2.892)	-54.2% -0.780+ (0.448)	-3.068 (2.856)
Poverty Line to Three Times Poverty Line[1]	-48.2% -0.657* (0.330)	-3.020 (2.519)	-44.9% -0.596+ (0.332)	-2.869 (2.478)	-45.3% -0.604* (0.338)	-3.167 (2.508)	-46.3 -0.621* (0.335)	-3.103 (2.499)
Owns Home	0.017 (0.236)	4.499* (1.898)	0.106 (0.252)	4.620* (1.961)	0.071 (0.242)	4.332* (1.945)	0.055 (0.244)	4.445* (1.899)
MKA's Education								
Completed High School	0.917 (0.585)	4.409 (2.743)	-0.047 (0.467)	4.295 (2.851)	0.004 (0.464)	4.468 (2.802)	0.014 (0.464)	4.364+ (2.701)
Completed Vocational School	0.917 (0.585)	0.243 (4.910)	0.888 (0.572)	0.205 (4.941)	0.889 (0.583)	0.175 (4.930)	0.864 (0.587)	0.216 (4.848)
Completed Some College	0.099 (0.503)	0.134 (3.432)	0.084 (0.504)	0.123 (3.416)	0.094 (0.506)	0.038 (3.443)	0.114 (0.502)	-0.038 (3.400)
Completed Associate's Degree	0.358 (0.587)	3.576 (3.394)	0.349 (0.583)	3.483 (3.517)	0.349 (0.586)	3.695 (3.540)	0.382 (0.586)	3.665 (3.528)
Completed Bachelor's Degree	161.7% 0.962+ (0.515)	4.821 (3.188)	141.1% 0.880+ (0.521)	4.686 (3.312)	146.0% 0.900+ (0.519)	4.92 (3.275)	152.2% 0.925+ (0.518)	4.818 (3.180)
Completed Less than Master's Degree	481.2% 1.760+ (0.971)	-0.942 (3.854)	0.483 (0.963)	-0.677 (4.077)	428.6% 1.665+ (1.005)	-0.888 (3.981)	472.0% 1.744* (0.978)	-1.101 (3.861)
Completed Master's Degree	318.3% 1.431* (0.590)	3.416 (3.067)	267.7% 1.302* (0.614)	3.291 (3.201)	288.5% 1.357* (0.607)	3.504 (3.129)	301.1% 1.389* (0.599)	3.354 (3.014)
Completed Doctorate Degree[2]	518.4 1.822** (0.600)	4.278 (3.129)	365.5% 1.538* (0.660)	3.781 (3.605)	401.8% 1.613** (0.622)	4.842 (3.498)	457.3 1.718** (0.611)	4.447 (3.195)
Family Characteristics								
Married	-0.297	-5.040*	-0.314	-5.044*	-0.296	-5.097*	-0.284	-5.160*

	(0.266)	(1.349)	(0.260)	(2.160)	(0.263)	(2.125)	(0.264)	(2.143)
Number of Household Members	-0.143 (0.095)	0.941 (0.812)	-0.125 (0.092)	0.950 (0.814)	-0.137 (0.092)	0.939 (0.814)	-0.133 (0.093)	0.938 (0.812)
Parents Other Characteristics								
Age 30 to 49	0.022 (0.328)	-5.664* (2.308)	-0.058 (0.324)	-5.876* (2.335)	-0.037 (0.324)	-5.448* (2.338)	-0.014 (0.3332)	-5.546* (2.324)
Age 50 Plus[3]	-0.291 (0.655)	-1.840 (3.922)	-0.46 (0.649)	-2.146 (4.091)	-0.404 (0.671)	-1.561 (4.031)	-0.360 (0.676)	-1.634 (3.990)
Does Not Speak English	-68.9% -1.167+ (0.594)	1.601 (5.257)	-69.0% -1.172+ (0.599)	1.451 (5.211)	-70.0% -1.203+ (0.599)	1.792 (5.199)	-69.5% -1.188+ (0.596)	826 (5.208)
Mother in U.S. Less than Four Years	0.019 (0.569)	11.889+ (7.289)	-0.010 (0.559)	11.828+ (7.277)	-0.011 (0.560)	11.996+ (7.368)	-0.041 (0.568)	11.980+ (7.316)
Father in U.S. Less than Four Years	676.0% 2.049** (0.717)	-0.279 (7.106)	628.6% 1.986** (0.689)	-0.415 (7.186)	649.3% 2.014** (0.690)	-0.226 (7.382)	637.4% 1.998** (0.711)	-0.194 (7.217)
Mother Noncitizen	-0.262 (0.297)	3.859+ (2.246)	-0.274 (0.295)	3.830+ (2287)	-0.247 (0.296)	3.872+ (2.220)	-0.272 (0.293)	3.916+ (2.193)
Father Noncitizen	0.016 (0.316)	1.247 (2.340)	-0.032 (0.318)	1.190 (2.372)	-0.019 (0.316)	1.285 (2.304)	0.010 (0.316)	1.215 (2.282)
Race and Ethnicity								
Latino Mexican	0.443 (0.414)	-2.119 (3.003)	0.468 (0.397)	-1.909 (3.61)	0.447 (0.408)	-2.296 (3.096)	0.451 (0.408)	-2.278 (3.063)
Latino Non-Mexican	-0.191 (0.445)	1.013 (3.087)	-0.141 (0.436)	0.959 (3.077)	-0.142 (0.446)	1.025 (3.105)	-0.152 (0.444)	1.056 (3.114)
African American	213.3% 1.142* (0.542)	4.131 (3.207)	255.7% 1.269* (0.551)	4.389 (3.259)	234.3% 1.207* (0.546)	3.807 (3.258)	218.7% 1.159* (0.562)	3.914 (3.236)
Native American	465.2% 1.732* (0.659)	-2.344 (7.351)	394.3% 1.598* (0.715)	-2.345 (7.214)	452.9% 1.710* (0.698)	-2.630 (7.486)	524.0% 1.831* (0.640)	-2.705 (7.394)
Asian	0.395 (0.328)	-4.293+ (2.364)	0.326 (0.318)	-4.466+ (2.382)	0.320 (0.330)	-4.103+ (2.365)	0.319 (0.321)	-4.101+ (2.373)
Two or More Races[4]	0.423 (0.377)	-3.143 (2.730)	0.367 (0.385)	-3.258 (2.796)	0.378 (0.383)	-2.935 (2.769)	0.376 (0.379)	-2.872 (2.761)
Child Characteristics								
Child Female	-0.203 (0.197)	-0.716 (1.331)	-0.217 (0.196)	-0.766 (1.321)	-0.235 (0.196)	-0.521 (1.348)	-0.249 (0.200)	-0.527 (1.285)
Child Age Four	125.2%	1.276	120.3%	1.232	121.2%	1.352	118.4%	1.381

	0.812** (0.203)	(1.513)	0.790** (0.204)	(1.514)	0.794** (0.205)	(1.522)	0.781** (0.207)	(1.543)
Child Age Five[5]	-57.6% -0.859** (0.282)	-2.195 (1.935)	-56.1% -0.823** (0.283)	-2.076 (2.031)	-57.1% -0.847** (0.286)	-2.249 (1.930)	-57.8% -0.863** (0.292)	-2.235 (1.929)
Parent Believes Child Health Poor	1.558 (2.123)	11.811+ (6.704)	1.585 (2.150)	11.773+ (6.434)	1.646 (2.132)	11.826+ 6.968)	1.702 (2.104)	11.642+ (6.797)
Parent Believes Limited Ability Child	-0.529 (0.544)	-2.816 (2.874)	-0.466 (0.552)	-2.684 (2.948)	-0.540 (0.562)	3.011 (2.952)	-0.557 (0.563)	-2.952 (2.880)
Neighborhood Characteristics								
Neighborhood People Not Helpful	-81.0% -1.661* (0.794)	3.035 (3.755)	-79.5% -1.583* (0.786)	3.138 (3.791)	-79.3% -1.577* (0.793)	2.859 (3.731)	-78.9% -1.557* (0.773)	2.787 (3.811)
Neighborhood Not Safe	-1.147 (0.807)	-15.978** (4.051)	-1.072 (0.811)	-15.565** (3.855)	-1.1142 (0.807)	-16.263** (3.939)	-1.157 (0.801)	-15.122** (3.945)
Second City Residence	-0.331 (0.275)	-1.134 (2.477)	-0.200 (0.287)	-0.915 (2.562)	-0.162 (0.294)	-1.597 (2.634)	-0.134 (0.289)	-1620 (2.792)
Suburban Residence	-44.1% -0.581** (0.234)	-4.614* (1.897)	-38.9% -0.494* (0.232)	-4.409* (1.998)	-40.9% -0.527* (0.233)	-4.768* (1.947)	-39.8% -0.508** (0.227)	-4.755* (1.934)
Town/Rural Residence[6]	-0.071 (0.238)	-4.828* (2.206)	0.431 (0.335)	-4.175 (2.784)	0.387 (0.291)	-5.623* (2.439)	0.370 (0.279)	-5.518* (2481)

Preschool Facilities Var Distances								
Preschool Slots Per 3-5-Year-Old in 5 Mile Radius (predicted)			4.896++ (3.124)	8.664 (22.767)				
Preschool Slots Per 3-5-Year-Old in 10 Mile Radius (predicted)					4.713+++ (2.951)	-12.175 (22.292)		
Preschool Slots Per 3-5-Year-Old in 20 Mile Radius (predicted)							14,031.6% 4.951+ (2.839)	-11.542 (20.585)
Number of Observations	1,928	1,928	1,928	1,928	1,928	1,928	1,928	1,928
R-Squared (Pseudo for Logit)	0.212	0.216	0.214	0.216	0.214	0.217	0.215	0.217

A potential concern is the presence of multicollinearity among the explanatory variables that biases the standard error of the regression coefficients upward and yields the false conclusion that an explanatory variable exerts a statistically insignificant influence. I checked for this with a calculation of pair wise correlation coefficients among all explanatory variables for which none was above the absolute value of 0.50. A further check of Variance Inflation Factors (VIFs) for the regression using positive hours of preschool attendance yielded none above five. Both of these indicate that multicollinearity is unlikely to be a concern.

Statistical significance in a two-tailed test: ** $p < 0.01$, * $p < 0.05$, + $p < 0.10$, ++ $p = 0.121$, +++ $p = 0.114$ confidence.

[1]Excluded category is More than Three Times Poverty Line; [2]Excluded category is Less than High School; [3] Excluded category is Primary Caregiver Less than Age 30; [4]Excluded category is white; [5]Excluded category is Child Age Six; [6]Excluded category is Urban.

^Holding all other explanatory variables constant, for statistically significant logistic regression coefficient, the values in bold represent the change in odds of attending preschool for a one-unit change in the given explanatory variable that is derived by first calculating the "Odds Ratio" = value of natural exponent raised to the power of regression coefficient, and then subtracting one from this, and multiplying by 100 (see <http://logisticregressionanalysis.com/817-understanding-logistic-regression-output-part-3-assessing-the-effects-of-the-x-variables>).

Attend or Not

Values in bold for the odd-numbered regressions in Table 2 represent the increases in the odds (likelihood) of preschool attendance if the value of a specific explanatory variable changes from zero to one. The value of -55.7 for the explanatory variable below poverty line in regression one indicates that if a household moves from a household income of more than three times the federal poverty line (the excluded income category) to an income below the federal poverty line (FPVL), then their likelihood of sending their age-appropriate child to preschool falls by 55.7 percent.[16] Whereas if a household income drop from more than three times the FPVL places them in the range of the poverty line to three times poverty line, the likelihood of sending their child to preschool falls by the smaller -48.2 percent. However, even more important than household income in determining preschool attendance, is the most knowledgeable adult's (MKA) education.[17] In comparison to the base category of not graduated from high school, a MKA parent with a doctorate degree, master's degree, some post-bachelor's degree education, or a bachelor's degree is respectively about 500, 300, 450, and 150 percent more likely to have her child attend preschool. Noteworthy is the finding that a change in MKA's educational achievement from less than high school, to completing a high school diploma or an associate's degree, resulted in no detected difference in influence on preschool attendance.

Regarding other parental influences on preschool attendance, the regression results in Table 2 indicate that if the MKA parent in the household does not speak English, the child's likelihood of preschool attendance falls by about 70 percent. A child with a father born outside the United States and in the country for less than four years is about 650 percent more likely to attend preschool than a foreign-born father that was here longer.[18] In comparison to a child considered white by her MKA parent, an African-American and Native-American child is respectively about 220 and 450 percent more likely to go to preschool. Other racial and ethnic categories, once controlling for the explanatory factors included in the regression model, exhibited likelihoods of preschool attendance no different from that for whites.[19] A child age four is about 120

[16] Note that the CHIS categorize a household's reported income as: (1) zero to 99 percent federal poverty line (FPL); (2) 100 to 199 percent FPL; (3) 200 to 299 percent FPL; and (4) 300 percent and above. In preliminary regression runs, category (1) counted as the base, and all three other categories included. In repeated trials, only category (4) was statistically significant and thus the decision to include it only in the final regression.

[17] The CHIS methodology called for the household's most knowledgeable adult to answer the interviewer's questions. Therefore if the father or mother is not specified, the response applies to this MKA adult.

[18] Though in interpreting this finding note the small sample size of only 2.1 percent (40 out of 1,928) of households in the CHIS having a father born outside the United States or here less than four years. The small sample sizes for households with a mother born outside of United States (2.3 percent), mother here less than four years (2.3 percent); or whose MKA considers the health of child poor (0.5 percent), the ability of child limited (4.2 percent), neighbors not helpful (2.6 percent), and neighborhood not safe (1.8 percent), are also important to know when considering the applicability of these regression findings related to these characteristics.

[19] The purpose of this paper is not to directly address the question of whether a Latino child is more or less likely to attend preschool, but does offer some evidence on this through answering the supply and demand issue described in the abstract. The takeaway from this being that if two sets of parents are identical in education, income, marital status, English proficiency, (and everything else controlled for in pa-

percent more likely to get formal schooling before kindergarten than a three-year-old is. Likely, due to the eligibility for kindergarten, a child age five is about 57 percent less likely to attend preschool than a three-year old is.

An opinion expressed by the MKA that neighborhood people not helpful (as compared to those that do not believe this) correlates with about an 80 percent decrease in preschool attendance. Those that live in a suburban residence are about 42 percent less likely to send their three- to five-year-old to preschool than those that live in an urban location (central city of an urbanized area). The effects of second city residence in an urbanized area or town/rural residence outside an urbanized area were no different from the base of residence in an urbanized area's central city.

The greater presence of available preschool capacity per potential child that could attend exerted an influence within a radial band 20 miles from the home.[20] At first glance, the odds ratio reported in Table 2 indicates an "unbelievable" fourteen thousand percent increase in the probability of attendance expected when going from *zero preschool slots for this 20-mile distance radius to a preschool slot available for all who could possibly attend*. In the real world, such a change is just not possible given the respective average values of preschool slots per 3- to 5-year old in the 20-mile radius of around 0.18, with a standard deviation of about 0.05 and no zero values. It is therefore only realistic to consider the effect of preschool slots per 3- to 5-year old in 20-mile radius in terms of a one standard deviation change. Thus, if supply of preschool slots per potential demand rises by 0.06 (one standard deviation) in a 20-mile radius around a household's residence, the likelihood of preschool attendance increases by a believable 842 (0.06 x 14,031) percent. The finding of a distinct statistical significance when accounting for a 20-mile radius of preschool providers (as opposed to the just less than statistical significance of accounting for preschool providers in five- and 10-mile radii) is sensible if one considers that a parent prefers her child's preschool to be close to her place of work. More preschool slots per potential attendees increase the likelihood of this occurring if the increase occurs in a wider radial distance from one's home than if the same increase occurs closer to home. These statistically significant supply-side findings, after holding demand-side factors constant, offer convincing evidence that the availability of preschool slots per age-appropriate children within reasonable distances from a home matters to the decision to send an age-appropriate child to preschool.

Hours Attended

The coefficients in bold in the even-numbered columns of Table 2 represent the statistically significant influence on hours attended of preschool (for those that chose to attend) for a unit change in the respective explanatory variable. For instance, a household that owns a home attends preschool about 4.5 more hours a week (relative to a mean of 28.5 hours for those attending). While a child with married parents, or a MKA parent age 30 to 49 (in comparison to one less than that age), respectively attends between 5 and 5.5 hours less preschool a week. Parental influence on hours attended also occurs through a foreign-born mother in the U.S. less than four years or mother is a noncitizen. Children of mothers with a short time in the country exhibited about 12 more hours in preschool in a week, with noncitizen mothers demonstrating about four

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per's regression analyses), then the fact that one declares themselves to be Latino and the other does not, exerts no independent influence on whether their children attend preschool.

[20] Note that the regression coefficients for the radial bands of preschool slots per child in radial bands of five and 10 miles were found statistically significant at about the 88 percent level of confidence in a two-tailed test (just below the 90 percent cutoff).

more. With about four hours less per week, only children of Asian descent exhibited a difference in hours attended than whites. If parent believes child's health is poor, they kept them in preschool for about 11.5 more hours than one who did not.

Neighborhood characteristics also influenced hours attended for those choosing preschool attendance. Believing your neighborhood is not safe reduced preschool hours on average about 16 hours. Furthermore, in comparison to those households living in an urbanized area's central or second city, those with a suburban residence or town/rural residence attended preschool about five less hours. Though the presence of preschool facilities increased the likelihood of attending preschool, the OLS regression results in Table 2 offer no indication that available preschool slot per age-eligible child influences preschool hours attended.

Overall Marginal Effects

The TPM regression methodology also allows for the calculation of marginal effects expected on the values of the full sample of preschool hours (including zero hours) when one explanatory variable changes by one unit. An intuitive interpretation of the statistically significant values in Table 3 comes through a comparison to the mean of 7.4 preschool hours for all 1,928 households interviewed. The findings are relatively consistent across the four regression specifications using different measures of provider availability.

The mean value of preschool hours attended is 7.4. A change in an explanatory variable exhibiting greater than this value on preschool hours occurred for completed doctorate degree and father in U.S. less than four years (at around nine hours greater), and the opinion that the neighborhood is not safe (at a decrease of eight hours). An expected effect near the mean of seven hours of additional preschool attendance occurs through completed less than master's degree, completed master's degree, and being Native American. The regression findings also show that expressing the opinion that neighborhood people are not helpful reduces preschool hours by its exhibited mean of about seven. Being African American (rather than white), exerts a positive magnitude of six additional hours of preschool attendance. Completed bachelor's degree (rather than less than a high school graduate) or does not speak English respectively exert the marginal effects of raising or lowering preschool hours by about five. A child age four, child age five, or household below poverty line (relative to a child age three or household income greater than three times the FPVL), respectively raises, lowers, and lowers hours attended by around four. suburban residence or poverty line to three times poverty line, if changed to satisfy these criteria from urban residence or three times poverty line, lowers preschool hours by around three. Married lowers preschool hours by approximately two hours.

Summary and Policy Implications

An intention of this research was to identify specific characteristics of households (demand-side influences) that affect preschool attendance of children aged three to five. A second intent was to measure the influence of the availability of preschool providers (supply-side influences) to determining this preschool attendance. In this final section, I summarize the regression findings on demand factors most important to preschool attendance and draw policy implications from them. Next, I compare the relative importance of these demand factors to supply factors in preschool attendance. Finally, I discuss the policy relevance of proximity to preschool providers to increasing preschool attendance.

Table 3. Conditional Marginal Effects at Mean for all Statistically Significant Influences on Overall Value of Preschool Hours[1]

Explanatory Variable	No Provider Measure	Provider Measure Within Five Miles	Provider Measure Within Ten Miles	Provider Measure Within Twenty Miles
Household Income and Wealth				
Below Poverty Line	-4.206+	-3.897+	-4.085+	-4.076+
Poverty Line to Three Times Poverty Line	-3.516*	-3.210*	-3.302*	-3.372*
Most Knowledgeable Adult's Education				
Completed Bachelor's Degree	5.228*	4.825*	4.964*	5.061*
Completed Less than Master's Degree	7.703+	6.368+	7.284+	7.602+
Completed Master's Degree	7.057**	6.447**	6.738**	6.862**
Completed Doctorate Degree	8.971**	7.595**	8.138**	8.541**
Family Characteristics				
Married	-2.290+	-2.361+	-2.292+	-2.252+
Parent Other Characteristics				
Does Not Speak English	-4.921+	-4.963+	-5.044+	-4.973+
Father in U.S. Less than Four Years	9.122**	8.800**	8.969**	8.913**
Race and ethnicity				
African American	5.900*	6.506*	6.122*	5.935*
Native American	7.308*	6.697*	7.154*	7.692*
Child Characteristics				
Child Age Four	3.878**	3.768**	3.810**	3.763**
Child Age Five	-4.264**	-4.074**	-4.216**	-4.292**
Neighborhood Characteristics				
Neighborhood People Not Helpful	-6.861*	-6.480*	-6.516*	-6.4447+
Neighborhood Not Safe	-8.179*	-7.751*	-8.197*	-8.245*
Suburban Residence	-3.479**	-3.046**	-3.263**	-3.178**
Preschool Slots Per 3-5 Year Old in 20 Mile Radius	Not sig	Not sig	Not sig	19.986+

[1] Derived using STATA's *margins, dy/dx atmean* command. These indicate the expected change in hours of preschool attended (from a mean of 7.387) for a one-unit change in the respective variable, holding all other explanatory variables constant.

Statistical significance in a two-tailed test: ** $p < 0.01$, * $p < 0.05$, + $p < 0.10$.

Policy Implications from Demand Factors

The regression estimation used here measures the distinct influences that supply and demand factors have on the decision to attend preschool, and for those attending, the further decision regarding how many hours on average in a week to attend. The regression results showing that different factors have distinct impacts on the two-part preschool decision of a parent, are particularly important for the purpose of suggesting public policies to increase preschool activity among three- to five-year-olds, Thus, when developing preschool policy, it is appropriate for policymakers to identify what exactly they seek to increase.

If the goal is to increase preschool participation of any length of time, then attention to those with low household income does matter. A household with an income level at less than three times the federal poverty line (FPVL) is about 50 percent less likely to send their three- to five-year-old to preschool than one with a household income greater than three times the FPVL (holding other causal factors constant). Using this probability based on income change as a base of comparison, the logistic regression method employed here showed that differences in the education level of the most knowledgeable adult (MKA) in the household is three to 10 times more influential in determining whether a three- to five-year-old child attends preschool than income differences.[21]

In addition, recall the simple distinction in Figure 1, and confirmed by others, that Latino children attend preschool at about half the rate of other race/ethnicities. Using logistic regression analysis, this research finds that once accounting for other factors driving preschool attendance, three- to five-year-olds identified as Latino by their MKA parent are no less likely to attend preschool than whites or Asians. Greenberg and Kahn (2012) have also confirmed this finding. Furthermore, the children of African Americans and Native Americans are respectively more than two and four times more likely to attend than whites or Asians. Comparing this influence to the 50 percent less likely drop due to not being at three times the federal poverty line, these positive ethnic/racial effects are more than four and nine times greater. In addition, the fact that a child is three-years-old (as compared to four) puts them at risk of not being in preschool at a measured influence that is over twice as large as the effect of being lower income. Even the detected influence of a parent not speaking English, or believing that neighbors are not helpful, exerts a negative influence on preschool attendance that is about one and half times the negative influence of household income being less than three times the federal poverty level.

There are important policy implications that emerge from these findings. If the policy goal is to increase preschool attendance of any sort through outreach efforts to educate parents about the benefits of preschool attendance, or to subsidize the cost of preschool tuition, such efforts are likely to yield the greatest payout if targeted to those families with a parent possessing less than a bachelor's degree, having a child aged three, being non-English speaking, and who mistrusts the presence of helpfulness in their community.[22]

Alternatively, if the policymaker desires instead to design outreach, education, and subsidy campaigns to increase the hours of preschool attended of those who have already decided to send their children to preschool, the OLS regression results recorded here suggest that these efforts

[21] Barnett and Yarasz (2007) also conclude that policies to increase preschool attendance must reach out to the low-educated parent, and not just the ones with low household income.

[22] See Adams et al. (2008) and Crosby et al. (2005) for summaries of the evidence on how best to provide child care subsidies to low-income families.

will result in the biggest payoff if directed at married parents, of the age 30 to 39, who rent their residence, and are Asian. For these are the only demand side characteristics found to exhibit a statistically significant and negative influence on average preschool hours in a week. With the finding being that for each of these characteristics exhibited in a household, they are likely to exhibit approximately four to five hours less attendance than the 28.5 hours on average observed in this CHIS sample. These influences are cumulative, and a household exhibiting all four enrolls their child in preschool for less than 10 hours.

If government intervention regarding preschool is not meant to specifically increase attendance of any sort or hours attended by those already in preschool, but just has as its goal the desire of raising average hours attended by all children of preschool eligible ages, then the household characteristics to target are again slightly different. These being in order of importance: households with incomes less than three times the federal poverty line; with a most knowledgeable adult with less than a bachelor's degree; married parents; non-African American and non-Native Americans; children aged three; and children aged five not attending kindergarten. Remember, these are single characteristics to look for and not meant to imply that a poor Latino family should not receive the attention of government interventions designed to raise the average hours of preschool attendance among three- to five-year-olds. In this case, it just means that the government's policy interventions could be a result of the family's poverty and not their Latino heritage.

Policy Implications from Supply Factors

This analysis provides important information on the influence of availability of preschool slots per age-eligible children on preschool attendance. First, confirming what previous research of this type has already found, children in suburban households (holding other causal factors constant including the other indicators of location controlled for here) are about 40 percent less likely to attend preschool. Consider also the baseline comparison to the influence of a household's income being at less than three times the federal poverty line as compared to over it, leading to about a 50 percent decrease in likelihood of attending preschool. This discouraging effect of suburban residence on preschool attendance is nearly as large. It indicates that the focus of programs meant to increase preschool attendance should be as much on the household characteristic of living in a suburb as low income.

Furthermore, this study offers clear statistical findings that the supply of slots for preschool attendance, weighted by differences in children who may use them, exerts a significant influence on a household's decision to attend. The average value of this measure for a 20-mile radius of the CHIS respondent's place of residence is 0.177. This means that only 17.7 percent of the three- to five-year-old children living in these radii would have a place to go to preschool if all their parents wanted to send them. Raising this availability by one standard deviation (such that six percent more could potentially attend) within 20 miles of the residences in the sample, the likelihood of an age-appropriate child's preschool attendance (holding the other causal factors contained in this regression analysis) by over 800 percent. Keeping in mind that this study found that lower-income households are about 50 percent less likely to attend preschool than the affluent, these potential increases in probability of attendance due to supply-side influences are worth noting.

Due to these clearly detected positive influences of proximity to likely open preschool attendance slots, public policies that try to achieve greater preschool attendance need to consider the supply side influences on it. Besides targeting households with the identified demand based

characteristics shown to result in a lower likelihood of preschool attendance and hours attended, policymakers may also want to consider public interventions designed to increase the availability of providers (as measured here) in places severely lacking.[23] This could involve direct government provision in these areas in the form of more public and Head Start forms of preschool, or government subsidies to increase the number of preschool slots offered by private preschools. However, policymakers must keep in mind that the influences reported here for an increase in preschool slots per potential preschool demanders include both a lower price affect to existing neighborhood households and the possibility of inducing mobility to the neighborhood in households desiring preschool attendance. Thus, if a statewide program undertaken to increase preschool availability, the regression determined influence of preschool slots per potential demanders could represent an upper-end effect that would be lower in proportion to the amount of mobility household mobility induced through preschool availability.

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[23] See Queralt and Witte (1998) for a regression study of factors found to be important in the determination of the number of childcare centers in Massachusetts communities. They find that high-income communities have larger supply of preschool slots than low-income communities and zoning codes often act as a barrier to further provision.

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