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## Abstract

Poor educational attainment is a persistent problem among latino children, relative to non-Latinos. This paper examines the effects of participation in the Head Start program on Latinos. We find that large and significant benefits accrue to Head Start children when we compare them to siblings who did not participate in the program. On average, Head Start closes at least 1/4 of the gap in test scores between latino children and non-hispanic white children, and 2/3 of the gap in the probability of grade repetition. Latinos are not a homogenous group and we find that the benefits of Head Start are not evenly distributed across sub-groups. Relative to siblings who attend no preschool, the gains from Head Start are greatest among children of Mexican-origin and children of native-born mothers, especially those whose mothers have more human capital. In contrast, latino children whose mothers are foreign-born and Puerto Rican children appear to reap little benefit from attending Head Start, relative to their siblings.



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The available evidence shows that interventions aimed at improving the skills of teens and young adults have limited effects (c.f. Grossman, 1992; Heckman, 1993; Lalonde, 1995; U.S. Dept. of Labor, 1995). Hence, early intervention programs for preschoolers have been suggested as an alternative means of improving educational attainment among disadvantaged children. Children who lag behind their peers when they start school often fall further behind -- they are more likely to repeat grades, and to eventually drop out of school. Thus, the goal of sending every child to school "ready to learn" was endorsed by Congress in the 1994 "Goals 2000: Educate America Act". Preschool programs are thought to help prepare children for school by providing cognitive stimulation, as well as health and nutritional benefits. However, there are large disparities in the utilization of such programs: in 1993, 80% of children in families earning more than $75,000 attended a preschool, compared to 45% of children in families with incomes less than $30,000 per year. Moreover, many of the programs attended by lower income children are of lower quality: they often have higher child/staff ratios, more teacher turnover, teachers with less training, and frequently lack services such as health screenings as well as formal curriculums or guidelines outlining what students are to learn (U.S. General Accounting Office, 1995).

The Head Start program is a notable exception to this rule. Head Start is a federal-local matching grant program that aims to improve the skills of poor children so that they can begin schooling on an equal footing with their more advantaged peers. Program guidelines require that at least 90% of participants be from families below the poverty line. In 1992, for example, 95% of the children served were poor (U.S. Dept. of Health and Human Services, 1993). Begun in 1964 as part of the "War on Poverty", the Head Start program now serves over 700,000 children in predominately part-day programs, at a cost of approximately $4,000 per child, per year (U.S. House of Representatives, 1993). This represents roughly 30% of eligible 3 to 5 year olds. By way of comparison, the average family with an employed mother spent a total of approximately $3,000 on child care in 1991, and poorer families spent even less (Casper, Hawkins and O'Connell, 1994). In order to serve greater numbers of poor children, the federal government has increased Head Start funding annually since 1989. In addition, many state governments began funding similar programs in the early 90s (Smith, Fairchild, and Groginsky, 1995).

The effects of Head Start on black, and to a lesser extent white, students have been extensively discussed,[1] but, to date, the effects of Head Start on latino children have been little studied. This is an important omission for several reasons: a quarter of Head Start children are Hispanic, and many of these children are likely to have special needs, particularly with regard to language skills. As a group, Latinos lag behind both blacks and whites in terms of educational attainment. Although educational attainment has increased significantly for both Latinos and non-Latinos since the 1960s (Bean and Tienda, 1987; Mare, 1994), the latino deficit remains large: in 1990, 58% of Latinos aged 20 to 24 years old were high school graduates compared to 80% of blacks and 85% of non-hispanic whites (Kominski and Adams, 1992). Some, but not all, of this latino deficit is due to immigration by less educated Latinos. For example, in our sample of NLSY mothers, 84% of blacks, and 85% of non-Hispanic whites are high school graduates; in comparison, only 72% of native-born Latinas and a mere 56% of non-native born Latinas graduated from high school.

These educational deficits contribute to high poverty rates among Latinos. In 1990, 26% of Latinos had incomes below the poverty line, relative to 12% of non-Latinos. Among children, the situation was more extreme with 36% of latino children in poverty compared to 18% of non-latino children (U.S. Bureau of the Census, 1991). The average hispanic man earns two-thirds of what a non-hispanic man earns, and Smith (1994) estimates that differences in educational attainment explains 75% of this wage differential. Not only are Latinos economically disadvantaged but they constitute a large and growing fraction of the U.S. population. For example, in 1992, 12% of 15 to 24 year olds were hispanic and the proportion is projected to grow to approximately 20% by 2025 (US Bureau of the Census, 1992).

In this study, we examine the impact of Head Start and other preschools on several measures of the cognitive and educational attainment of latino children using a sample drawn from the National Longitudinal Survey's Merged Child-Mother file (NLSCM). We attempt to isolate the overall effect of participation in the Head Start program by contrasting children who have been enrolled in Head Start with siblings who have not. This strategy enables us to control for all observed and unobserved family

[1] See McKey *et al* (1985) and Barnett (1992) for reviews, and Currie and Thomas (1995) for some recent evidence.

background characteristics that are fixed over time. We also control for some important observed changes in family circumstances over time. In addition, we compare the impact of Head Start relative to "no preschool" to the impact of participation in other preschools relative to "no preschool". The implied "difference-in-difference" allows us to benchmark the effects of Head Start against the effects of other preschools in an attempt to control for possible biases in the estimated program effects due to child-specific determinants of participation in any preschool.

There are quantitatively large and statistically significant positive effects of participation in Head Start on three cognitive test scores and on the probability that a child does not repeat a grade, which we interpret as a measure of schooling attainment. These benefits accrue to Head Start children, relative to siblings who do not attend preschool and also relative to those who attend other preschools. But the benefits of Head Start are not evenly distributed across identifiable subgroups of the latino population. Specifically, latino children with native-born mothers and those of Mexican origin benefit the most. Children of immigrant mothers and Puerto Rican children garner little advantage from participating in Head Start, relative to siblings who attend no preschool.

The rest of the paper is organized as follows: Part I discusses the Head Start program, and presents some hypotheses about why its effects might vary across latino subgroups. Part II discusses our estimation methodology and is followed by a description of the data. The main results are presented in Part IV which is followed by a description and evaluation of the assumptions underlying our methodology in Part V. Part VI concludes.

## I. What Does Head Start Do?

*a) Program Content*

It is useful to make a distinction between preschool and other forms of child care. While preschools will perforce provide child care, not all forms of child care provide children with cognitive stimulation, a supportive environment, medical care, or a nutritious diet. For example, concern has been expressed that the family child care often used by low-income families typically does not enhance child

development (U.S. General Accounting Office, 1994; Fuller *et al.*, 1995). Moreover, while families with working mothers must find some form of child care, we will show below that enrollment in preschool is not closely associated with maternal employment. On the one hand, it is clear that many non-working mothers seek out preschool experiences for their children,[2] and on the other hand, part-day preschool programs may not provide a good substitute for full-day child care.

The Head Start program gives some poor children free access to preschools that are of higher quality than either the preschools, or the other child care arrangements, utilized by many poor children (U.S. General Accounting Office, 1995). To begin with, while non-Head Start preschools are subject to only minimal regulation (U.S. General Accounting Office, 1994), Head Start centers are expected to conform to a specific set of guidelines laid out in the Head Start Program Performance Standards (U.S. DHHS, 1992).[3] Secondly, Head Start programs provide a full range of services. For example, each child is supposed to receive appropriate preventive medical care, such as immunizations and screenings for lead poisoning, and about one-third of the child's daily nutritional needs in the form of meals and snacks. These interventions may enhance cognitive functioning among children at risk for health problems or malnutrition (Brown and Pollitt, 1996). Head Start centers are required to try to involve parents, and many provide parenting programs as well as services to children. Access to this type of quality preschool programming may affect cognition through the direct transmission of skills, through the development of enhanced self-esteem and a positive attitude towards learning, and perhaps indirectly through improvements in health status and the home environment.

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[2] More generally, Hotz and Kilburn (1995) report that a quarter of the non-working mothers of preschool children in the NLSY used some form of non-parental child care in 1986.

[3] The national standards emphasize some specific skills that children are expected to master: for example, children are to work "toward recognition of the symbols for letters and numbers..." and to develop "intellectual skills" more generally (e.g. by listening to stories). The guidelines also place much emphasis on the development of self confidence and a positive attitude towards learning. For example, program administrators need to establish a "supportive social and emotional climate which enhances children's understanding of themselves as individuals...". Children are also to be given "many opportunities for success through program activities", and to "question and gain mastery through learning by doing" (U.S. DHHS, 1992, pages 6 and 7). Thus, although there are over 1,300 Head Start programs all run at a local level, there is some uniformity in their goals and standards. One audit study conducted in the early 90s confirmed that there was substantial compliance with these guidelines -- only approximately 10% of Head Start centers were out of compliance with one or more standards (U.S. DHHS 1993).

*b) Possible Additional Effects on Latinos, and on Latino Subgroups.*

Previous research suggests there are at least two mechanisms through which early childhood interventions could be especially beneficial to latino children relative to non-Latinos. First, for many Latinos, preschool will be their first exposure to English and, second, preschool experiences are likely to enhance cultural assimilation and socialization.

The most obvious way that latino children differ from many other children is that they are less likely to speak English at home. Poor English language skills are likely to affect their educational performance and so, exposure to English in a Head Start program or at another preschool may confer important benefits when the child enters regular school. Moreover, these benefits may well differ depending on whether the child attended Head Start rather than another preschool since Head Start programs are mandated to provide some degree of bilingual education. For example, Head Start centers are supposed to include "persons who speak the primary language of the children and are knowledgeable about their heritage...at least one teacher or aide interacting regularly with the children must speak their language. Where only a few children, or a single child, speak a language different from the rest, one adult in the center should be available to communicate in the native language" (DHHS, 1992, pages 7 and 8). Children are also to be given "ample time to talk to each other and ask questions in the language of their choice". Head Start centers are expected to build "ethnic pride", and to have a "curriculum which is relevant and reflective of the needs of the population served (bilingual/bicultural, multicultural... etc.)". Since there is some debate about whether bilingual education of young children ultimately enhances or hinders the eventual acquisition of English language skills, it is an empirical question whether Head Start programs have a bigger impact than other preschools, where bilingual instruction is not mandated.

It is unlikely that all latino children will benefit equally from the development of English skills since many speak English as their mother tongue. For example, Bean *et al.* (1994) report that over 80% of latina women born in the United States speak only English in the home but fully 84% of the foreign-born speak mostly Spanish at home. To address this issue, the empirical analyses below will be conducted

separately for children born of native mothers and children whose mothers were born abroad.[4]

Language skills are not the only differences between latino and non-latino children. Several investigators have pointed out that, relative to other non-native English speakers, latino children have considerably poorer educational performance (Bernal et al., 1991; Rong and Grant, 1992). The education literature suggests that Latinos are handicapped by a mismatch in the verbal and non-verbal communication styles of students, parents, and teachers. An example that is often given is that teachers may find latino students and parents "passive" when in reality they are trying to be respectful or struggling with a language barrier, and that this perceived passivity may be wrongly interpreted as lack of intelligence or interest in the child's education (Bernal *et al.*, 1991; Knight *et al.*, 1993; Tapia, 1992; Treuba, 1993).

Given high degrees of residential segregation, low levels of "social" or "ethnic" capital (Coleman, 1988; Borjas, 1992; Lazear, 1995), and/or neighborhood effects (Case and Katz, 1991; Mayer and Jencks, 1990) could also work against the educational attainment of latino children. These effects are likely to be particularly severe among children of the foreign born, since as Denton and Massey (1988) report, Hispanics born in the United States are much less likely than latino immigrants to be residentially segregated.

This evidence suggests that Head Start and other preschools may have additional positive effects on latino children by promoting cultural assimilation, and by providing a wider range of role models. In this case, the least assimilated/most socially isolated children might be expected to reap the most dramatic gains from Head Start/preschool. Alternatively, it may be the case that some degree of assimilation is necessary in order for a child to achieve the maximum benefits from Head Start/preschool. That is, if cultural mismatch is a problem for school-age children, it may also be a problem for preschool children. In this case, the most assimilated children might be expected to gain most from Head Start and other preschools. This insight provides an additional motivation for conducting the empirical analyses separately

[4] There are very few children who were born outside the United States in the sample we use and so it is not possible to estimate separate effects for these children. The sample that is used is discussed in detail below.

for latino children of native-born mothers who are likely to be better assimilated than children of mothers born outside the continental U.S.

Thus far, we have been discussing Latinos as a group. However, many scholarly studies emphasize differences in the experiences of various latino subgroups within the United States (c.f. Bean and Tienda, 1987). For example, poverty rates vary from 29.5% among Mexican-origin households to 39.4% for Puerto Rican households (U.S. Bureau of the Census, 1993). The incidence of single-headed households, and low birthweight are also much higher among Puerto Ricans, while the fraction who are not high school graduates is also higher (U.S. Bureau of the Census, 1991b, 1993; Black and Markides, 1993). Latino subgroups may also differ in unmeasured respects relevant to their performance on standardized tests and the benefits they obtain from Head Start and other preschools. Thus, in addition to comparing children of native-born Latinas with children of foreign-born mothers, we will separately examine children of Mexican and Puerto Rican origin.

## II. Methods

If children were randomly assigned to Head Start and other preschools, then the impact of each program could be evaluated by simply comparing those who attend with those who do not. However, children are not randomly assigned to the programs. For example, Head Start children are more likely to live in relatively poor families and children who attended other preschools tend to live in better off households. If, on average, poorer children lag behind in school, then the average Head Start child is also likely to perform poorly in school. Hence direct comparisons of average outcomes for Head Start children with those of other preschoolers are likely to be misleading.

If all the differences between Head Start, preschool and other children were observable (and observed), then it would be straightforward, to control for those characteristics and estimate the true program effect in a multivariate least squares regression context. However, it is difficult to imagine any survey collecting enough information on children and their parents to fully control for all differences among them. In fact, it is entirely plausible that some of the differences are intrinsically *unobservable*

(or very difficult to measure). For example, enrollment in Head Start or preschool is a choice, typically made by parents. Consider two mothers who appear to be identical in all observable dimensions in any survey. If one of them has a better grasp of the potential benefits of Head Start than the other, then, unless that is measured in the survey, it will emerge as an unobservable in the regression. Whether this reflects differences in "tastes" for investment in children's human capital, differences in the information the mother has about how her children will respond to Head Start, or differences in information about the resources available to her in the community (including Head Start programs), the central point is the same. If the better informed mother sends her children to Head Start and makes other investments that enhance child development, then least squares regression estimates of the effects of Head Start will be biased upwards. There may, however, be off-setting biases: for example, Haskins (1989) and Lee *et al.* (1990) argue that given a limited number of spaces, Head Start administrators choose the most disadvantaged children to participate in Head Start. This selection process would tend to bias the estimated effect of Head Start downwards in a least squares regression. It is not possible, therefore, to sign the bias *a priori*.

In the absence of a treatment-control experiment, it is necessary to make an assumption about the structure of these underlying unobservables. If the decision to enroll in Head Start or another preschool program is made by the mother and reflects her "taste" for investment in human capital, for instance, then it will be the same for all her children as long as her tastes do not change over time. In this case, a comparison of outcomes for two siblings, one of whom attended Head Start and one of whom did not, provides an unbiased estimate of the impact of the program. More generally, including a "mother fixed effect" in the regression will control for all time-invariant observed *and* unobserved differences among children within a family.

Not all family characteristics are fixed, however. Household income, whether the mother works, and whether she is living with a spouse or partner may all vary over time, and many studies have investigated whether these factors have a direct impact on child outcomes.[5] For example, growth in

[5] Where the family lives can also change over time and may be important -- it could be related to program availability, and other characteristics of neighborhoods that might impact child outcomes. Unfortunately, we cannot investigate this hypothesis given our small sample sizes. Only 25 of the sample children had mothers who had changed states between the time their two children were age-eligible for Head Start. Another 21 mothers were

family income after a child has attended Head Start may result in a younger sibling being ineligible for the program. If one sibling was raised in poverty (and attended Head Start), while another sibling was not (and did not attend Head Start), estimates of the effects of Head Start based on comparisons between the two siblings would be biased downwards if poverty is associated with worse outcomes. Similarly, one could argue that changes in the marital or employment status of the mother could be related both to the propensity to enroll in Head Start or other preschools and to child outcomes, although the biases in these cases are not obvious *a priori*. Since measures of all three of these changes in family circumstances are reported in the survey, they have been included in the models discussed below.[6]

Still, it could be argued that employment, income, and living arrangements reflect choices made by mothers (and fathers) and thus are properly treated as endogenous variables. We follow a pragmatic approach and estimate the regression models both with and without these potentially endogenous regressors. We find that when family fixed effects are included in the model, the estimated program effects are virtually identical in the two specifications and so we do not report estimates from the more parsimonious model in all tables.

Estimates from fixed effects models of the following form are presented in Section IV below:

$$OUTCOME_{ift} = a_f + bHDST_{if} + cPRE_{if} + dX_{ift} + u_{ift}, \qquad [1]$$

where i indexes the child, f indexes the family, t indexes time, and $a_f$ is a family fixed effect. OUTCOME is one of four indicators of child educational attainment and cognitive achievement that are described below. The covariates of central interest in this study are the dummy variables, HDST and PRE. HDST is equal to one if the child attended Head Start; PRE is equal to one if the child did not attend Head Start but did attend some other preschool program. The vector X includes time-varying family and child-specific characteristics. The latter include the child's gender, age, and a dummy variable equal to one if the child is the first born since they may all affect grade repetition and test scores (even after standardizing

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missing information about the state at the time one of the children was eligible.

[6] There is little evidence that maternal employment *per se* is bad for children (c.f. Parcel and Menaghan, 1994). The effects of single-parenthood are more controversial. Single-parent families are more likely to be poor than other families and it not clear whether the apparent negative effects of single-headedness are due to the poverty of these households or to single-headedness *per se* (Garfinkel and McLanahan, 1986).

with national norms). As discussed above, X also includes controls for whether the mother was working when the child was age 3, whether a spouse or partner was in the household then, and household income averaged over the period the child was age 3 to 5. Because of the inclusion of the family fixed effect, these covariates have the interpretation of changes across time; for example, if a mother works throughout the survey period, then she does not contribute to the identification of the coefficient on maternal employment. Child-specific idiosyncratic residuals are captured by $u_{ift}$.

Only under certain assumptions can the coefficients b and c be interpreted as unbiased estimates of the effects of participation in Head Start and other preschools, respectively. First, these effects are identified by within-family variation in enrollments, so we need to have a large enough sample of "changers" to identify the effects. Half the children in the sample were in families in which there were differences between siblings in the type of preschool attended; inclusion of the "non-changers" allows us to more precisely identify the other controls included in the model.[7] Second, it is assumed that once the characteristics, X, have been controlled, participation in Head Start and other preschool programs is not correlated with the $u_{ift}$. That is, those factors determining within-family differences in selection into the programs are uncorrelated with differences in child outcomes among siblings. A full discussion of the potential biases that may arise if this condition is not satisfied is deferred to Part V, below, where we also present ancillary evidence about the likely importance of these biases. Third, it is important to keep in mind that if there is measurement error, these fixed effects estimates may well understate the true effects of Head Start and other preschools. In the presence of measurement error, taking out fixed effects can result in "throwing the baby out with the bathwater", since much of the true "signal" may be discarded while only the measurement error remains.

As discussed above, there are good reasons to expect the impact of early school experience to differ depending on the ethnic and family background of the child. All the regressions will be estimated

[7] We can group the families in our sample into six categories: all children in Head Start (78 children); all children in other preschools (133 children); no children in any preschool (175 children); some children in Head Start and some with no preschool (130 children); some in other preschool and some in no preschool (142 children); and some in Head Start and some in other preschools (92 children).

separately for children whose mothers are native born and for those with foreign-born mothers; Mexican-origin children and children of Puerto Rican origin are also examined separately.

## III. Data

The National Longitudinal Survey of Youth (NLSY) began in 1979 with 6,283 young women who have been surveyed annually ever since. In 1986, and every other year thereafter, those who had borne at least one child and their children were given a special assessment. That information is contained in the National Longitudinal Survey Child-Mother (NLSCM) files.

For this study, data from each year of the NLSY, 1979 through 1992, have been combined with four waves of the NLSCM (1986, 1988, 1990 and 1992). By 1992, the original NLSY female respondents were age 27 through 34 and information is recorded for some 9,000 children. Attention is restricted to children aged 5 and older at the time of the survey, since only these children had completed the three tests we use.[8] In addition, children without a sibling in the relevant age range are excluded since they cannot be used in the fixed effects analysis. We found that OLS estimates of the effects of Head Start and preschool are very similar whether they are estimated using the full sample of latino children or only the sample with siblings. Finally, this study focuses on latino children who were identified by the NLSY as those with at least one parent of latino descent.[9] After excluding children with missing information on Head Start and other preschool participation, we have a sample of 750 latino children drawn from 324 families.

Although the sample of hispanic mothers was nationally representative at the time the sample was drawn in 1978, subsequent immigration means that the children of these mothers are not representative of all U.S. latino children today. Specifically, all the immigrant mothers in our sample arrived in the United States before 1978, and therefore virtually all of the children were born in the United States.

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[8] Some 3 and 4 year olds were given the PPVT test, but to facilitate cross-test comparisons, we prefer to focus on a sample with non-missing scores on all three tests. Estimates of the effects of Head Start on PPVT were very similar if we also included PPVT scores of 3 and 4 year olds.

[9] The mother/father codes that were counted as Latino are: Mexican American, Chicano, Mexican, Mexicano, Cuban, Cubano, Puerto Rican, Puertorriqueno, Boricua, Latino, Other Latin American, Hispano, and Spanish Descent.

However, the absence of a fully representative sample of latino children is balanced by the rich array of outcome measures available in the NLSCM, and by the relatively large sample of latino children that is available for analysis.

*a) Differences in Family Background*

The questions we use to identify children who attended Head Start and preschool are "Did your child ever attend Head Start?" and "Did your child ever attend preschool?". These questions were asked in 1988, 1990, and 1992. If a mother ever answered "yes" to any one of these questions then we code attendance as a "1" for that child.[10] Table 1 shows selected family background measures for children in Head Start, other preschools, and no preschool. The first three columns pertain to all latino children; groups are broken down by origin and ethnicity in the remaining columns.

The most striking fact that emerges from the table is that Head Start children are disadvantaged. Relative to children who attend other preschools, Head Start children come from families with much lower (long-run) household income[11] and have mothers with less human capital, as indicated by lower rates of high school graduation and lower scores on the Armed Forces Qualifications Test (AFQT), an indicator of verbal, mathematical, and abstract reasoning skills.[12] The mothers of Head Start children also tend to

[10] Most mothers who answered "yes" to the Head Start question, also answered "yes" to the preschool question. While it is possible that they meant the child also attended another preschool, the fraction of children who only attended Head Start and the fraction who are reported as having attended both decline dramatically with family income. In contrast, the probability of only attending another preschool rises with income. Hence, in the regressions reported below, all children who are reported as ever having attended Head Start are distinguished from those who *only* attended other preschools. Moreover, statistical tests suggest this grouping is appropriate. The models have been estimated distinguishing three groups of children: those who only attended Head Start, those who only attended other preschools and those who attended both. We find no significant differences between the effects of Head Start among children whose mothers reported that they only attended Head Start, and among children whose mothers answered "yes" to both questions.

[11] All incomes reported in the paper are in real 1990 dollars and are computed using regional CPI's in order to account for regional price differences. The measure of permanent income we use is the mean household income from 1985 to 1992. We start in 1985 because prior to that date, some women reported their parent's income rather than that of their own household.

[12] The AFQT test was developed by the military to aid in the job placement of new recruits; hence it is primarily a test of the job skills a person is likely to be bring to employment. The AFQT is normalized by mother's age using the whole NLSY sample: a z-score of negative 1 indicates that the mother scored one standard deviation below the NLSY mean.

come from larger families, and households that were less likely to have had either an adult male or an adult female working when the mother was 14. Relative to other preschoolers, Head Start children are less likely to live in a household with a father or father-figure at age 3, and their mothers are less likely to have been working. Head Start children even appear to be disadvantaged relative to those who attend no preschool: long-run family income is about 15% lower in Head Start families although the gaps in other dimensions are much smaller. There can be little doubt that Head Start is serving relatively poor children.

Table 1 also illustrates differences in family background by natality and ethnicity. Mothers are identified as "Mexican origin" if they were Mexican born, or if either of their parents were Mexican born. Puerto Ricans are defined similarly. "Foreign born" refers to those mothers who were born outside of the continental United States. Relative to natives, family income is substantially higher in households with foreign-born and Mexican-origin mothers although these women's human capital levels -- as measured by high school graduation and AFQT scores -- are significantly lower than those of native-born Latinas. In sharp contrast, Puerto Rican families are slightly poorer than other Latinos although maternal human capital levels are actually higher. The link between family income and maternal human capital is clearly not homogenous across these sub-groups.

The association between income and preschool choice also varies across the sub-groups. The probability of attending a preschool rises with income and Head Start participation declines with income for all children except Puerto Ricans. For them, income is unrelated to any of the preschool choices. In addition, Puerto Rican children are much more likely to attend Head Start and less likely to attend other preschools relative to all other Latino children. These facts suggest that Puerto Rican children may be served by Head Start programs of higher quality and by other preschools of lower quality than other Latinos.

In principal, it would be interesting to divide our sample further. For example, we might wish to examine children of Mexican-born mothers and compare them to children of first-generation Mexican women but that would result in very small cell sizes: 56 mothers are Mexican born and 42 are first-

generation women of Mexican-origin. It would also be of interest to stratify both region and ethnicity but again the sample sizes are too small. Thus, we are forced to forego these more disaggregated analyses.

*b) Child Outcomes*

The analysis focuses on test scores from three widely used cognitive tests: the Picture Peabody Vocabulary Test (PPVT), the Peabody Individual Achievement Test in Mathematics (PIAT-MATH), and the Peabody Individual Achievement Test in Reading Recognition (PIAT-READING). Chart 1 provides details about the coding of these variables. Each row shows the measure, the age group for whom the measure was recorded, and some additional comments about the tests and their norms.[13]

Given the protocols described in Chart 1, there is typically more than one measure of each test score per child. There are at least three reasons for scores to differ systematically over time. First, early intervention may provide an initial boost which then "fades out". Second, there may be cohort effects that arise either because of the expansion in the Head Start program over time or, given the structure of the NLSY, because children who were first tested in 1992 are younger, and likely to be born to older mothers than children tested earlier. Alternatively, there may be random variation in test scores reflecting measurement error. We explored two possible methods of summarizing the available information about each child. First, we examined the child's score in 1992. Second, following Currie and Thomas (1995) we examined the mean of all the scores reported for each child. We found that the sample mean of the 1992 scores was very similar to the sample mean taken over each child's mean scores. The latter measure also had systematically smaller standard errors than the mean of the 1992 scores.[14] This result suggests that measurement error is a greater concern than either of the two possible sources of systematic bias

[13] See Baker and Mott (1989) for a fuller description of these tests. Although the tests were offered in Spanish, we found virtually all the children took them in English. We do not use a test of Reading Comprehension available in the NLSCM because this test was only administered to children who scored above a certain level on the Reading Recognition test. Hence, there are complicated selection issues involved in the use of this test.

[14] A comparison of a regression of the child's average score on the 1992 score and the reverse regression provides a simple summary of the evidence. If there is no measurement error, the coefficient in each regression will be 1; if there is measurement error it will be less than one. When the 1992 score is the regressand, the coefficients are 0.89, 0.93 and 0.94 for PPVT, PIAT Math and PIAT reading, respectively. When the average score is the regressand, the slopes are 1.05, 1.01 and 1.02 for the same tests. (Standard errors are 0.01 in all cases.) Not only is there substantial measurement error in the scores in any particular test but it is the PPVTs that appear to be the most noisy.

discussed above.[15] Using the average score for each child (rather than the score at a particular age or point in time) also provides us with more observations, since some children have missing observations for some test scores in some years. Hence, we use the average of all of the scores reported for each child as our measure, and it is the mean of this variable that is reported in Table 1, and used in all of the models reported below.

The relationship between test scores and future child outcomes is a subject of considerable controversy (c.f. Hanushek, 1986), although Murnane, Willett, and Levy (1995) find that a high school senior's mastery of skills taught no later than the 8th grade (as measured by achievement on standardized tests) is a significant determinant of future wages. In view of this controversy, we also examine grade repetition, a measure of schooling attainment.

Academic performance in early grades has been shown to be a significant predictor of eventual high-school completion among both Latinos and non-Latinos (see Barrington and Hendricks, 1989; Cairns *et al.*, 1989; Ekstrom, 1986; Fernandez *et al.* 1989; Grissom and Shepard, 1989; Velez, 1989; and Ensminger and Slusarcick, 1992 for recent evidence on this question.) Currie and Thomas (1995b) show, using the entire NLSCM sample, that the three test scores we consider are good predictors of grade repetition, but that the relationship is certainly not one-to-one. Hence, it is interesting to consider this aspect of scholastic achievement separately, although due to the fact that questions about grade repetition were only asked to children 10 and over, sample sizes for the grade repetition question are roughly half those for the test scores.

Means of these outcomes by preschool status are presented in the second panel of Table 1. Children who attend preschools other than Head Start typically do much better on the standardized tests and are less likely to repeat a grade than all other children. This is not surprising since these children are from the highest income families. However, although Head Start children are the most disadvantaged (in

[15] In principal, it would be interesting to look for "fadeout" of Head Start effects over time among Latinos. However, this analysis is precluded by small sample sizes. The fact that the average of all scores on a test for a particular child is not much different than the 1992 score is consistent with the finding in Currie and Thomas (1995) that there is little "fadeout" in the effects of Head Start among white and hispanic children when the two groups are pooled.

terms of family income and maternal human capital), they slightly outperform children who stay at home. Differences between the sub-groups of Latinos are discussed below.

The test scores shown in Table 1 are expressed in percentiles, so that, in principle, they can be used to assess differences between the average latino child in the sample, and the median child in the United States. However, the PIAT norms are old, and the average non-hispanic white child in the NLSY (including the over-sample of poor children) tests at the 53rd percentile on the PIAT-MATH test and at the 59th percentile on the PIAT-READING test. By way of comparison, the average percentile score on the PPVT test is 45 for non-hispanic white children. Thus, latino children score substantially below the average non-hispanic white child in the NLSY although the gaps on the vocabulary test (PPVT) are much larger than the gaps in the math or reading recognition tests.[16] Also, 27% of these latino children have repeated a grade compared to 23% of the non-hispanic white NLSCM children.

## IV. The Effects of Head Start and Other Preschools

*a) Effects on All Latinos*

Table 2 reports OLS and fixed effects estimates of the effects of Head Start and other preschools on the three test scores and on the probability that a child has never repeated a grade.[17] The first column in each panel reports the average gaps between Head Start children and other preschoolers relative to children who stay at home (the excluded category). These estimates repeat the numbers in Table 1 and are reported to assist in drawing comparisons. For all four outcomes, Head Start children perform slightly better than those who do not attend preschool but other preschoolers do significantly better. These are our baseline estimates of b and c in [1]. The "difference-in-difference" between Head Start and other preschoolers, (b-c), is reported at the foot of the table, along with the associated t statistic. It is negative,

[16] Similarly, the differences between white and black children are greater on the PPVT than on the other tests (Currie and Thomas, 1995b).

[17] Grade repetition is a discrete choice; for ease of interpretation, linear probability estimates are reported. Logits produce very similar estimates.

large in magnitude and significant for all three test scores: Head Start children perform much more poorly than other preschoolers on these tests.

Table 1 demonstrates that, relative to children who attended no preschool, Head Start children are disadvantaged and other preschoolers are better off. The second column of Table 2 demonstrates that observable differences in child and family characteristics explain a good deal of the difference between the three groups of children. When controls for observable characteristics are added to the model, the effects of other preschools are substantially dampened and remain statistically significant only for PIAT-Reading, while the gap between Head Start children and other preschoolers is all but eliminated. Observables do not explain grade repetition well for other preschoolers although they do a better job for Head Start children.

Turning to the controls themselves, we see that first born children have higher scores and older children are more likely to have ever repeated a grade (reflecting the cumulative nature of the indicator). Both maternal AFQT scores and maternal education are positively associated with child test scores: AFQT scores are particularly powerful. However, neither indicator predicts grade repetition. The second set of maternal characteristics are time-varying and dated at around the time the child was first age-eligible for Head Start (age 3). There is little evidence here that family structure or maternal labor force participation are associated with child outcomes, but family income is a powerful predictor of test scores and grade repetition.[18]

In sum, after controlling for observed differences, there is little evidence from the OLS estimates that attendance at either Head Start or other preschools is associated with improved test scores (except for PIAT-Reading among those who go to preschools other than Head Start) although there is some evidence that grade repetition is reduced (but the effects are imprecisely estimated). We have argued, however, that there may be unobserved differences between families and so these OLS estimates may be biased.

[18] As discussed above, arguments could be made for either including or excluding these variables in the model. As it turns out, exclusion of the time-varying characteristics from the regressions in the second column does not change inferences regarding the effects of Head Start and other preschool on the four outcomes. Taking PPVT as an example, the effect of other preschools is 2.69 (standard error=1.95) and Head Start is 1.88 (standard error=2.05) when these effects are excluded.

Estimates from models that include maternal fixed effects are reported in the third column of each panel. These regressions control for all unobserved as well as observed fixed differences between families.

Controlling for unobserved family differences is, apparently, key: the fixed effects estimates are dramatically different from the OLS estimates. Participation in Head Start has a strong positive effect on test scores, particularly on PPVT and Piat-Math, and on the probability a child has not repeated a grade. In contrast, participation in other preschools confers no benefit relative to siblings who stay at home. Further, we find that for all tests except Piat-Reading, there are significant benefits associated with attending Head Start relative to staying at home *and* relative to attending other preschools (as indicated by the positive and significant difference-in-differences at the foot of the table).

In order to say something about the magnitudes of these effects, we can use the average non-hispanic white child as a reference and ask how much of the gap in test scores between this child and the average hispanic child who attended Head Start was made up by participation in the program. To do this, we take the means from Table 1, and assume that if the hispanic Head Start children had not attended the program, their mean scores would have been lowered by the estimated program effects from Table 2. We can then compare this lower score to the mean scores for non-hispanic white children given above in Section 3b to get an estimate of the raw gap. Dividing the program effects by this gap gives a back-of-the-envelope estimate of how much of the gap was closed by participation in the program.

Following this procedure suggests that Head Start closes between one-quarter and one-third of the gap in test scores between latino children and non-hispanic white children, and two-thirds of the gap in the probability of repeating a grade.[19] On the other hand, the estimated effects of other preschools are similar to those found in the OLS models suggesting that when either observable or unobservable characteristics of households are controlled for, attendance at other preschools has no statistically significant effect on child outcomes relative to the alternative of no preschool.

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[19] The calculations (rounding to the nearest integer in the case of test scores) are as follows: in the absence of Head Start, the probability of grade repetition and the scores on the PPVT, PIAT-MATH, and PIAT-READING tests would have been .5, 13.4, 33.4, and 43.6 respectively. Hence, the gaps between these children and the non-Hispanic white children would have been: .27, 31.6, 19.6, and 15.4. Taking the gains shown in Table 5 and dividing by these gaps yields gains of .2/.27, 9.8/31.6, 5.8/19.6, and 3.6/15.4.

One interpretation of these results is that when families pay for preschool, they typically choose programs that do about the same job in terms of stimulating the child's cognitive abilities as the no-preschool alternative.[20] In contrast, Head Start may allow poor parents to send children to programs of higher quality than the alternatives they would otherwise have access to or choose to invest in.

As discussed above, sibling differences in the choice of preschool and in outcomes may depend on changes in family circumstances. Thus, time-varying family characteristics (dated when the child was age 3) are included in the fixed effects regressions reported in the fourth column of each panel. There is some evidence that household structure and maternal employment status have a small direct impact on child outcomes.[21] But our inferences regarding the effectiveness of Head Start and other preschools are unchanged by the inclusion of these variables.

These variables only capture some of the ways that family circumstances change over time. However, the impact of any other unobserved changes that are correlated with these three indicators will, in part, be soaked up by these indicators. The robustness of the key results of this paper to the inclusion or exclusion of time-varying family controls provides some additional confidence in their validity.

*b) Effects on Subgroups of Latinos*

As discussed above, the literature suggests that the impact of early intervention programs may vary with the ethnicity and origin of latino children. To explore this possibility, the models in the fourth column in each panel of Table 2 have been re-estimated using subgroups of latino children. The results are reported in Table 3.

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[20] For example, the amount that the family is willing (or able) to pay for preschool may be related to the opportunity cost of the mother's time. Women with higher opportunity costs may pay more, and get better quality child care. What our results suggest is that the children of these women would also have better cognitive outcomes were they to stay at home instead of attending other preschools.

[21] The most striking result is that PIAT-Math test scores are higher if a spouse or partner was present in the household when the child was age 3, relative to a sibling without a father-figure present at that age. The effect is concentrated among the foreign born: the differential in the sibs' scores is more than 12%ile points (t=2.4). PPVT and PIAT-Reading scores are, however, not different. Fathers, it seems, are better at transferring quantitative relative to verbal skills. Some of the literature on family structure and child-wellbeing has identified differential effects on sons and daughters; however in these data, no gender differences emerge. For excellent discussions of the more general issues, see Seltzer (1994) and Thomson, Hanson, and McLanahan (1995).

To ease comparisons, the first column repeats the numbers in the fourth column of each panel in Table 2. Children whose mothers were born in the continental United States are included in the second column; children of foreign-born mothers are in the third column. Table 1 showed that, for all outcomes other than PPVTs, there is little difference in the average performance of children of native-born mothers relative to those of foreign-born mothers. However, Table 3 shows that the benefits associated with participation in Head Start accrue disproportionately to the native born for whom the effects are positive, large in magnitude, and statistically significant (except for grade repetition which is very imprecisely estimated due to the small sample size). In contrast, among children whose mothers are foreign born, there is no apparent advantage associated with participation in Head Start or in other preschools.

The fourth and fifth columns of Table 3 focus on children whose mothers are of Mexican and Puerto Rican origin, respectively. Head Start compensates for a substantial part of the deficit that participants of Mexican-origin face, at least as measured by PPVT and Piat-Math scores although their reading skills and the probability of repeating a grade seem to be less amenable to improvement through exposure to Head Start. Thus, other things being equal, Mexican-origin children who attend Head Start perform better than siblings who attend other preschool and also siblings who do not attend any preschool.

In contrast, among Puerto Ricans, Head Start confers no discernible benefits relative to keeping a child at home. But, the "difference-in-difference" between Head Start children and other preschoolers is very large and statistically significant for PIAT-Reading, PIAT-Mathematics and for the probability of repeating a grade. Since Puerto Rican children who stay at home perform better than other preschoolers on the PIAT tests, it may be that the other preschools these children attend are of low quality.[22] This is consistent with the fact, noted above, that among these Latino sub-groups Puerto Ricans stand out as the

[22] We were however, unable to find any information about the quality of preschool programs available to children of different latino groups. For example, the NLSY has no information about the quality of preschools, while the National Household Educational Survey has information about quality, but does not identify latino subgroups. Our inquiries also suggest that the Head Start Bureau does not collect such information. The NLSY does however, report child care costs for the youngest child in some years. We found that in 1988, Puerto Rican families spent the least, Mexicans spent 15% more, and the foreign born spent 22% more. If there is a correlation between price and quality, then these figures suggest that Puerto Ricans use the lowest quality child care services.

only group for whom the probability of attending a non-Head Start preschool does not rise with income. Overall probabilities of attending other preschools were also lower among Puerto Ricans.

It is possible that these ethnic differences are due in part by regional differences in the quality of preschool. We have found evidence that among Latinos the effects of attending other preschools are higher in California than in the rest of the country, a finding that is consistent with the fact that for many years, California has had a large, subsidized preschool program for low income children with standards similar to those of Head Start (U.S. General Accounting Office, 1995). Since Puerto Ricans are less likely to live in California than other Latinos, they are less likely to benefit from these programs than say, Mexicans. Unfortunately, sample sizes do not permit us to separately identify the effects of region, and the effects of ethnicity.

As discussed above, English language skills may affect the gains a child receives from Head Start. In the NLSY, mothers chose whether to be interviewed in English or in Spanish. About half of the foreign born latina mothers chose to be interviewed in Spanish at least once, while virtually none of the native-born mothers ever did. We use whether or not the mother was ever interviewed in Spanish as an indicator of whether or not the mother is likely to have spoken Spanish in the home. Since significant benefits accrue to children of native-born mothers who participate in Head Start while Head Start children with foreign-born mothers appear to gain little, one might conclude that Head Start had larger effects on children who spoke English at home. The evidence is, however, ambiguous since children of Mexican origin do benefit from Head Start and about 40% of them had mothers who chose to be interviewed in Spanish. Finally, the vast majority of Puerto Rican children had mothers who always chose to be interviewed in English, but as we saw above, these children gain little from Head Start, relative to attending no preschool.

In order to test more directly whether Head Start is able to compensate for limited exposure to English, the fixed effect regressions have been further stratified by distinguishing those children whose mothers were interviewed in English from those who were not. The results are reported in the first panel of Table 4. Because it is of primary interest, we report only the effect of Head Start; all regressions

include the same set of covariates as Table 3. Almost all native-born mothers and about 90% of Puerto Rican mothers were always interviewed in English and so these decompositions are not performed separately for these groups (although both groups are included in the "all latinos" sample and the Puerto-Rican born are included in the "foreign-born" sample). For sample size reasons, we focus on the three test scores and ignore grade repetition.

The models of PPVT scores indicate that Latinos as a whole and those of Mexican origin, benefit from Head Start regardless of the language spoken at home. However, among children of the foreign born, PPVT scores are significantly higher if Spanish is spoken at home and, in fact, those who speak English at home do not benefit at all. Recall, that we concluded on the basis of Table 3, that Head Start had no effect on the PPVT scores of children of foreign-born mothers. Table 4 suggests that this conclusion must be amended: Head Start benefits children of foreign-born mothers who speak Spanish in the home, but does not benefit the children of foreign-born mothers who speak English at home. This latter group includes, but is not limited to, children of mothers born in Puerto Rico.

Dividing the sample by language of interview produces imprecise estimates of the effects of Head Start on PIAT scores. Nevertheless, the estimates for "all Latinos" suggest that Head Start improves PIAT scores only among the children of Latinas who speak English in the home. It is interesting to contrast these results with those obtained for PPVT scores. It is possible that while vocabulary is improved by participation in a Head Start program, formal math and reading skills are not highly developed at that age. Thus, in order to acquire these skills, children who speak less English at home may need continuing assistance when they reach school age.

Table 1 suggests two additional reason why the benefits of Head Start may differ with the natality of the mother: children of native-born mothers tend to live in households with lower income but more maternal human capital. It is possible that the effects of Head Start differ systematically with family background and resource availability. For example, it may be the case that it is important for the parents to reinforce lessons learned in Head Start (in which case there could be a positive interaction between Head Start and family income or maternal human capital); alternatively, if there are decreasing returns to

human capital investments, it may be the case that the benefits of Head Start are greatest among children from the most disadvantaged backgrounds. These hypotheses are explored in the last two panels of Table 4 which examine the effect of Head Start across the distribution of family income and maternal AFQT. In the second panel, the effects of Head Start on those children whose family income was above the median income for the sample at the time the child was age 3 are distinguished from those whose family income was below the median. In the third panel, the sample is stratified by whether maternal AFQT was above or below the sample median.

The second panel shows that, in general, the impact of Head Start does not vary with income in any of the Latino sub-groups, although there is a tendency for the effect on PPVT and PIAT-Reading scores to be higher among higher income families. (This is also true if households are stratified on permanent income rather than income at age 3.) In contrast, as demonstrated in the third panel of the table, the benefits of Head Start are substantially greater among children whose mothers have higher AFQT scores. However, looking across the columns shows that this differential is only statistically significant among children of the native born. Note that since this is essentially an interaction between Head Start and maternal AFQT holding the level of maternal AFQT constant, it has nothing to do with intergenerational transmission of test-taking skills *per se*. A similar pattern emerges when the data are stratified by whether or not the mother is a high school graduate.

Since differences in the benefits of Head Start by income are small, family resources do not seem to be the key constraint in determining the effectiveness of the Head Start program. Rather, the children who benefit most from participation in Head Start (relative to siblings who stay at home or attend some other preschool) are those whose mothers are both native-born and have higher levels of human capital as measured by AFQT. Either these native-born mothers are, themselves, learning more from the program or they are better able to enhance the stimulation the child receives in the program at home.

In summary, this section has three main results. First, children of native-born mothers reap substantial benefits from participating in Head Start, relative to siblings who attend other preschools and relative to those who stay at home. Among these Head Start children, those whose mothers have more

human capital benefit the most. Second, while the average child of a foreign-born mother does not benefit from Head Start, those Head Start children whose foreign-born mothers were interviewed in Spanish tend to score significantly better on the PPVT than siblings who do not attend Head Start. This finding suggests that the Head Start program provides compensatory exposure to these children for their limited exposure to English during early childhood. Third, there are dramatic differences between ethnic groups with regard to benefits from Head Start: Mexican-origin children appear to reap the largest gains from Head Start, while Puerto Rican children receive little benefit from Head Start relative to siblings who stay home. However, Puerto Rican Head Start children (and children who do not go to any preschool) do perform better than siblings who attend other types of preschools suggesting that these other preschools may be of poor quality.

## V. Discussion

The fixed effects methodology we have adopted provides a powerful means of controlling for unobserved heterogeneity. But, as discussed above, it relies on strong assumptions. Specifically, it is necessary to assume that the factors that determine within-family differences in selection into Head Start or other preschools are not strongly correlated with factors that determine within-family differences in child outcomes. This condition is most likely to be met if administrative factors determine selection into Head Start and other preschools. This would be the case if, for example, whether or not an eligible child attends a preschool program depends on the availability of a program in the community, or on the availability of space in the local program, and this availability changes from year to year for reasons that are unrelated to the family's circumstances. The U.S. General Accounting Office (1995) reports that in the four states they studied, many Head Start and preschool programs serving low income families had lengthy waiting lists although the total number of places available in Head Start has been increasing over time. Hence, it is not implausible that within-family differences in participation are determined largely

by administrative factors, although we do not have the administrative data necessary to directly test this conjecture.[23]

It is also possible that unobserved changes in family circumstances or differences between siblings drive both within-family differences in participation and within-family differences in outcomes. This section discusses possible biases in the estimated effects of Head Start/other preschools that could arise from linkages of this type.

Suppose for example, that parents systematically favor one child (or that one child is more able), and the favored (or more able) child is more likely to be sent to Head Start or other preschools. If favored children also have better outcomes (perhaps because parents make other types of investments in them), then the estimated effects of attendance at either type of preschool would be overstated, since they would capture some of the impact of parental favoritism (or innate ability).

Alternatively, it might be the case that favored children were more likely to be kept at home, in which case, the effects of any preschool might be understated relative to the effects of no preschool. Finally, if instead of having better outcomes, favored children were spoiled and turned out badly, then the effects of Head Start/preschool would be under/over estimated depending on whether these children were more/less likely to attend. We do not need to invoke favoritism or differences in ability among children. Similar biases would occur if parents know what is best for their children and send the child who would benefit most from Head Start to Head Start and the child who would benefit most from another preschool to another preschool.

It is extremely difficult to control for unobserved child-specific factors, although, as discussed above, we do include observable characteristics such as age, gender, and an indicator for whether the child is the first born in all of our regressions. To the extent that parental favoritism (or expectations) are associated with these characteristics (such as, for example, parents preferring males or the first born) their inclusion will control for favoritism in the fixed effects regressions.

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[23] Our inquiries with the Head Start Bureau suggest that they do not collect this information, which may explain why the General Accounting Office found it necessary to do its own survey.

We have explored two strategies to more directly test the hypothesis that favoritism or differential ability explains our results. First, if a child is sent to Head Start because he or she is favored, then we should observe that child being treated preferentially, relative to siblings, in other dimensions of human capital investments. Two indicators of these investments are available in the NLSCM: the number of books the child owns and the number of museum visits made by the child. There is no evidence that the (small) within-family differences in these indicators are related to choice of preschool. Second, by examining indicators of child well-being prior to attendance at Head Start or preschool, it is possible to assess the extent to which our results reflect a correlation between child-specific unobservables and choice of preschool. We have examined four indicators of well-being all measured prior to the child's third birthday. They are birthweight, which may be an indicator of ability or endowment and has been shown to be correlated with cognitive achievement (Rosenzweig and Wolpin, 1995); height-for-age and weight-for- height, which are indicators of longer-run and shorter-run nutritional status, respectively; and whether a child received a doctor check-up in the previous year indicating access to preventive health care. Once again, after controlling for mother fixed effects, we find no evidence that differences in these four outcomes are related to choice of preschool.[24]

Some additional purchase on the problem may be gained if one is willing to assume that the child-specific factors that cause parents to choose Head Start rather than no preschool, are similar to the factors that cause parents to choose other preschools relative to no preschool. Suppose for example that a parents send children who they feel would benefit from Head Start or other preschool programs to these programs, and keep other children at home. Then the fixed effects estimates of Head Start/other preschools will both be biased upwards. But the differences between the estimated effects of Head Start and other preschools will be subject to less bias. These are the "difference-in-difference" estimates presented in Tables 2 and

[24] There is only one case that even borders on significance. Children who were shorter than a sibling, given age (and prior to their third birthdays) are more likely to have attended Head Start whereas a taller sibling is more likely to have attended another preschool. This suggests that, if anything, favored children are sent to preschools rather than Head Start indicating that our estimated Head Start effects may be downward biased. However, the differences in height are small (on the order of 2% around the median height) and the t statistic on the difference-in-difference is only 1.637.

3. The fact that they are positive and significant indicates that Head Start has consistently larger effects than other preschools on child outcomes.

If this fact is to be explained by the biases discussed above, then it would have to be the case either that children who attended Head Start were more favored relative to siblings who stayed home than other preschool children. Or, the difference in ability between the Head Start child and no-preschool siblings would have to be greater than between other preschool children and their no-preschool siblings. Neither of these arguments is particularly compelling. Thus, the larger estimated effects of Head Start in the fixed effects framework suggest that the positive Head Start we find are not driven solely by biases due to unobserved child-specific factors.

We can also ask whether *observable* differences between siblings or changes in family circumstances affect the choice of participation in Head Start or other preschools. Results of these explorations are reported in Table 5. We present estimates from a series of Chamberlain conditional logits which include a household fixed effect. These models place the spotlight on within-family differences in observables.

The choice between sending a child to any preschool (including Head Start) and keeping the child at home is examined in the first panel of the table. For all Latinos, none of the observed child-level or family-level characteristics is a significant predictor of the probability a child attends any preschool. Turning to the latino subgroups, we find that of the 24 coefficients on Head Start and other preschools that are estimated, only one is statistically significant (the first born children of foreign-born mothers are more likely to go to a preschool).

These insignificant results may reflect heterogeneity in the characteristics of children who go to Head Start and those who attend other preschools. Hence, the second panel focusses on those who attend any preschool and examines the choice between Head Start and other preschools.[25] There is weak

[25] The estimation method is analogous to estimating a multinomial logit model with fixed effects in that it imposes the "Independence of Irrelevant Alternatives" assumption that the omission of one option has no effect on the choice between the remaining options. An alternative would be to estimate a multinomial probit model with random effects which would impose the very strong assumption that the omitted household variables are uncorrelated with the variables included in the model.

evidence that, conditional on going to any preschool, a child is more likely to attend a Head Start program if a father-figure is present (if the mother is native born) or if the mother is working (among Mexicans). In both cases, the coefficient is only marginally significant.[26]

The third panel compares Head Start children with those who stay at home and in the fourth panel other preschoolers are compared with siblings who stay at home. There are only two statistically significant coefficients. (If a father-figure is present at age 3, then Mexican-origin children are more likely to attend Head Start rather than stay at home and children of foreign-born mothers are more likely to attend other preschools.) In summary, Table 5 indicates that after controlling for family fixed effects, the choice of preschool is only weakly related to observable child-specific or time-varying family characteristics.[27]

Finally, we turn to the issue of spillovers from one sibling to another. Spillover effects may be important if a child teaches his or her sibling something learned in Head Start or at preschool, if parents learn about child-rearing skills or gain access to services which benefit all children, or if the parents make compensating investments in the child that did not attend any preschool. In all of these cases, Head Start and preschool effects will be underestimated relative to the effects of no preschool in the fixed effects models. We might expect the extent of this bias to be larger for Head Start since the potential for spillovers may be greater in programs which seek to involve parents and make explicit attempts to improve parenting skills.

It is plausible that spillovers are more likely to be transmitted from older to younger children. In this case, the estimated benefits of preschool will be correlated with birth order. Consider a pair of siblings. If the older child attended Head Start, and the younger did not but benefitted indirectly through spillovers, then our fixed effects estimates of the benefits of Head Start will be biased towards zero.

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[26] In our sample, there is no within-family variation in the presence of a spouse or partner and the choice of type of preschool among children with foreign born mothers and those of Mexican origin.

[27] The models in Table 5 have been re-estimated with two additional regressors: birthweight and height-for-age which are indicators of health and, perhaps, ability. Our conclusions are unaffected by their inclusion and, consistent with the evidence described above, there is no evidence that these indicators are correlated with within-family differences in the propensity to enrol a child in a particular type of preschool.

However, if the younger child attended Head Start and first born did not benefit from any spillovers, the estimated Head Start effects will be unbiased. We have explored this hypothesis by including an interaction between whether the child is the first born and both Head Start and preschool attendance. The spillovers hypothesis suggests these interactions should be negative (and equal in magnitude to the main preschool and Head Start effects).

The interactions between first born and preschools other than Head Start are small in magnitude, more often positive than negative and never statistically significant. We conclude there is little evidence of spillovers among these children. The interactions between first born and Head Start are also small, positive and insignificant for PPVT. But, they are negative and, in some cases almost as large as the main effect for the PIATs and grade repetition. Since these interactions are not statistically significant, we view this as only suggestive evidence that there may be spillovers among Head Start children. It does imply, however, that the estimated benefits of Head Start discussed above may, in fact, be lower bounds.[28]

## VI. Conclusions

This study documents large positive effects of participation in Head Start on the test scores and schooling attainment of latino children. Our estimates suggest that on average, Head Start closes at least one quarter of the gap in test scores between latino children and the average non-hispanic white child in the NLSCM, as well as two-thirds of the gap in the probability of grade repetition. In contrast, once family characteristics are controlled for, attendance at other preschools has no statistically significant effect on these measures relative to no preschool, suggesting that families that pay for preschool choose facilities that do about the same job in terms of stimulating their child's cognitive skills as keeping the child at home.

There are important differences in the effects of Head Start and other preschools across subgroups of the latino population. In particular, relative to children who attend no preschool, the benefits of Head Start are smaller among first-generation children and Puerto Rican children, and larger among children

[28] The interactions between Head Start and first born are consistently negative and significant for one sub-group: Puerto Ricans. It appears that there may be important spillovers from older to younger children in these households.

of Mexican origin. Among children of native-born mothers, the gains to Head Start are also larger for children whose mothers have higher AFQT scores. However, our estimates suggest that Puerto Rican children are better off in Head Start than in the alternative preschools used by these children. The finding that for some latino children other preschools may be worse than no preschool may provide a rationale for finding reported by Fuller *et al.* (1995) that latino parents are less likely to use such programs.

This study highlights some of the benefits and costs of analyzing Head Start programs using large survey data sets. On the one hand, we are able to document large effects of Head Start on latino children as a group, as well as differences in the effects of Head Start across latino subgroups. However, even in this relatively large national data set, sample sizes are not large enough to allow us to test many interesting hypotheses about the reasons why Head Start effects differ across groups -- for example, we cannot compare Mexican-origin children whose mothers were foreign born to those whose mothers were native born. Data limitations have also restricted us to focusing on the effects of parent and child characteristics rather than on the impact of "supply side" variations in the availability of different kinds of programs. If it were possible to link administrative or survey data containing information on Head Start centers and other preschools at the local level to household survey data like the NLSCM, a more complete analysis of both "demand and supply" factors would be feasible.

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**Chart 1: Child Outcome Measures**

| Measure | Age Group | Comments |
|---|---|---|
| Grade Repetition ever | 10 years + | Question is whether the child ever repeated a grade. The question has been asked in each wave since 1988. Coded 1 if the mother answered "yes". |
| PPVT Score | 3 years + | Only measured once per child until 1992, when repeat measures were taken. Percentile scores based on nationally accepted norms for age and gender are used. Measures taken while a child was in preschool or Head Start are not used. Subject is shown 4 pictures and read a word. Subject points to picture that corresponds to word. |
| PIAT Scores | 5 years + | Measured as often as the child was age eligible. Percentile scores based on nationally accepted norms for age and gender are used. Reading recognition test has 16 items in which words are read aloud and child points to 1 of 4 words. 84 items in which child reads word aloud. Mathematics test has 100 multiple choice items that range from discriminating and matching problems to geometry. Questions are divided roughly as follows: 50% applications, 30% concepts, and 20% computations. |

# Table 1
## Family background characteristics and child outcomes

| | ALL LATINOS | | | NATIVE BORN | | | FOREIGN BORN | | | MEXICAN | | | PUERTO RICAN | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Head Start | Other Preschool | None | Head Start | Other Preschool | None | Head Start | Other Preschool | None | Head Start | Other Preschool | None | Head Start | Other Preschool | None |
| *Mother characteristics* | | | | | | | | | | | | | | | |
| *Household income (1990 $000)* | | | | | | | | | | | | | | | |
| Long-run average | 21.40 | 30.45 | 24.96 | 20.47 | 29.11 | 25.41 | 23.82 | 34.34 | 24.10 | 24.19 | 31.04 | 25.87 | 20.65 | 27.17 | 23.07 |
| (over 1985-92) | (1.08) | (1.28) | (0.77) | (1.20) | (1.29) | (0.96) | (2.33) | (3.29) | (1.30) | (1.90) | (2.74) | (1.49) | (2.35) | (3.36) | (1.90) |
| When child age 3 | 19.32 | 26.94 | 22.51 | 18.79 | 25.80 | 23.13 | 20.80 | 30.40 | 21.37 | 21.10 | 26.30 | 23.40 | 18.92 | 23.29 | 21.11 |
| (3 year average) | (0.99) | (1.28) | (0.76) | (1.08) | (1.27) | (0.90) | (2.25) | (3.39) | (1.40) | (1.73) | (2.66) | (1.62) | (2.15) | (3.71) | (2.03) |
| High school graduate | 0.55 | 0.78 | 0.57 | 0.59 | 0.82 | 0.64 | 0.46 | 0.66 | 0.47 | 0.48 | 0.63 | 0.42 | 0.54 | 0.80 | 0.63 |
| AFQT z-score | -1.16 | -0.74 | -1.10 | -1.12 | -0.61 | -0.92 | -1.25 | -1.09 | -1.40 | -1.22 | -1.10 | -1.47 | -1.10 | -0.53 | -0.82 |
| | (0.05) | (0.05) | (0.05) | (0.05) | (0.06) | (0.05) | (0.11) | (0.12) | (0.08) | (0.10) | (0.12) | (0.07) | (0.11) | (0.17) | (0.11) |
| Number of siblings | 5.52 | 4.71 | 5.55 | 5.39 | 4.56 | 5.32 | 5.85 | 5.07 | 5.93 | 6.06 | 5.49 | 6.00 | 5.76 | 4.47 | 5.57 |
| (in 1979) | (0.22) | (0.20) | (0.18) | (0.26) | (0.22) | (0.22) | (0.43) | (0.41) | (0.30) | (0.44) | (0.35) | (0.32) | (0.43) | (0.52) | (0.46) |
| *(1) if in hh when mother age 14* | | | | | | | | | | | | | | | |
| Working adult male | 0.36 | 0.43 | 0.36 | 0.41 | 0.47 | 0.41 | 0.22 | 0.33 | 0.28 | 0.38 | 0.42 | 0.41 | 0.21 | 0.20 | 0.24 |
| Working adult female | 0.61 | 0.74 | 0.65 | 0.71 | 0.69 | 0.71 | 0.37 | 0.87 | 0.55 | 0.73 | 0.85 | 0.70 | 0.37 | 0.53 | 0.31 |
| *(1) if when child age 3* | | | | | | | | | | | | | | | |
| Spouse/partner in hh | 0.66 | 0.70 | 0.71 | 0.64 | 0.68 | 0.73 | 0.72 | 0.76 | 0.69 | 0.81 | 0.86 | 0.74 | 0.65 | 0.50 | 0.47 |
| Mother working | 0.30 | 0.42 | 0.33 | 0.29 | 0.42 | 0.37 | 0.31 | 0.42 | 0.27 | 0.40 | 0.43 | 0.37 | 0.23 | 0.33 | 0.12 |
| *Ethnicity and natality* | | | | | | | | | | | | | | | |
| Foreign born | 0.30 | 0.28 | 0.38 | . | . | . | . | . | . | . | . | . | . | . | . |
| Mexican origin | 0.29 | 0.27 | 0.34 | . | . | . | 0.46 | 0.63 | 0.49 | . | . | . | . | . | . |
| Puerto Rican origin | 0.29 | 0.13 | 0.15 | . | . | . | 0.46 | 0.09 | 0.25 | . | . | . | . | . | . |
| *Child outcomes* | | | | | | | | | | | | | | | |
| *Test scores* | | | | | | | | | | | | | | | |
| PPVT | 23.11 | 29.77 | 21.92 | 25.17 | 32.86 | 24.74 | 18.21 | 21.95 | 17.34 | 25.35 | 22.02 | 15.35 | 20.34 | 28.78 | 18.15 |
| %ile | (1.73) | (1.74) | (1.18) | (2.01) | (2.05) | (1.49) | (3.29) | (3.10) | (1.86) | (3.44) | (3.12) | (1.60) | (3.20) | (5.13) | (2.98) |
| Piat Mathematics | 39.13 | 44.22 | 39.03 | 38.58 | 45.36 | 39.92 | 40.43 | 41.34 | 37.57 | 41.79 | 40.68 | 35.54 | 38.66 | 39.21 | 41.87 |
| %ile | (1.57) | (1.57) | (1.15) | (1.86) | (1.85) | (1.41) | (2.94) | (2.94) | (1.97) | (3.25) | (2.92) | (1.95) | (2.93) | (4.82) | (3.28) |
| Piat Reading Recog | 47.18 | 56.16 | 46.87 | 46.87 | 55.89 | 46.56 | 47.89 | 56.85 | 47.36 | 47.61 | 54.66 | 44.56 | 47.95 | 50.19 | 43.98 |
| %ile | (1.78) | (1.56) | (1.41) | (2.15) | (1.82) | (1.72) | (3.20) | (3.05) | (2.41) | (3.66) | (3.09) | (2.44) | (3.43) | (4.34) | (4.33) |
| (1) never failed | 0.70 | 0.79 | 0.66 | 0.67 | 0.81 | 0.69 | 0.76 | 0.77 | 0.62 | 0.81 | 0.83 | 0.57 | 0.63 | 0.69 | 0.64 |
| Sample size | 182 | 237 | 331 | 128 | 170 | 205 | 84 | 67 | 126 | 52 | 65 | 111 | 52 | 30 | 49 |
| Within group %ages | 24 | 32 | 44 | 25 | 34 | 41 | 30 | 24 | 46 | 22 | 29 | 49 | 40 | 23 | 37 |

Notes: Standard errors in parentheses. Sample sizes for grade repetition are roughly half those reported in the last two rows.

Table 2

OLS and Fixed Effects Estimates of Impact of Head Start and Other Preschools on Test Scores and Grade Repetition

| | PPVT %ile score | | | | PIAT MATH %ile score | | | | PIAT READING %ile score | | | | NEVER REPEATED A GRADE | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | OLS | | FE | | OLS | | FE | | OLS | | FE | | OLS | | FE | |
| | (1) | (2) | (3) | (4) | (1) | (2) | (3) | (4) | (1) | (2) | (3) | (4) | (1) | (2) | (3) | (4) |
| (1) Child ever attended | | | | | | | | | | | | | | | | |
| Head Start | 1.18 | 2.41 | 9.75 | 9.86 | 0.10 | 1.21 | 5.78 | 5.15 | 0.31 | 1.35 | 3.60 | 3.05 | 0.04 | 0.10 | 0.20 | 0.22 |
| | (0.54) | (1.19) | (4.05) | (4.06) | (0.05) | (0.61) | (2.10) | (1.86) | (0.14) | (0.62) | (1.18) | (0.99) | (0.70) | (1.68) | (1.94) | (2.09) |
| Other preschool | 7.85 | 2.65 | 2.98 | 2.97 | 5.19 | 2.03 | -4.05 | -3.84 | 9.29 | 5.93 | -0.44 | -0.45 | 0.13 | 0.11 | -0.04 | -0.06 |
| | (3.90) | (1.38) | (1.28) | (1.26) | (2.77) | (1.09) | (1.52) | (1.44) | (4.42) | (2.87) | (0.15) | (0.15) | (2.32) | (1.90) | (0.35) | (0.55) |
| Child characteristics | | | | | | | | | | | | | | | | |
| Male | . | -0.24 | 0.40 | 0.29 | . | -2.65 | -3.20 | -2.87 | . | -5.80 | -4.46 | -4.23 | . | -0.08 | -0.07 | -0.07 |
| | | (0.15) | (0.26) | (0.19) | | (1.71) | (1.81) | (1.62) | | (3.38) | (2.27) | (2.14) | | (1.68) | (1.17) | (1.05) |
| First born | . | 5.45 | 3.84 | 3.61 | . | 3.23 | 2.32 | 2.34 | . | 5.16 | 2.36 | 2.26 | . | -0.06 | 0.09 | 0.08 |
| | | (2.98) | (1.93) | (1.79) | | (1.81) | (1.02) | (1.02) | | (2.62) | (0.94) | (0.89) | | (1.15) | (1.11) | (0.94) |
| Age in 1992 (years) | . | 0.06 | 0.09 | 0.12 | . | 0.03 | -0.36 | -0.12 | . | 0.08 | 0.26 | 0.39 | . | -0.02 | -0.08 | -0.08 |
| | | (0.21) | (0.21) | (0.28) | | (0.09) | (0.74) | (0.25) | | (0.27) | (0.48) | (0.71) | | (2.11) | (3.43) | (3.20) |
| Mother characteristics (fixed across children) | | | | | | | | | | | | | | | | |
| High school | . | 3.51 | . | . | . | 3.50 | . | . | . | 3.97 | . | . | . | . | . | . |
| | | (1.81) | | | | (1.85) | | | | (1.90) | | | | (0.02) | | |
| AFQT z-score | . | 8.73 | . | . | . | 4.13 | . | . | . | 4.53 | . | . | . | 0.02 | . | . |
| | | (7.38) | | | | (3.58) | | | | (3.56) | | | | (0.61) | | |
| # siblings of mother | . | -0.92 | . | . | . | -0.25 | . | . | . | -0.13 | . | . | . | 0.01 | . | . |
| | | (3.38) | | | | (0.95) | | | | (0.45) | | | | (0.77) | | |
| (1) if adult in hh when mother age 14 who worked | | | | | | | | | | | | | | | | |
| female | . | -2.32 | . | . | . | -1.85 | . | . | . | -5.02 | . | . | . | 0.01 | . | . |
| | | (1.40) | | | | (1.14) | | | | (2.80) | | | | (0.18) | | |
| male | . | 2.07 | . | . | . | 1.47 | . | . | . | 5.80 | . | . | . | 0.09 | . | . |
| | | (0.71) | | | | (0.52) | | | | (1.85) | | | | (1.02) | | |
| Mother characteristics (when child was age 3) | | | | | | | | | | | | | | | | |
| Spouse/partner present | . | -0.61 | . | -0.34 | . | -1.56 | . | 5.25 | . | -1.08 | . | 3.54 | . | . | . | 0.02 |
| | | (0.32) | | (0.14) | | (0.85) | | (1.94) | | (0.54) | | (1.18) | | (0.02) | | (0.16) |
| Mother working | . | -1.92 | . | -2.00 | . | -0.88 | . | 0.73 | . | -1.53 | . | -0.19 | . | -0.02 | . | -0.06 |
| | | (1.05) | | (0.88) | | (0.49) | | (0.29) | | (0.77) | | (0.07) | | (0.32) | | (0.64) |
| ln(family income) | . | 4.72 | . | 0.38 | . | 6.56 | . | 3.99 | . | 7.91 | . | 3.23 | . | 0.18 | . | 0.14 |
| | | (3.04) | | (0.16) | | (4.33) | | (1.46) | | (4.72) | | (1.07) | | (4.04) | | (1.50) |
| Intercept | 21.92 | -14.96 | 18.63 | 15.36 | 39.03 | -21.55 | 45.16 | -0.68 | 46.87 | -29.47 | 47.82 | 12.70 | 0.66 | -0.87 | 1.73 | 0.34 |
| | (16.84) | (0.95) | (4.43) | (0.63) | (32.21) | (1.40) | (9.38) | (0.02) | (34.50) | (1.73) | (8.97) | (0.41) | (20.32) | (1.87) | (6.33) | (0.33) |
| Difference-in-difference | | | | | | | | | | | | | | | | |
| Head Start-Oth preschool | -6.67 | -0.24 | 6.76 | 6.90 | -5.09 | -0.82 | 9.83 | 8.99 | -8.98 | -4.59 | 4.04 | 3.50 | -0.09 | -0.01 | 0.24 | 0.28 |
| | (2.86) | (0.11) | (2.49) | (2.51) | (2.34) | (0.38) | (3.17) | (2.89) | (3.69) | (1.90) | (1.17) | (1.01) | (1.35) | (0.17) | (1.81) | (2.07) |
| $R^2$ | 0.02 | 0.21 | 0.75 | 0.75 | 0.01 | 0.12 | 0.62 | 0.62 | 0.03 | 0.16 | 0.63 | 0.63 | 0.01 | 0.12 | 0.74 | 0.75 |
| Sample size | | 750 | | | | 750 | | | | 750 | | | | 376 | | |

Notes: t statistics in parentheses. OLS regressions in column 2 include controls for missing values of family characteristics. Grade repetition questions asked only of children 10 and older; test scores sample includes children 5 and older.

## Table 3: Effects of Head Start and Other Preschool on Child Outcomes

**Fixed effects estimates: stratified by natality and place of origin of mother**

| | ALL LATINOS | —Mother of child is— Native born | Foreign born | ——Child is of—— Mexican origin | Puerto Rican origin |
|---|---|---|---|---|---|
| PPVT | | | | | |
| Head Start | 9.86 | 12.21 | 3.95 | 15.10 | 2.76 |
| | (4.06) | (4.07) | (0.96) | (3.87) | (0.66) |
| Other preschool | 2.97 | 2.33 | 1.73 | 5.10 | -3.92 |
| | (1.26) | (0.78) | (0.46) | (1.26) | (0.77) |
| Difference | 6.90 | 9.88 | 2.21 | 10.00 | 6.68 |
| | (2.51) | (2.87) | (0.49) | (2.31) | (1.27) |
| $R^2$ | 0.75 | 0.74 | 0.78 | 0.76 | 0.82 |
| PIAT-Mathematics | | | | | |
| Head Start | 5.15 | 6.42 | 2.39 | 9.95 | 0.73 |
| | (1.86) | (1.95) | (0.46) | (2.08) | (0.13) |
| Other preschool | -3.84 | -3.83 | -6.95 | -0.46 | -16.56 |
| | (1.44) | (1.17) | (1.44) | (0.09) | (2.40) |
| Difference | 8.99 | 10.24 | 9.34 | 10.41 | 17.29 |
| | (2.88) | (2.72) | (1.62) | (1.96) | (2.44) |
| $R^2$ | 0.62 | 0.62 | 0.64 | 0.65 | 0.65 |
| PIAT-Reading Recognition | | | | | |
| Head Start | 3.05 | 6.97 | -6.23 | 2.09 | 0.63 |
| | (0.99) | (2.02) | (1.01) | (0.37) | (0.11) |
| Other preschool | -0.45 | -2.06 | -1.81 | 2.86 | -14.94 |
| | (0.15) | (0.60) | (0.32) | (0.48) | (2.06) |
| Difference | 3.50 | 9.03 | -4.42 | -0.77 | 15.58 |
| | (1.01) | (2.28) | (0.65) | (0.10) | (2.09) |
| $R^2$ | 0.63 | 0.67 | 0.62 | 0.64 | 0.71 |
| Never repeated a grade | | | | | |
| Head Start | 0.22 | 0.21 | 0.13 | 0.11 | 0.29 |
| | (2.09) | (1.56) | (0.74) | (0.60) | (1.03) |
| Other preschool | -0.06 | -0.16 | -0.06 | -0.07 | -0.35 |
| | (0.55) | (1.00) | (0.31) | (0.24) | (1.14) |
| Difference | 0.28 | 0.36 | 0.19 | 0.18 | 0.64 |
| | (2.07) | (2.05) | (0.88) | (0.63) | (1.80) |
| $R^2$ | 0.75 | 0.77 | 0.75 | 0.75 | 0.74 |
| Sample sizes: | | | | | |
| Test scores | 750 | 503 | 247 | 228 | 131 |
| Never failed | 376 | 232 | 144 | 120 | 68 |

Note: t statistics in parentheses. Difference=Head Start-Other preschool. Regressions include controls for child's age, gender, whether first born, presence of spouse/partner at age 3, mother employed at age 3, ℓn(mean household income while age 3-5).

## Table 4: Effect of Head Start on Test Scores
## Stratified by language of interview, level of maternal AFQT and level of family income

| | | ALL LATINOS | —Mother of child is— Native born | Foreign born | —Child origin is— Mexican | Puerto Rican |
|---|---|---|---|---|---|---|
| **Language of interview** | | | | | | |
| PPVT | Foreign language | 15.19 | . | 18.22 | 20.61 | . |
| | | (2.60) | | (3.17) | (3.01) | |
| | English | 10.12 | . | 1.15 | 15.03 | . |
| | | (3.93) | | (0.22) | (3.25) | |
| Piat Math | Foreign language | 4.52 | . | 4.91 | 5.82 | . |
| | | (0.62) | | (0.64) | (0.60) | |
| | English | 5.01 | . | 0.19 | 8.02 | . |
| | | (1.74) | | (0.03) | (1.47) | |
| Piat Reading | Foreign language | -5.81 | . | -12.75 | -17.25 | . |
| | | (0.55) | | (1.21) | (1.31) | |
| | English | 6.77 | . | -0.56 | 7.98 | . |
| | | (2.13) | | (0.07) | (1.21) | |
| **Family income when child was age 3** | | | | | | |
| PPVT | > median | 14.39 | 14.68 | 10.45 | 11.93 | 38.83 |
| | | [2.62] | [2.27] | [0.87] | [1.59] | [2.07] |
| | < median | 9.93 | 13.08 | 4.36 | 15.96 | 3.85 |
| | | [3.74] | [3.99] | [1.00] | [3.58] | [0.74] |
| Piat Math | > median | 9.17 | 11.08 | 0.29 | 6.20 | 30.19 |
| | | [1.52] | [1.64] | [0.02] | [0.65] | [1.48] |
| | < median | 5.78 | 9.19 | 2.11 | 10.81 | 3.34 |
| | | [1.81] | [2.34] | [0.38] | [1.86] | [0.52] |
| Piat Reading | > median | 0.61 | 0.49 | 0.04 | -2.75 | 7.70 |
| | | [0.09] | [0.07] | [0.00] | [0.28] | [0.37] |
| | < median | 7.68 | 14.94 | -5.45 | 5.35 | 0.04 |
| | | [2.01] | [3.55] | [0.73] | [0.65] | [0.01] |
| **Maternal AFQT** | | | | | | |
| PPVT | ≥ median | 13.90 | 18.37 | 2.25 | 9.66 | 2.40 |
| | | (3.35) | (3.66) | (0.30) | (1.15) | (0.31) |
| | < median | 6.31 | 6.62 | 4.70 | 13.06 | -1.02 |
| | | (2.36) | (2.02) | (1.02) | (3.33) | (0.25) |
| Piat Math | ≥ median | 9.10 | 10.24 | 7.52 | 10.07 | -2.35 |
| | | (2.18) | (2.16) | (0.75) | (1.24) | (0.25) |
| | < median | 1.67 | 3.05 | 0.54 | 4.79 | -0.35 |
| | | (0.50) | (0.72) | (0.09) | (0.84) | (0.05) |
| Piat Reading | ≥ median | 14.37 | 15.70 | 9.01 | 18.09 | 6.11 |
| | | (3.25) | (3.04) | (0.97) | (1.77) | (0.80) |
| | < median | -2.16 | 2.06 | -9.47 | -6.91 | -7.05 |
| | | (0.52) | (0.44) | (1.14) | (0.96) | (0.77) |

Notes: Coefficients and (standard errors) on control for Head Start reported for each regression; all regressions also include a family fixed effect along with controls for other preschools, child's age, gender and whether first born, whether father-figure in household at age 3, whether mother working at age 3 and ln(family income) around age 3. Language of interview is English if all Child-Mother interviews conducted in English. Almost all natives were interviewed in English; they are excluded from the analyses; About 90% of Puerto Rican mothers were interviewed in English and, given the small cell sizes, they are also excluded from the analyses.

## Table 5: Conditional Fixed Effects Estimates of Probability Attending Head Start, Other Preschools or Non Preschool

| | ALL LATINOS | —Mother of child is— Native born | Foreign born | ——Child is of—— Mexican born | Puerto Rican born |
|---|---|---|---|---|---|
| 1. Any Preschool vs None | | | | | |
| Child -- Male | 0.17 | 0.15 | 0.20 | -0.43 | -0.07 |
| | (0.73) | (0.51) | (0.48) | (0.98) | (0.13) |
| First born | 0.39 | 0.04 | 1.15 | 0.80 | -0.37 |
| | (1.27) | (0.09) | (2.08) | (1.42) | (0.50) |
| Age in 1992 (years) | -0.10 | -0.05 | -0.17 | -0.16 | 0.14 |
| | (1.77) | (0.75) | (1.77) | (1.78) | (1.11) |
| Family characteristics at age 3 | | | | | |
| Spouse/partner present | 0.08 | -0.28 | 0.93 | 1.03 | 0.35 |
| | (0.25) | (0.71) | (1.59) | (1.60) | (0.47) |
| Mother working | -0.17 | -0.40 | 0.34 | -0.06 | 0.07 |
| | (0.51) | (0.93) | (0.57) | (0.09) | (0.08) |
| ℓn(family income) | 0.14 | 0.39 | -0.58 | -0.50 | -0.44 |
| | (0.45) | (0.97) | (0.97) | (0.87) | (0.66) |
| 2. Head Start vs Other Preschool | | | | | |
| Child -- Male | -0.37 | -0.11 | -1.46 | 0.62 | -0.18 |
| | (0.77) | (0.18) | (1.14) | (0.51) | (0.13) |
| First born | 0.31 | 0.64 | -0.14 | 1.47 | -1.58 |
| | (0.53) | (0.87) | (0.12) | (0.87) | (1.13) |
| Age in 1992 (years) | -0.05 | -0.19 | 0.35 | -0.05 | 0.45 |
| | (0.40) | (1.19) | (0.96) | (0.09) | (1.41) |
| Family characteristics at age 3 | | | | | |
| Spouse/partner present | 1.65 | 1.54 | . | . | 1.22 |
| | (1.94) | (1.76) | | | (0.85) |
| Mother working | 0.94 | 0.73 | 2.48 | 2.61 | -0.61 |
| | (1.40) | (0.83) | (1.59) | (1.65) | (0.34) |
| ℓn(family income) | 0.35 | 0.34 | 0.64 | -1.69 | 1.45 |
| | (0.58) | (0.43) | (0.37) | (1.05) | (1.00) |
| 3. Head Start vs None | | | | | |
| Child -- Male | 0.39 | 0.45 | 0.43 | 0.17 | 0.10 |
| | (1.19) | (1.10) | (0.73) | (0.27) | (0.15) |
| First born | 0.67 | 0.52 | 0.95 | 1.71 | -0.77 |
| | (1.48) | (0.88) | (1.25) | (1.87) | (0.85) |
| Age in 1992 (years) | -0.03 | 0.03 | -0.14 | -0.21 | 0.24 |
| | (0.38) | (0.30) | (1.08) | (1.48) | (1.34) |
| Family characteristics at age 3 | | | | | |
| Spouse/partner present | -0.29 | -0.39 | -0.24 | 2.67 | 0.36 |
| | (0.68) | (0.78) | (0.28) | (2.18) | (0.40) |
| Mother working | -0.24 | -0.41 | 0.10 | 0.46 | 0.03 |
| | (0.43) | (0.60) | (0.10) | (0.44) | (0.03) |
| ℓn(family income) | 0.52 | 0.93 | -0.70 | 0.06 | -0.36 |
| | (1.08) | (1.59) | (0.67) | (0.08) | (0.38) |
| 4. Other Preschool vs None | | | | | |
| Child -- Male | 0.26 | -0.07 | 0.42 | -0.88 | -0.02 |
| | (0.73) | (0.16) | (0.55) | (1.13) | (0.02) |
| First born | 0.17 | -0.37 | 1.57 | 0.04 | 0.39 |
| | (0.39) | (0.64) | (1.82) | (0.06) | (0.20) |
| Age in 1992 (years) | -0.20 | -0.19 | -0.26 | -0.20 | -0.03 |
| | (2.36) | (1.65) | (1.79) | (1.47) | (0.09) |
| Family characteristics at age 3 | | | | | |
| Spouse/partner present | 0.95 | 0.74 | 2.16 | 0.91 | 0.95 |
| | (1.86) | (1.07) | (2.21) | (1.27) | (0.64) |
| Mother working | 0.10 | -0.14 | 0.88 | -0.27 | 1.09 |
| | (0.22) | (0.23) | (1.04) | (0.29) | (0.62) |
| ℓn(family income) | -0.21 | -0.04 | -1.17 | -2.21 | -0.21 |
| | (0.44) | (0.06) | (1.41) | (1.33) | (0.18) |

Notes: t statistics in parentheses.

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