NBER WORKING PAPER SERIES

DOES HEAD START MAKE A DIFFERENCE?

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Working Paper No. 4406

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
July 1993

We thank Jon Gruber for helpful comments and Nancy Cole for excellent research assistance. Janet Currie thanks the National Science Foundation for support under SES-9122640 and the National Bureau of Economic Research for support under the Olin fellowship program. This paper is part of NBER's research programs in Labor Studies and Health Economics. Any opinions expressed are those of the authors and not those of the National Bureau of Economic Research.

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ABSTRACT

Although there is a broad bi-partisan support for Head Start, the evidence of positive long-term effects of the program is not overwhelming. Using data from the National Longitudinal Survey's Child-Mother file, we examine the impact of the program on a range of child outcomes. We compare non-parametric estimates of program effects with estimates from parametric models that control for selection by including mother fixed effects. This comparison suggests that studies that ignore selection can be substantially misleading; it also suggests that the impact of selection differs considerably across racial and ethnic groups. After controlling for selection, we find positive and persistent effects of participation in Head Start on the test scores of white and Hispanic children. These children are also less likely to have repeated a grade. We find no effects on the test scores or schooling attainment of African-American children. White children who attend Head Start are more likely to receive a measles shot, while African-American enrollees receive measles shots at an earlier age. African-American children who attend Head Start are also taller than their siblings. In a sample of the children's mothers, we find evidence that whites who attended Head Start as children are taller and have higher AFQT scores than their siblings who did not.

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Head Start is a federal matching grant program that aims to improve the learning skills, social skills, and health status of poor children so that they can begin schooling on an equal footing with their more advantaged peers. Federal guidelines require that 90% of the children served be from families with incomes below the federal poverty line. Begun in 1964 as part of the "War on Poverty", Head Start is the element of that program which has enjoyed the greatest public and bi-partisan support. Former President Bush and President Clinton have pledged to increase federal funding so that all eligible children may be served. Today 622,000 children, roughly 28% of eligible 3 to 5 year olds, are served at a cost of $2.2 billion per year (Stewart, 1992).

Both policy makers and the general public appear to believe that the benefits of Head Start are well-known and well-documented. Head Start is thought to have significant immediate effects on IQ which decline over time and become insignificant by the third grade. Head Start is also thought to reduce grade repetition, high school dropout rates, and teenage pregnancies, and to improve children's medical care and health status (c.f. Children's Defense Fund, 1992). However, a close reading of the literature shows that the evidence in support of these conclusions is rather limited.

To begin with, despite the broad goals of the Head Start program, the majority of previous studies have focused only on assessing gains in terms of IQ. For example, a recent review of 210 studies conducted by the U.S. Department of Health and Human

Services (McKey et *al.*, 1985)[1] cites only 34 studies that have examined effects on health. These 34 studies provide useful qualitative information about the health effects of the program, but very few of them attempt to quantify the effects in any way.

McKey *et al.* also note that few studies have examined the impact of Head Start on schooling attainment. These include: McDonald and Monroe (undated), Goodstein, Cawley, and Burrows (1975), Consortium (1983), Copple, Cline, and Smith (1987), Bee (1981) and Hebbeler (1985). The first two studies found positive effects while the others found little effect. And we are aware of only one other study (McDonald and Monroe) that has examined the impact of Head Start on measures of long term achievement such as high school completion, welfare participation, and age at first birth. They examine the effects of Head Start on high school completion and teen pregnancy but find no effect.

In fact, the most widely cited evidence in support of the long-term benefits of Head Start comes from studies of model preschool programs such as the Perry Preschool Project or the Tennessee Early Training Project. These programs were funded at higher levels, involved more intensive programs, and had better-trained staff then the typical Head Start program. Furthermore, many of these studies involved very small samples: for example, the

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[1] There have been several other surveys of the Head Start literature. See Westinghouse Learning Corporation and Ohio University (1969), Bronfenbrenner (1975), Datta (1979), Horowitz and Paden (1973), and White (1985-86). Vinovskis (1993) shows that the debate about the efficacy of compensatory education in the U.S. dates back at least to the 1840's when 40% of all three year olds in Massachusetts were attending infant schools.

Perry Preschool Project followed 58 treatments and 65 controls (Berrueta-Clement *et al*, 1984).

Finally, many studies make use of a quasi-experimental design in which the comparison children are drawn from waiting lists for the Head Start program. There is anecdotal evidence that local staff select the most disadvantaged children to participate. If this is true, then studies that rely on this design could understate the effect of Head Start (Haskins, 1989). Lee, Brooks-Gunn and Schnur (1988) reanalyzed data on Head Start children and two groups of "controls" and found that the Head Start group were less likely to have a father present, and had less educated mothers. Barnett (1992) notes that many studies are also biased by attrition since children who attend remedial classes, who repeat a grade, or who move, are lost.

In this study we use data from the National Longitudinal Survey's Child-Mother file (NLSCM) to examine the impact of Head Start on a broad array of outcomes including measures of the child's cognitive attainment, scholastic success, utilization of medical care, and health. The NLSCM offers a large national sample of children who attended regular Head Start programs. Since both mothers and children were asked about participation in the program, we also use the sample of mothers to examine the long term effects of Head Start.

A great advantage of the NLCSM is that, in contrast with many previous studies, we can include controls for differences between the family backgrounds of Head Start children and non-Head Start children, by comparing the outcomes of children who were enrolled to those of siblings who were not. Similarly, when we turn to the sample of mothers, we can compare mothers who were enrolled with their sisters who were not.

It is also possible to identify children who attended other types of preschool programs and to compare their outcomes with those of the Head Start children. These children may be a more relevant comparison group than children who attend no preschool since they are also cared for in group settings away from home.

The rest of the paper is laid out as follows: Section 2 provides a discussion of the methods we employ. An overview of the data including non-parametric estimates appears in section 3. Results based on sibling differences are shown in section 4 and our conclusions follow. To make a long story short, we find that participation in Head Start has a positive effect on a broad range of outcomes, but there are significant racial and ethnic variations in the effects which cannot be entirely explained by the fact that some groups are more disadvantaged than others. In this paper, we focus on identifying those who benefit from Head Start and the ways in which these children benefit; we see this as a necessary first step towards a more complete evaluation of the costs and benefits of Head Start.[2]

[2] Expenditures on Head Start comprised 20% of all federal expenditures on child care in 1986 (Kahn and Kamerman, 1987). It would be useful to compare the costs and benefits of Head Start with public and private expenditures on other forms of child care. These comparisons are complicated by the fact that 80% of Head Start programs are part-day and may not be close substitutes for other (full-day) child-care services. (Hayes *et al.*, 1990).

2. Model and Empirical Methods

We are interested in measuring the impact of participation in Head Start on a series of indicators of child well-being, Y_i; these include measures of cognitive achievement, performance in school, vaccination histories, and child height which is an indicator of nutritional status. Following Becker (1981), we assume that household members allocate resources in order to maximize their welfare given a budget constraint and a human capital production function. This leads to a conditional demand function (Pollak, 1969) in which child outcomes, Y_i, depend on individual and household characteristics, X_i, as well as participation in Head Start, HS_i, or a preschool, PS_i:

[1] $Y_i = f(HS_i, PS_i, X_i, \varepsilon_i)$

where ε_i represents individual specific unobserved heterogeneity part of which may be common across household members.

As a first step in describing these relationships, we use a multi-dimensional non-parametric estimator. We examine the relationship between household permanent income and child outcomes controlling for enrollment into Head Start or preschool. Non-parametric regression provides a powerful tool when there is little *a priori* knowledge about the shape of these income-outcome relationships and so it is a useful descriptive device.

There are several reasons why levels of outcomes might differ by race and ethnicity: cognitive tests may be culturally biased; children whose mother tongue is not English may not perform well in language based tests; part of child height is genetic and African-

American children tend to be taller; and white and African-American children tend to receive health care from different kinds of providers -- African-Americans are half as likely as whites to be seen by a private doctor or HMO (Bloom, 1990). It is less clear *a priori* that the shapes of the functions should differ across race, once an intercept shift has been allowed. However, the non-parametric estimates leave no doubt that they do. Since we find empirically that the function f depends on the race or ethnicity, e, of the child, we allow the shape of the relationships between the outcomes and the covariates to vary depending on whether the child is African-American, white or Hispanic:

[2] $Y_i = f_e(HS_i, PS_i, X_i, \varepsilon_i)$

These non-parametric estimates are discussed in Section 3.

It is not straightforward to move from the description of the relationship between Head Start and child outcomes provided by the non-parametrics to statements about the causal effects of Head Start. The basic problem is that children are not randomly assigned to Head Start: both parents and program administrators choose whether or not a particular child will participate. Since enrollment in Head Start and other preschools is endogenous, Ordinary Least Squares (OLS) estimation of [2] may result in biased estimates of these effects.

If it were possible to measure all of the characteristics of children, parents, and administrators that determine participation, then the endogeneity of program participation would not result in biased estimates of program effects. In practice, many of these variables are unobservable. To the extent that these unobserved characteristics are constant over time and common to all household members then they will be shared by siblings. In this case, the difference between the outcomes of siblings will not be affected by the unobserved characteristics and so models that incorporate household fixed effects will provide unbiased estimates of the impact of Head Start on child well-being.

To see this, partition child and household characteristics, X_i into two groups: child specific characteristics X_{ci}, such as age and gender, and household specific characteristics, X_{hi}. Let the latter be both time varying, X_{hit}, such as current income, and also time invariant, $X_{hi\bullet}$, such as native ability. Assume that the unobservable ε_i is comprised of two components, a child specific component ε_{ci}, and a household specific component, ε_{hi}. Then the child outcome function [2] can be rewritten:

[3] $Y_i = f_c(HS_i, PS_i, X_{ci}, X_{hi\bullet}, X_{hit}, \varepsilon_{ci}, \varepsilon_{hi})$

If f_c is linear then including a fixed effect for each mother yields the estimating equation:

[4] $Y_i' = f_c(HS_i', PS_i', X_{ci}', X_{hit}', \varepsilon_{ci}')$

where a prime denotes deviations from the household means. This is equivalent to examining sibling differences. All household level time invariant observables and unobservables are now removed from the function. In order to consistently estimate the parameters of [4] it is critical that there be no within household unobserved characteristics that affect participation in Head Start or preschool; that is ε_{ci}' should be orthogonal to the regressors.

This orthogonality condition could be violated if a parent systematically favored the sibling that was in Head Start. In this case, the estimated Head Start effect from [4] would be an over-estimate of the true program effect. This would occur if, for example, parents favored first born children, or boys, and these children were more likely to be enrolled in Head Start; we thus control for birth order and gender of the child in the results reported below.

If differences across racial and ethnic groups are fully captured by intercept shifters, then the parameters of [4] will be the same across groups. This is a testable assumption and turns out to be false; we therefore allow all coefficients to vary with race which is equivalent to estimating [4] with a full set of race interactions. These fixed effects estimates are presented in Section 4.[3]

The advantage of using sibling comparisons is that any constant sources of unobserved heterogeneity between Head Start children and other children are eliminated by this procedure. The

[3] Another way to address the problem of the endogeneity of program participation is to use instrumental variables estimators. We have experimented with this approach but have not been successful in identifying convincing instruments, at least from an empirical point of view. We tried, for example, assuming that a mother's participation in Head Start affected her child's outcomes only through the child's own participation in Head Start. Although maternal participation in Head Start is a significant predictor of the child's participation (Mott and Quinlan, 1992), it does not explain much of the variation in participation and the second stage estimates of the impact of Head Start are very imprecise. Nelson and Startz (1990) report then in these circumstances, IV estimates can be very misleading. In any case, we do not report the IV results in this paper.

disadvantage is that it tends to bias the estimated effects of the program towards zero for two reasons. First, it is well known that in the presence of measurement error, differencing may result in "throwing the baby out with the bath water", since the true "signal" may be discarded while the "noise" remains.

Secondly, estimates with household fixed effects are based on households in which one child attended Head Start and the other did not. If there are any spillover effects of Head Start from one sibling to the other, then the difference between the two siblings will underestimate the effect of the program. Spillover effects might be important either because a child teaches his or her sibling something learned in Head Start, or because the parent learns something or gains access to a service that is beneficial to both children. Conversely, a negative shock to a family that made one child eligible for Head Start could have an adverse impact on the other child, even if that child was not eligible for Head Start because of age. These arguments suggest that the estimates presented below may be lower bounds on the true program effects.

3. The Data

(a) An Overview of the NLSCM

The National Longitudinal Survey of Youth (NLSY) began in 1979 with 6283 young women between the ages of 14 and 21. These women have been surveyed annually ever since. As of 1990, they had given birth to over 8500 children. In 1986, the NLS began a separate survey of the children of the NLSY, the National Longitudinal

Survey's Child-Mother file or NLSCM. All the children completed age-appropriate assessments of cognitive skills, mothers answered questions about their child's schooling attainment and utilization of health care, and the children's heights were recorded. Second and third waves of the NLSCM were undertaken in 1988 and 1990. In these two waves, mothers were asked whether their child had ever participated in Head Start.

It is important to note that the original NLSY oversampled African-Americans, Hispanics, and the poor and so it is not a representative sample of all American mothers in the relevant age group. Also, the fact that we are focusing on children with siblings biases our sample towards the poorest, since poor women tend to have larger families and begin child bearing at younger ages. But the unrepresentativeness of the sample is balanced by the fact that a relatively large proportion of the sample children, 15%, participated in Head Start. In addition, there are large enough numbers of African-Americans and Hispanics to allow separate examinations of these groups.

Figure 1 presents non-parametric estimates of the relationship between enrollment in Head Start, other preschools, or no preschool and household permanent income. The non-parametric estimator used throughout the paper is a locally-weighted smoothed scatterplot (LOWESS) (Cleveland, 1979) which is a nearest neighbor-type estimator. Essentially, each observation is replaced by its predicted value based on a weighted regression using the observations in a band around it and so the shape of the estimated function is determined locally throughout the distribution of income. (See, also, Hardle, 1991).[4]

We define permanent income as the logarithm of average annual household income between 1978 and 1990 (in real 1990 dollars).[5] Use of this measure should attenuate the influence of measurement error and breaks the link between household income at a point in time and eligibility for the Head Start program. Household permanent income is about $29,000 for the average white child, $23,000 for Hispanics and $18,000 for African-Americans. About 8% of white children in the sample participated in Head Start; the proportion is twice as large for Hispanics (16%) and three times as great for African-Americans (27%).

The non-parametric estimates in the first panel of Figure 1 demonstrate that participation in Head Start declines with permanent income. However, Figure 1 also shows that even at the

[4]LOWESS estimates are calculated by creating a band around each observation (y_i, x_i, say) and estimating a weighted linear regression of the dependent variable on the independent variables. The predicted value of y_i is then plotted against x_i to form the LOWESS estimates. Observations within the band are weighted by the tricube function, $w_j=(1-d_j^3)^3$, where d_j is a measure of the distance between observation j and the observation of interest, i. In the simple regression case $d_j=(x_j-x_i)/(x_i^*-x_i)$ where x_i^* is the furthest observation from observation i within the band. The weight is positive for each observation within the band; the weight is equal to one at the point itself, and declines as points are further away. Observations outside the band are given a weight of zero. In addition to choosing the weighting function (or kernel), it is necessary to choose the band width. We have experimented with a range of values and report those for which we think the estimated function is sufficiently smoothed to reveal the essential shape.

[5] In cases where the mother was living with her parents, we use the family income. Otherwise, we use the sum of the mother's own income and any spouse or partner's income.

same level of income, African-Americans are more likely to have been in Head Start: the estimated function for whites is everywhere below that for African-Americans.[6]

The middle panel of Figure 1 shows that the probability of attending a preschool rises with permanent income. Differences in the probability of attendance across racial and ethnic groups are much smaller[7] with no group dominating the other at all income levels.

About half of all children in the sample did not attend any preschool. The last panel of Figure 1 shows that although this probability tends to decline with income, African-Americans are most likely to have attended some type of preschool at all income levels.

Means and standard errors of sample variables are shown in Table 1[8]. White preschool children are by far the most advantaged in terms of household permanent income: the average for these

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[6]For example, among children from households with permanent income between $30,000 and $40,000, 2% of whites, 10% of Hispanics and 20% of African Americans participated in Head Start.

[7]Overall, 22% of African Americans, 25% of Hispanics and 30% of whites attend non-Head Start preschools.

[8]Non-parametric estimators perform best with large sample sizes and so our estimates are based on the entire sample of data from the 1986, 1988 and 1990 NLSCMs. Since the fixed effects estimates, presented below, use only those children who have at least one sibling in the survey, this reduces the sample (by about 20%) to 5,630 children. It turns out that the full and reduced samples are similar in all observable dimensions: for example, permanent income among Whites on Head Start is $16,900 in the full sample and $16,700 in the reduced sample; among African Americans, the means are $15,400 and $15,100 respectively. We thus present means in Table 1 for only the reduced sample used in the fixed effects estimation.

children is about double the income of children who attended Head Start and about 50% higher than household income of African-Americans who attended preschool. In contrast, Head Start children have roughly similar incomes regardless of race or ethnicity. Hence, the disparity between preschool children and those on Head Start is greatest among whites.

In addition to this income advantage, children who attend preschools (other than Head Start) are also better off then Head Starters in most other observable dimensions. Their mothers are better educated, had higher average age at first birth, and scored higher on the Armed Forces Qualification Test (AFQT), a standardized test of ability.[9] They are also more likely to have a father-figure present in the household in 1990 than their peers who attended Head Start. One potential disadvantage that the preschool children suffer is that their mothers are more likely to be employed in 1990, which may indicate that these women are less able to spend time with their children.[10]

The rest of this section uses non-parametric methods to describe the relationship between participation in Head Start and other preschool programs, and a series of child outcomes that include scores on tests of cognitive skills, probability of retention in grade, utilization of medical care, and height

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[9]Since the NLSY respondents were of different ages when the test was administered, the scores are standardized using the mean score for each year of age.

[10] For a more detailed analysis of the correlates of Head Start participation in the NLSCM see Mott and Quinlan (1992).

conditional on age. A comparison of the non-parametric results with the sibling differences shown below will shed light on the importance of controlling for the fact that Head Start children may differ from other children in unobservable as well as observable ways.

(b) Measures of Cognitive Skill and Schooling Attainment

The tests of cognitive skills that we use include the Peabody Individual Achievement Test Mathematics Assessment (PIAT-MATH), the Peabody Individual Achievement Test Reading Comprehension Assessment (PIAT-READING)[11], and the Peabody Picture Vocabulary Test (PPVT). For a comprehensive description of these assessments, see Baker and Mott (1989).

The PIAT and PPVT assessments are widely known and used. We use percentile scores based on nationally established norms for each age. The PPVT is also normed for gender. It has been claimed that these tests have high test-retest reliability and tend to be highly correlated with other measures of cognitive achievement (Baker and Mott, 1989). We focus on math and reading comprehension skills because these are regarded as among the most basic academic skills. PPVT scores from the NLSCM have been used in several recent studies as the sole measure of intellectual ability. (Hill and O'Neill, 1992; Desai *et al.*, 1989). It is instructive to

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[11] The NLSCM also includes the PIAT test of Reading Recognition. Children must score above a minimum level on this test of word recognition before they will be tested for reading comprehension. Examination of the reading recognition scores produced results which were qualitatively similar, though weaker, than the results reported below for reading comprehension.

compare results based on this test with results based on the other two PIAT scores.

The PIAT's were administered to all children of five and over, and were administered to many children in more than one wave of the survey. In cases where there are repeated measures we use the mean score in order to attenuate the influence of random measurement error.[12] The PPVT was administered to all children of three and over, but due to budget constraints, was typically only administered once per child.

Non-parametric estimates of the relationship between Head Start and other preschool participation, permanent income, and test scores are shown separately for whites, African-Americans, and Hispanics in Figures 2 through 4.[13] These figures show that on all three tests, scores tend to rise with income and whites score higher than other children.

The racial and ethnic differences are most dramatic for PPVT scores: the average score for a white child is 42 but the scores for African-Americans and Hispanics are only 16 and 22, respectively. The slopes of the income-PPVT functions are also significantly different across the three groups: they are twice as

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[12] A third of the total variation in the PIAT scores is "within" rather than "between" children which indicates that measurement error may be an important problem. Zigler, Abelson and Seitz (1973) show that a preschooler's performance on the PPVT is influenced by anxiety and rapport with the interviewer, which suggests one possible source of within child variability in test scores.

[13] Unless otherwise indicated, the bandwidths for all LOWESS estimates are 35% for children on Head Start, 30% for children in pre-school and 25% for other children.

steep for whites as for African-Americans.

The fact that these tests may have cultural biases that impede the performance of minorities provided an initial rational for a separate examination of each group. These figures show that there are good reasons, on empirical grounds, for permitting the shapes of the regression functions to vary with race and ethnicity.

Figures 2 through 4 can be used to compare the effects of Head Start, preschool, and no preschool attendance on test scores, after controlling for permanent income. They indicate that white preschool children have higher scores than either Head Start children or those who never attended preschool. This is true at all income levels. Furthermore, on the PIATs, Head Start children tend to score below those who had no preschool.[14]

Among African-Americans, the evidence is substantially different. At low levels of income, no clear differences emerge among the three groups of children. As income rises, however, the PIAT scores of preschoolers tend to rise faster than those who attended Head Start or no preschool.

Finally, the figures show that among Hispanics, both preschool and Head Start children tend to have higher PIAT-READING and PPVT

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[14] In a linear regression of test scores on dummy variables for Head Start participation, preschool participation, age, gender, and controls for income, we find that preschoolers score 3 to 5 points higher than those who never attended preschool. In turn, the latter score about 5 points higher on the PIATs relative to Head Start children. All of these differences are statistically significant.

scores relative to children who did not attend preschool.[15] This suggests that early English-language schooling may have powerful effects on the reading and vocabulary skills of Hispanic children.

The question about schooling attainment that we use is "Has your child repeated any grade(s) for any reason?" which was asked only of children at least 10 years old.[16] About 30% of white and Hispanic children and 40% of African-American children are reported to have repeated a grade.[17]

Non-parametric estimates of the probability of repeating a grade are shown in Figure 5. The probability of repeating a grade tends to decline with income except for white Head Start children: at all but the lowest income levels, white children who attended Head Start are more likely to repeat a grade than other white children. In contrast, grade repetition among African-Americans is unrelated to Head Start or other preschool attendance. Among Hispanics both Head Start and other preschool children are less likely to repeat a grade than children who attended no preschool.

In sum, Figures 2 through 5 suggest that preschoolers tend to perform better both in terms of test scores and school attainment than those children who attended Head Start or no preschool at all.

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[15] These differences are larger for preschoolers and significant in both cases.

[16] This restriction results in smaller sample sizes and so the non-parametric estimates have larger bandwidths (of 55%) in each case.

[17] Keep in mind that academic failure is not the only reason for a child to repeat a grade. Children may also repeat grades because of absenteeism or because they are deemed to lag behind their peers socially.

Among African-Americans and Hispanics, there are no clear differences between the latter two groups of children. Among Whites, however, Head Start children appear to perform significantly worse than those who never went to preschool. Furthermore, the gap in test scores and schooling attainment between white children who attended Head Start and white children who attended other preschools is much greater than it is for African-Americans or Hispanics -- and this is true after controlling for income in a very flexible way. We will return to the issue below.

(c) Health Care and the Health Status of Children

Turning to measures of the utilization of health care and health status, we look at whether the child had received a measles shot by 1990, and the child's height-for-age. Head Start aims to "provide a comprehensive health services program which includes a broad range of medical services..." including "an assessment of immunization status". The Head Start program performance standards also state that "every child in a part-day program will receive a quantity of food in meals...and snacks which provides at least 1/3 of daily nutritional needs..." (Head Start Bureau, 1992). The requirement that all children be fed has been an integral part of the program since its inception. Both nutritious food and better medical care are expected to improve child growth. Hence, there is some reason to expect a positive effect of participation in Head Start on child height as well as on immunization rates.

Unlike test scores or schooling attainment, immunization probabilities are fairly similar for whites, African-Americans, and Hispanics (even after controlling for income). Whereas little over half the children in the sample have received a measles shot, this proportion is about 0.85 among those children who attended Head Start. In part, this reflects the fact that immunization probabilities tend to decline slightly with income, as shown in Figure 6.

This figure demonstrates one of our most striking results: for whites and African-Americans, the probability of having been immunized against measles is significantly higher at all income levels for children who were in Head Start relative to those who went to other preschools. The latter are, in turn, more likely to have been immunized than those who did not attend any preschool. Among Hispanics, the large differences are between those who went to Head Start or another preschool and those who did not.[18] Thus, for all three ethnic groups, those who did not attend any preschool are the least likely to have been immunized.

Height-for-age, is a relatively objective measure of health status which has been profitably used in the nutrition, economic history and development literatures (see, for example, Fogel, 1986; Martorell and Habicht, 1986). The evidence suggests that well-nourished children in many societies follow similar growth curves and it has been argued that height, conditional on age and gender, is a good indicator of longer run nutritional and health status.

Growth varies systematically with age and gender so we

[18] All these differences are significant.

standardize height following guidelines from the National Center for Health Statistics (1976). Each child in the sample is compared with the median child in a population of well nourished children of the same age and gender in the United States; the sample height-for-age is expressed as a percentage of this median.[19] In spite of the fact that the NLSCM is a sample of relatively poor children, the height (conditional on age and gender) of the average child is only slightly below the US median. This is partly because African-Americans are significantly taller than whites or Hispanics.

The growth curves of poor children in many countries show systematic deviations from the growth curves of the median child (Waterlow, *et al.*, 1977). As Appendix Figure 1 shows, in the NLSCM, the growth of children tends to falter at an early age but appears to catches up to the median US child after age 2. For this reason, it is likely to be important to compare children of approximately similar ages. Hence, we use the first measure of height taken after age 5 for each child.

Figure 7 shows that among whites and African-Americans, height for age is largely unrelated to income but there are substantial

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[19]In the NLSCM, child height is either measured (by the enumerator or mother) or recalled by the mother. In the 1986 survey, it is not possible to identify those children that were actually measured although reported height was apparently based on recall for very few children (personal communication, Paula Baker, 1993). In the 1988 and 1990 surveys, the heights of about 30% of children were reported by their mothers and the probability of being measured rises with age. There is very little evidence for stacking in the recall data and the variances are similar for both recall and measured data and so, in this paper, we use all reported child heights. These issues are taken up more fully in Currie and Thomas, (1993).

differences among the three preschool groups. White children who attended preschools are (significantly) taller than other children. It is not clear that there is much difference between those who attended Head Start and those who did not attend any preschool. Among African-Americans, children who attended Head Start are very close, in terms of height, to those who attended preschools and both these groups of children are taller than the other children. All these patterns persist across the income distribution. The differences among Hispanics are less clear although at the top of the income distribution we see that, like African-Americans, Hispanic Head Starters and preschoolers are about the same height and are taller, given age, than the other children.

In sum, the results in Figures 6 and 7 suggest that Head Start children are more likely to be immunized than other children and also tend to be as tall as children who attended other preschools, at least among African-Americans and higher income Hispanics.

Recall that Head Starters tend to perform no better on test scores than other preschoolers and whites seem to perform worse than those who attended no preschool at all. It may be that the positive correlation between health and Head Start or preschool enrollment reflects selection into the program: taller and healthier children may be more likely to be enrolled. We address the issue of selection below.

(d) Households with Changes in Children's Head Start Status

The non-parametric estimates may reflect omitted unobserved characteristics of the families or children that are correlated with participation in Head Start. In an attempt to control for these differences, we estimate models that include fixed effects for each mother. These models are identified using the subset of children in families who live in families in which at least one child attended Head Start and at least one did not. A description of this subsample of children appears in Table 2.

The first row of Table 2 shows that Head Start effects in the fixed effects models are based largely on within-family comparisons of children in Head Start with siblings who did not attend any preschool: relatively few families with a child who attended Head Start had a child who attended a different kind of preschool. Although the results are not shown, the converse is also true: families with at least one child in preschool and at least one child not in preschool were unlikely ever to have had a child in Head Start. Thus, estimates of Head Start and other preschool effects are based on largely non-overlapping samples of families.

The second thing that is apparent in Table 2, is that using sibling differences eliminates many of the large differences in observables between Head Start and other children that were evident in Table 1. For example, the difference between the family income at the time the Head Start child was age 3 and the time the sibling was age 3, is small.[20] The probability that the mother was

[20] Income at age 3 is relevant since this is the age that most children would begin preschool or Head Start. We actually use the mean of income at age 2, income at age 3, and income at age 4 in order to attenuate the effects of random measurement error. If the child was born after 1988, we use the mean income in 1988, 1989, and 1990.

employed in the birth year is also similar for the two groups.

However, Table 2 suggests that within a family, the child who attended Head Start is more likely to have been the first born and so is older then the "no preschool" sibling and was born to a younger mother. Head Start children are also less likely to have had a father-figure present in the birth year. Thus, on the whole, children seem to have been enrolled in Head Start at a time when the mother was disadvantaged, relative to her future prospects. However, since there may be advantages associated with being the first born, we will control for this in the estimation. An examination of families with at least one other preschool and one non-preschool child showed the opposite pattern: children were more likely to attend preschool when their mothers were relatively well off.

Turning to test scores, Table 2 shows that Head Start children tend to out-perform their siblings on PPVTs. The difference is very pronounced among Hispanics (Head Starters score twice as high as other children) and large among African-Americans. Within families, children who attended Head Start are less likely to repeat a grade then siblings who attended no preschool. Head Starters are also more likely to have had a measles shot. Finally, among both African-Americans and Hispanics, Head Start children are taller then their siblings who did not attend although the reverse is true for whites.

In summary, the inclusion of mother fixed effects is unlikely to perfectly control for all relevant unobservables. Nevertheless, given the disadvantaged background of the Head Start children relative to even their own siblings, we contend that positive measured effects of Head Start that equal or exceed the measured effects of other preschool programs are unlikely to reflect omitted characteristics of mothers or children.

(e) Long run effects of Head Start

In the last part of the paper we focus on the long run effects of Head Start by exploiting the fact that in 1988, mothers in the NLSCM were asked "Were you ever in Head Start as a child?". Again, in order to take account of selection into Head Start, we estimate models that include family fixed effects and so use a sample of mothers who are sisters in order to examine the relationship between participation as a child and outcomes as an adult. This sample is rather small -- there are 103 white, 143 African-American, and 46 Hispanic mothers with a sister in the sample of mothers and complete information about their own and their sister's Head Start participation and outcomes. We do not, therefore, consider Hispanics separately.

The outcomes we consider are whether the mother ever participated in AFDC, high school completion, age at first birth, attained height, and the score on the Armed Forces Qualifications Test (AFQT). The women in this sample of mothers who are siblings are somewhat more disadvantaged than the mothers of children in the child-sibling sample: 52% participated in AFDC at some time compared to 33% in the larger group, 76% completed high school compared to 80%, the average age at first birth is 19 compared to

20.6, and the average (normalized) AFQT score is .92 compared to 1.04. There is no difference in average heights.

4: Results Using Sibling Differences

Parametric estimates of the effects of Head Start and other preschool attendance on a series of child outcomes are reported in Tables 3 through 7. The models are of the form [4], and include a fixed effect for each mother in order to capture time invariant household characteristics. Each regression also includes a control for whether or not the child attended Head Start or another preschool, the age of the child at the survey date (in months), gender, and an indicator for whether the child is the first born. We control for household income by including the log of the average income taken over the three years centered on the year the child turned 3. In a fixed effects context, it is the deviations of income and child age from mother-specific means that matter. Hence, income at age 3 is a measure of changes in the family's circumstances over time while child age controls for the effects of birth interval.

We have also estimated all of the models reported in Tables 3 to 7 below including controls for marital status in the birth year, and maternal employment status in the birth year. These variables were occasionally statistically significant, but their inclusion had little impact on the estimated coefficients on the Head Start or other preschool controls. We have chosen to present the more parsimonious models since they do not suffer from the potential endogeneity of changes in marital or employment status.[21]

(a) Measures of Cognitive Skill and Schooling Attainment

Models of PIAT and PPVT scores that include indicators for Head Start and preschool attendance as well as mother fixed effects are shown in Table 3. The results in the first half of the table apply to all children with valid assessments.

Recall that the non-parametric estimates above indicate that white children who attended Head Start get lower scores on these tests than either other preschoolers or those who never went to preschool. In a regression that does not account for selection, the coefficient on Head Start is significantly negative for both PIATs and also negative for PPVT.[22] In models that control for selection, all of these effects are positive and, in fact, Head Start is associated with a significant 5% increase in the percentile score on the PPVT.

The non-parametric estimates also suggested that white children who attended non-Head Start preschools did significantly better on these tests than either Head Start children or those who stayed at home. Accounting for selection reduces these effects to statistical insignificance.

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[21] We attribute the general lack of statistical significance of the employment and marital status variables to the fact that if a mother is continuously employed, unemployed, married, or unmarried, the impact will be absorbed by the fixed effect, and if the mother becomes divorced or goes to work, there may be a similar effect on all siblings.

[22] The OLS coefficients are -4.5 and -5.2 for PIAT-MATH and PIAT-READING, respectively, with standard errors around 2.0. The coefficient is -0.1 for PPVT.

A similar pattern emerges for Hispanics' performance on verbal tests (PPVT and PIAT-READING). According to the non-parametric estimates, preschool children perform significantly better than Head Start children who, in turn, perform better than those who did not attend preschool. The impact of Head Start is much bigger in the fixed effects estimates (about 9%), whereas the impact of preschool is reduced to 3 - 5% and these effects are not statistically significant.

For both whites and Hispanics failure to take account of selection leads to substantially different inferences regarding the impact of Head Start and preschool. Even conditional on observables, children who are enrolled in Head Start appear to be relatively disadvantaged whereas those who go to other preschools are relatively advantaged.

The test scores of African-American children are unrelated to whether they attended Head Start or other preschools. This is true in regressions that ignore selection and in the fixed effects estimates. No clear patterns emerge from a comparison of these estimates suggesting that the selection mechanism underlying enrolment in Head Start or preschool is quite different for these children relative to Hispanics and whites.

As observed in the non-parametric estimates, income has generally positive effects on the test scores of whites and Hispanics. It is, however, statistically significant only in the PIAT-MATH equation for Hispanics. In contrast with these results (and also with the non-parametric estimates) income is negatively associated with test scores among African-Americans in the fixed effects models. This effect is statistically significant in the case of PIAT-MATH scores. This perverse effect may have to do with the fact that African-American mothers are more likely to be single mothers, and raising their income by becoming employed may take time away from the child. Alternatively, there may be more measurement error in the reported incomes of African-Americans than in the incomes of whites or Hispanics.[23]

The second half of Table 3 presents estimates of similar functions based on the sample of children 8 years and older. We focus on this group in order to see if there are gains in test scores that persist three years or more after children have left Head Start. Recall that most previous studies found that the effects of Head Start had dissipated by this time. Only the coefficients on Head Start and other preschool attendance are shown. On the whole, the estimated coefficients on Head Start and other preschools are similar to those just discussed, although the coefficient on PPVT is larger for whites, and the coefficient on PIAT-READING loses statistical significance for Hispanics.

The interpretation of the results for children over 8 years old is complicated by the fact that the oldest children in the NLSCM are likely to have been born to the youngest and most disadvantaged mothers. The larger effect on PPVT among older whites may indicate that participation in Head Start has a greater

[23]We reran these regressions using per capita household income and found very similar results.

positive impact on the test scores of the most disadvantaged white children. We attempt to test this hypothesis more directly below.

In summary, relative to siblings who stayed at home, participation in Head Start has positive effects on the math and vocabulary scores of white children and on the reading and vocabulary scores of Hispanic children. Furthermore, we find that the benefits associated with Head Start appear to persist after the child is 8 years old. The effects also equal or exceed the effects of attending other preschools. In contrast, however, we find no effects on the test scores of African-American children.

Test scores measure certain abilities that may contribute to scholastic success. However, Copple *et al.* (1987) argue that ability is not the only determinant of a child's success in school. A positive self-image and determination for example, may also play a role. While there is some evidence that test scores are associated with higher wages (Murnane, 1993), it has been well established that education is one of the most important determinants of individual wages and employment probabilities. It is thus useful to examine a more direct measure of scholastic success than test scores.

In Table 4, we examine the probability that a child has ever repeated a grade which is a good predictor of whether he or she will eventually drop out of school[24]. The results here are similar

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[24] For example, Currie and Fallick (1990) found that NLSY respondents who were not in a grade appropriate for their age at 14 were more likely to drop out of school at age 16 then those who were.

to those for test scores. Participation in Head Start reduces the probability that white and Hispanic children repeat grades, but appears to have no effect on African-American children. Attendance at a non-Head Start preschool has no effect on grade repetition.

As discussed above, it is possible that the estimates based on sibling differences understate the true effects of the Head Start program. The fixed effects estimates could, therefore, be interpreted as evidence that Head Start has smaller effects on the test scores and scholastic attainment of African-American children than on the test scores and scholastic attainment of other children, rather than as evidence that there is no effect.

The fixed effects results for whites contrast sharply with the non-parametric estimates in the previous section suggesting that estimates that do not take account of selection into Head Start may be substantially misleading. Among Hispanics, the benefits associated with Head Start are also larger when we control for selection. In contrast, the non-parametric and fixed effects estimates for African-Americans are virtually identical. As in the case of test scores, the selection mechanisms seem to be very different across the three groups.

(b) Utilization of Health Care and Health Status

The effects of participation in Head Start and other preschools on the probability of having had a measles shot and on height-for-age are shown in Table 5. We find that Head Start participation is associated with increases in the probabilities that white and African-American children receive measles shots of

10% and 12% respectively. For whites, the effects of Head Start and other preschool participation are equal, while for African-Americans and Hispanics, preschool increases the probability of having had a measles shot by only 6%. Head Start is not estimated to have a statistically significant effect on the probability that a Hispanic child is immunized, but we cannot reject the hypothesis that the effects of Head Start and other preschool attendance are equal. All these results are essentially identical to the non-parametric estimates and suggest that taking account of selection has little impact on the estimated effect of Head Start or preschool on immunizations.

The fixed effects estimates may reflect the fact that the probability of having had a shot rises sharply with age, and children who have not attended any preschool are younger on average than other children. Hence, at the bottom of Table 5, we show estimates of the probability of having had a measles shot which use only children of public school age. White children in this age group who attended Head Start are still 8% more likely to have been vaccinated than children who did not. However, there is now no statistically significant effect of Head Start participation on the probability that an African-American or Hispanic child has been vaccinated.

This pattern of results suggests that white children who attend Head Start are more likely to be vaccinated against measles. However, African-American Head Start children and white children who attend other preschools are vaccinated earlier than they would otherwise have been, but are not in the end more likely to have been vaccinated by the time they reach elementary school. This result may reflect the fact that white children who attend other preschools and African-American Head Start children are more likely to have either private health insurance coverage or Medicaid coverage than white Head Start children in this sample.

Table 5 also shows regressions of height-for-age on Head Start and preschool attendance. As discussed above, height-for-age can be thought of as a measure of nutritional status. African-American children who attended Head Start are significantly taller than their siblings -- a result that was apparent in the non-parametric estimates. The impact of preschool, however, is smaller for all three ethnic groups when we control for selection and, in contrast with the non-parametric estimates, preschool children are not significantly taller than their siblings who stayed at home.

At the bottom of Table 5 we show results using the first measure of height obtained after the child turned 8 years old. As in Table 3, the purpose of these estimates is to examine whether the effects of Head Start persist over time: the evidence suggests that they may be relatively short-lived. This is somewhat surprising in view of the evidence regarding the critical importance of good nutrition at an early age.

The positive effects of Head Start on height might reflect selection into the program: (African-American) mothers may be more likely to send a child who is tall for his or her age to Head Start. Yet, if this is the explanation then the lack of any similar effect for other preschools is puzzling.

In general, white and Hispanic children seem to benefit from attending Head Start in terms of test outcomes, school performance and immunization records. Why do they not appear to be better nourished than their siblings? It is hard to transfer the test score benefits of Head Start from one child to another; food may be more fungible. Mothers may, for example, compensate siblings of Head Start children by giving them extra food at home at the expense of the Head Start child. Siblings of children in the program would then also benefit from Head Start, and estimates based on sibling differences would be biased downwards.

(c) Why Does Race Matter?

Why do the effects of Head Start vary so greatly with race? Our parametric results suggest that once selection into the program is taken into account, Head Start has a smaller effect on the test scores and schooling attainment of African-Americans than on the test scores and academic achievement of white and Hispanic children. This finding is all the more striking because we find that in terms of health, African-American children appear to gain more from Head Start than other children. African-Americans are as likely as white children to be vaccinated if they are in Head Start, and they are more likely to experience gains in height-for-age.

Why do race and ethnicity matter? One hypothesis is that there is heterogeneity in the Head Start programs that serve children of different races. Given that there are over 1,300 Head

Start programs (Hayes *et al.*, 1990) all administered at a local level, and that the program guidelines are not specific about how the goals of the program are to be attained, there is bound to be a great deal of heterogeneity in program content. It is possible that programs that serve African-Americans place more emphasis on health and less emphasis on academic achievement than programs serving white and Hispanic children. Such a focus might be justified if African-American children had greater health problems. Unfortunately, it is difficult to test this hypothesis given that we have no information about individual programs.

An alternative hypothesis is that the benefits of compensatory education depend both on the program itself and the child's home background including, for example, the level of resources at home, as well as the type and quality of school attended after Head Start. To the extent that African-American children come disproportionately from more disadvantaged homes, located in poorer communities, and attend troubled schools, one might expect Head Start to have smaller effects. Thus, race may be a proxy for a disadvantaged background.

On the other hand, since the average Hispanic child in this sample also comes from a disadvantaged background relative to a white child, one must explain the beneficial effects of Head Start on the test scores and academic achievement of these children. It is possible that children with English-language difficulties benefit disproportionately from the early opportunity to learn in an English-language setting.

In this section, we report two attempts to separate the effects of race and ethnicity from the effects of a disadvantaged family background. In the first, we pool children from the three racial and ethnic groups and limit the analysis to children in families with permanent incomes greater than $10,000 and less than $18,000. The $10,000 cutoff marks the 6th percentile of the white income distribution, the 26th percentile of the African-American income distribution, and the 12th percentile of the Hispanic distribution. The $18,000 cutoff marks the 28th, 64th, and 45th percentiles of the white, African-American, and Hispanic distributions, respectively. Since families with permanent incomes below $10,000 are disproportionately African-American and families with permanent incomes over $18,000 are disproportionately white, it is possible that the racial differences in the parametric estimates may reflect nothing more than the relative poverty of African-Americans.

Table 6 shows models estimated using this subsample that include interactions of race and ethnicity with Head Start and other preschool participation. There are no statistically significant racial differences in test scores. It is, however, worth noting that the point estimates of the effects of Head Start on PIAT-READING and PPVT are greater for whites than for African-Americans, and greatest for Hispanics. Given that the sample size is much reduced by the restriction on income, it is not clear that the lack of statistically significant race effects for test scores indicates that our earlier estimates reflect only income effects.

We do find, even in this subsample, that Head Start participation lowers the probability of retention in grade more for whites then for African-Americans, and increases height more for African-Americans than for whites. Hence, Table 6 suggests that there are statistically significant racial differences in the effects of Head Start even within a relatively homogeneous income group. Experimentation with other income cutoffs produced similar results.

Thus far, we have focussed on permanent income as our measure of long-run household resources. An alternative measure is the mother's AFQT score. We prefer AFQT to education since about 50% of the women report 12 years of schooling (see Appendix Figure 2). In contrast, AFQT scores are more evenly spread. In any case, AFQT and educational attainment are very highly correlated. The right hand panel of Appendix Figure 2 presents a non-parametric estimate of the relationship between education and AFQT scores: it is upward sloping and virtually linear.

We estimated models identical to those shown in Tables 3, 4 and 5 except that they also included interactions between the Head Start and preschool indicators and AFQT. The results (reported in Appendix Table 1) provide some support for the hypothesis that children from the most advantaged backgrounds gain more from Head Start. The interaction of AFQT and Head Start was positive and statistically significantly in the white and Hispanic models of grade repetition. African-American Head Start children's PIAT-MATH scores and heights also rose with the mother's AFQT. These results suggest that one way to ensure that disadvantaged children reap the greatest possible benefit from Head Start, is to strengthen the components of the program aimed at educating parents.

d) Long-term Effects of Head Start on the Mothers

In this section we examine the long-run effects of Head Start participation on the children's mothers. The outcomes we consider are the mother's participation in Aid to Families with Dependent Children (AFDC), her AFQT score, whether or not she graduated from high school, her height, and whether or not she had her first child as a teenager. Ordinary Least Squares regressions of these outcomes on the measurable characteristics of the mother imply that participation in the program has negative effects. However, as discussed above it is likely that in an OLS regression, the Head Start variable is a proxy for a disadvantaged background.

Hence, we adopt the same strategy for the mothers as we did for the children -- that is, we compare mothers to their sisters in the sample. To be more specific, we include only mothers who have at least one sister with non-missing Head Start information in the sample, and estimate models that include a fixed effect for each mother's own family. One drawback of this procedure is that since the question about Head Start participation was only asked of mothers, women who have a sibling in the NLSY who is not a mother cannot be included. The sample size is thus quite small, and the results should be interpreted with caution. They are reported in

Table 7 for whites and African-Americans.[25]

We do not know whether the mother attended another preschool and so the excluded category is likely to be quite heterogeneous. The only mother-specific covariate in the regressions is her current age. There does appear to be a positive effect of participation in Head Start on the AFQT scores and heights of whites. However, we find no significant effect on the probability of graduating from high school, or on AFDC participation although the point estimate on the later is negative. There is actually a positive and implausibly large effect of Head Start on the probability that a white mother was a teen at the first birth. This result may reflect the sampling structure of the NLSY: since Head Start began in 1964, only the youngest sister in many families was eligible for Head Start. And the probability that a given family got into the sample of mother-sisters was greatly increased if the youngest sibling had a child as a teenager. It is noteworthy that once again we find no effects for African-Americans although the sample size is actually larger for this group.

5. Discussion and Conclusions

Participation in Head Start is associated with better performance on tests among whites and Hispanics. These effects persist for children 8 years and older, and are perhaps detectable in the AFQT scores of the white mothers in our sample. Mothers who

[25]Hispanics are dropped from this analysis because of the small sample size.

attended Head Start also tend to be taller as adults. White and Hispanic children are also less likely to have repeated a grade if they attended Head Start and white children are more likely to receive measles shots.

In contrast, African-Americans who attended Head Start do not appear to perform better on tests or in school. They do, however, seem to do better in terms of health: they tend to receive measles shots earlier and are significantly taller than their siblings who did not attend a preschool.

A comparison of non-parametric estimates with estimates that take account of selection by incorporating mother fixed effects suggests that even when observables are accounted for, white children who attend Head Start are very disadvantaged in terms of academic potential. Conversely, white children who went to other preschools appear to be positively selected. Estimates of the effects of Head Start and preschool on test scores and schooling attainment that ignore selection may be biased. In contrast, there is little evidence that selection biases the estimated effects of Head Start on the health outcomes of any group. And we find no strong pattern of selection among African-Americans,

There are then, dramatic racial and ethnic differences in the effects of Head Start, and in the role of selection. These differences cannot be entirely explained by observable differences in household resources such as permanent income. Further investigation of the reasons for these differences is likely to provide insights that will make Head Start a more effective program.

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Table 1: Family Background and Child Assessments by Head Start Status, Race, and Ethnicity

	White			African-American			Hispanic		
	Head Start	Pre-school	No Pre-school	Head Start	Pre-school	No Pre-school	Head Start	Pre-school	No Pre-school
# of Obs.	273	836	1175	474	373	635	170	282	465
Maternal and Child Characteristics									
Household Income 78-90 (1000's)	16.72 (.48)	34.67 (.61)	25.42 (.36)	15.06 (.38)	21.22 (.74)	16.65 (.42)	17.24 (.69)	27.34 (.93)	21.31 (.50)
Maternal AFQT	.96 (.02)	1.24 (.01)	1.10 (.01)	.75 (.01)	.87 (.02)	.77 (.01)	.74 (.02)	.98 (.02)	.79 (.02)
Maternal Top Grade Completed	(.12)	11.08 (.06)	12.67 (.05)	11.65 (.08)	11.64 (.09)	12.48 (.07)	11.61 (.20)	10.70 (.12)	11.9410.80 (.10)
% Employed 1990	.48	.61	.54	.52	.65	.48	.46	.66	.48
% Spouse 1990	.66	.86	.80	.39	.48	.40	.67	.73	.75
Age at 1st Birth	18.36 (.15)	21.15 (.11)	19.48 (.08)	17.68 (.11)	19.16 (.15)	18.05 (.10)	18.46 (.23)	20.20 (.18)	19.05 (.13)
Child Age in Months, 1990	116.11 (2.22)	93.75 (1.16)	99.48 (1.20)	118.95 (1.81)	99.46 (2.02)	105.38 (1.76)	113.28 (3.05)	95.85 (2.13)	96.64 (1.85)
Child % First Born	.48	.58	.42	.47	.47	.40	.51	.50	.37
Child Assessments									
PIAT-MATH	40.32 (1.49)	56.74 (.91)	49.36 (.82)	36.94 (1.04)	42.65 (1.27)	37.74 (1.00)	38.56 (1.70)	43.64 (1.57)	38.78 (1.23)
PIAT-READING	46.54 (2.04)	64.85 (1.03)	56.81 (.97)	46.21 (1.23)	53.02 (1.60)	46.41 (1.22)	49.10 (2.24)	58.25 (1.80)	45.26 (1.57)
PPVT	30.59 (1.67)	48.10 (.97)	38.14 (.89)	15.18 (.90)	17.07 (1.10)	13.66 (.78)	19.57 (2.01)	26.66 (1.74)	17.95 (1.10)
% Repeated Grade	.45	.23	.27	.39	.41	.41	.28	.26	.36
% Measles Shot	.86	.69	.68	.87	.69	.71	.79	.68	.65
Height % of Median	99.54 (.41)	101.13 (.23)	100.28 (.20)	102.05 (.27)	101.98 (.34)	101.32 (.31)	99.93 (.46)	100.49 (.45)	100.20 (.36)

Note: Standard errors in parentheses. Means include all children with siblings in the sample and valid age and permanent income data.

Table 2: Characteristics and Assessments of Children in Families where Some (but not all) Children Attended Head Start.

	White			African-American			Hispanic		
	Head Start	Pre-school	No Pre-school	Head Start	Pre-school	No Pre-school	Head Start	Pre-school	No Pre-school
# of Obs.	176	43	128	310	89	163	133	54	106
Maternal and Child Characteristics									
Income at Age 3 (1000's)	14.46	18.22	15.74	14.66	19.00	16.01	16.92	20.81	17.13
	(.82)	(1.53)	(.68)	(.58)	(1.27)	(.87)	(1.10)	(2.21)	(1.10)
In Birth Year:									
% Employed	.22	.24	.17	.24	.25	.28	.24	.19	.16
% Spouse Present	.51	.51	.37	.22	.29	.27	.46	.59	.60
Mother's Age	20.35	21.23	21.83	19.72	21.47	21.06	20.11	21.63	21.80
	(.22)	(.48)	(.27)	(.18)	(.35)	(.30)	(.27)	(.45)	(.33)
Child Age in Months, 1990	110.79	104.75	96.39	118.75	99.36	105.92	115.47	97.80	96.99
	(2.65)	(5.00)	(3.24)	(2.29)	(4.05)	(3.84)	(3.61)	(4.62)	(3.93)
% First Born	.50	.47	.25	.47	.36	.25	.54	.43	.16
% Male	.43	.30	.48	.30	.52	.54	.52	.54	.52
Child Assessments									
PIAT Math	41.51	40.83	41.18	36.38	38.00	35.07	39.18	38.60	35.03
	(1.85)	(4.08)	(2.92)	(1.32)	(2.36)	(2.11)	(2.03)	(3.35)	(2.51)
PIAT Reading	49.79	42.91	48.45	45.34	50.50	43.11	47.40	54.69	37.37
	(2.61)	(6.07)	(3.56)	(1.46)	(3.50)	(2.25)	(2.57)	(3.43)	(3.68)
PPVT	32.77	32.32	25.93	15.51	13.15	13.36	19.18	10.28	10.09
	(2.16)	(3.90)	(2.24)	(1.15)	(1.88)	(1.68)	(2.23)	(2.12)	(1.81)
% Repeated Grade	.38	.47	.46	.45	.43	.52	.30	.44	.57
% Measles Shot	.85	.70	.63	.86	.73	.65	.80	.74	.63
Height % of Median	99.20	102.33	99.61	102.33	101.64	101.50	100.00	99.93	98.53
	(.42)	(.93)	(.65)	(.36)	(.63)	(.69)	(.51)	(1.07)	(.86)

Notes: Standard errors in parentheses. Income at age 3 is the 3-yr average centered on the year in which the child turned three, measured in 1990 dollars. Means include all children with valid age and income data.

Table 3: Head Start and Other Preschool Effects on Test Scores Including Mother Fixed Effects

	White			African-American			Hispanic		
A: All	PIAT MATH	PIAT READING	PPVT	PIAT MATH	PIAT READING	PPVT	PIAT MATH	PIAT READING	PPVT
Head Start	2.66	.71	5.04	1.58	-1.66	-.75	.31	8.74	9.42
	(.91)	(.19)	(1.78)	(.75)	(.61)	(.45)	(.10)	(2.08)	(3.55)
Other Preschool	3.43	-1.11	-.26	-1.44	1.73	.64	-2.10	5.64	3.01
	(1.61)	(.42)	(.13)	(.63)	(.57)	(.38)	(.71)	(1.37)	(1.22)
Log Income at age 3	2.42	.64	-.36	-3.33	-1.77	-2.16	6.03	4.43	1.11
	(1.12)	(.24)	(.18)	(1.80)	(.73)	(1.52)	(2.58)	(1.48)	(.53)
Male	.37	2.63	.23	1.59	4.62	.55	5.35	5.01	-.33
	(.27)	(1.57)	(.18)	(1.12)	(2.64)	(.51)	(2.67)	(1.79)	(.19)
Age in Months, 1990	.05	-.06	.16	.04	-.16	.13	.09	-.13	.02
	(1.14)	(1.15)	(4.37)	(1.27)	(3.28)	(5.41)	(1.82)	(1.52)	(.44)
First Born	1.54	2.93	1.54	-4.76	.98	-1.09	-2.21	4.05	3.29
	(.84)	(1.27)	(.89)	(2.56)	(.41)	(.78)	(.87)	(1.15)	(1.54)
# Observations	1299	918	1607	1061	806	1110	573	384	643
R-squared	.65	.69	.71	.63	.67	.69	.61	.65	.74
Mean Dep. Var.	49.76	55.89	39.47	38.09	45.97	14.67	38.59	47.42	20.09
B: Coefficients on Head Start and Preschool, Children >= 8 years old									
Head Start	2.83	2.11	9.30	-1.45	-.38	-2.16	.99	7.10	9.92
	(.74)	(.49)	(2.10)	(.52)	(.12)	(.87)	(.22)	(1.35)	(2.58)
Other Preschool	5.77	1.00	.22	5.44	2.92	2.82	-.91	-.53	3.14
	(2.03)	(.33)	(.07)	(1.64)	(.79)	(.97)	(.18)	(.09)	(.75)
# Observations	912	754	967	736	662	718	385	321	391
R-squared	.74	.75	.81	.71	.73	.77	.67	.66	.82
Mean Dep. Var.	50.39	54.66	41.45	36.98	43.64	16.43	39.19	45.43	20.18

Notes:
T-statistics in parentheses.

Table 4: Head Start Effects on Grade Repetition, Children 10 Years and Up, Including Mother Fixed Effects

	White	African American	Hispanic
Head Start	-.51	-.03	-.46
	(2.27)	(.31)	(2.96)
Other Preschool	-.08	-.17	-.005
	(.67)	(1.34)	(.02)
Log Income at Age 3	.08	-.14	-.38
	(.75)	(1.10)	(2.04)
Male	-.06	-.13	-.01
	(.97)	(1.93)	(.09)
Age in Months 1990	.004	-.001	.01
	(1.45)	(.35)	(1.91)
First Born	-.13	.05	-.16
	(1.35)	(.57)	(1.20)
# Observations	269	311	141
R-squared	.63	.59	.65
Mean Dep. Var.	.36	.47	.32

Note: T-statistics in parentheses.

Table 5: Head Start Effects on Health and Health Care Including Mother Fixed Effects

	Measles Shot			Height-for-Age		
	White	African-American	Hisp.	White	African-American	Hisp.
	All Ages			Children >=5		
Head Start	.10	.12	.04	.40	1.48	-.33
	(3.01)	(4.67)	(1.01)	(.52)	(2.17)	(.34)
Other Preschool	.10	.06	.06	.64	.49	.53
	(4.92)	(2.24)	(1.70)	(1.15)	(.69)	(.55)
Log Income at Age 3	-.01	-.02	.03	-.92	.01	.10
	(.21)	(1.07)	(.97)	(1.63)	(.01)	(.13)
Male	.003	-.02	.02	.35	.69	1.19
	(.21)	(1.06)	(.67)	(.97)	(1.56)	(1.85)
Age in Months, 1990	.01	.01	.01	.002	.01	.01
	(24.55)	(25.13)	(20.85)	(.19)	(.89)	(.60)
First Born	-.02	-.03	-.03	.71	.58	.66
	(1.07)	(1.43)	(1.12)	(1.47)	(.99)	(.82)
# Observations	2757	1765	1111	1258	986	539
R-squared	.79	.79	.78	.60	.55	.56
Mean Dep. Var.	.58	.63	.56	100.45	101.73	100.18
	Children >= 5			Children >= 8		
Head Start	.08	.02	.04	.05	-.55	2.02
	(2.18)	(.72)	(.93)	(.14)	(.55)	(1.59)
Other Preschool	.03	-.02	.02	1.17	.54	1.71
	(1.11)	(.45)	(.41)	(1.39)	(.48)	(1.18)
# Observations	1901	1264	742	527	506	279
R-squared	.73	.66	.68	.66	.58	.63
Mean Dep. Var.	.84	.87	.84	101.20	102.14	100.33

Notes:
T-statistics in parentheses. For height, we use the age when measured rather than the age in 90.

Table 6: Racial and Ethnic Differences in the Effects of Head Start Among Children with Permanent Incomes ge $12,000 and le $18,000., Including Mother Fixed Effects

	PIAT MATH	PIAT READING	PPVT	Grade Retention	Measles Shot	Height for Age
Head Start * White	1.26	.91	2.92	-.63	.15	.67
	(.12)	(.36)	(.16)	(1.18)	(3.46)	(.61)
Head Start * African-American	1.21	-3.24	.97	-.02	.10	2.38
	(.34)	(.71)	(.31)	(.17)	(2.48)	(2.48)
Head Start * Hispanic	-5.58	3.21	4.60	-.15	.03	1.35
	(1.21)	(.54)	(1.21)	(.58)	(.65)	(1.06)
Other Preschool * White	3.07	5.98	-3.31	.05	.02	1.42
	(.60)	(.85)	(.82)	(.12)	(.31)	(1.03)
Other Preschool * African-American	-3.37	1.12	1.96	-.10	.08	.33
	(.99)	(.25)	(.66)	(.57)	(1.85)	(.36)
Other Preschool * Hispanic	-2.13	4.62	-1.05	.21	.07	-1.67
	(.45)	(.78)	(.26)	(.58)	(1.18)	(1.31)
Log Income at Age 3	1.16	3.22	-1.43	-.22	-.04	-.17
	(.54)	(1.05)	(.83)	(1.36)	(1.51)	(.29)
Male	.66	-1.88	1.54	.07	-.01	-.13
	(.44)	(.99)	(1.24)	(.88)	(.43)	(.32)
Age in Months, 1990	.01	-.18	.10	.002	.01	.01
	(.26)	(3.28)	(3.07)	(.59)	(22.79)	(.69)
First Born	-.44	3.36	.08	-.08	-.04	.15
	(.23)	(1.34)	(.05)	(.73)	(1.54)	(.30)
# Observations	958	687	1099	243	1590	905
R-squared	.61	.65	.69	.55	.77	.62
Mean Dep. Var.	37.35	44.58	19.57	.48	.66	100.60

Notes: T-statistics in parentheses.

Table 7: Long Term Effects of Head Start on the Mothers, Including Family Fixed Effects

	AFQT	Highschool (0/1)	Height (inches)	Teen 1st Birth (0/1)	Ever AFDC
Whites: # Observations=103					
Head Start	.18	.04	1.75	.45	-.30
	(1.68)	(.18)	(1.88)	(2.08)	(1.59)
Mother's Age	.01	.03	-.10	-.09	-.03
	(.53)	(1.10)	(.73)	(2.82)	(.99)
R-squared	.81	.63	.75	.66	.72
Mean Dep. Var.	1.05	.72	64.52	.54	.23
Blacks: # Observations=143					
Head Start	-.01	-.10	.19	-.01	.02
	(.27)	(.95)	(.26)	(.08)	(.23)
Mother's Age	-.02	-.02	-.05	-.02	-.13
	(1.79)	(1.04)	(.31)	(.67)	(5.40)
R-squared	.68	.63	.59	.57	.69
Mean Dep. Var.	.77	.74	64.23	.69	.52

Note: T-statistics in parentheses.

Figure 1: Non Parametric Estimates of the Relationship
Between Permanent Income and Type of Preschool

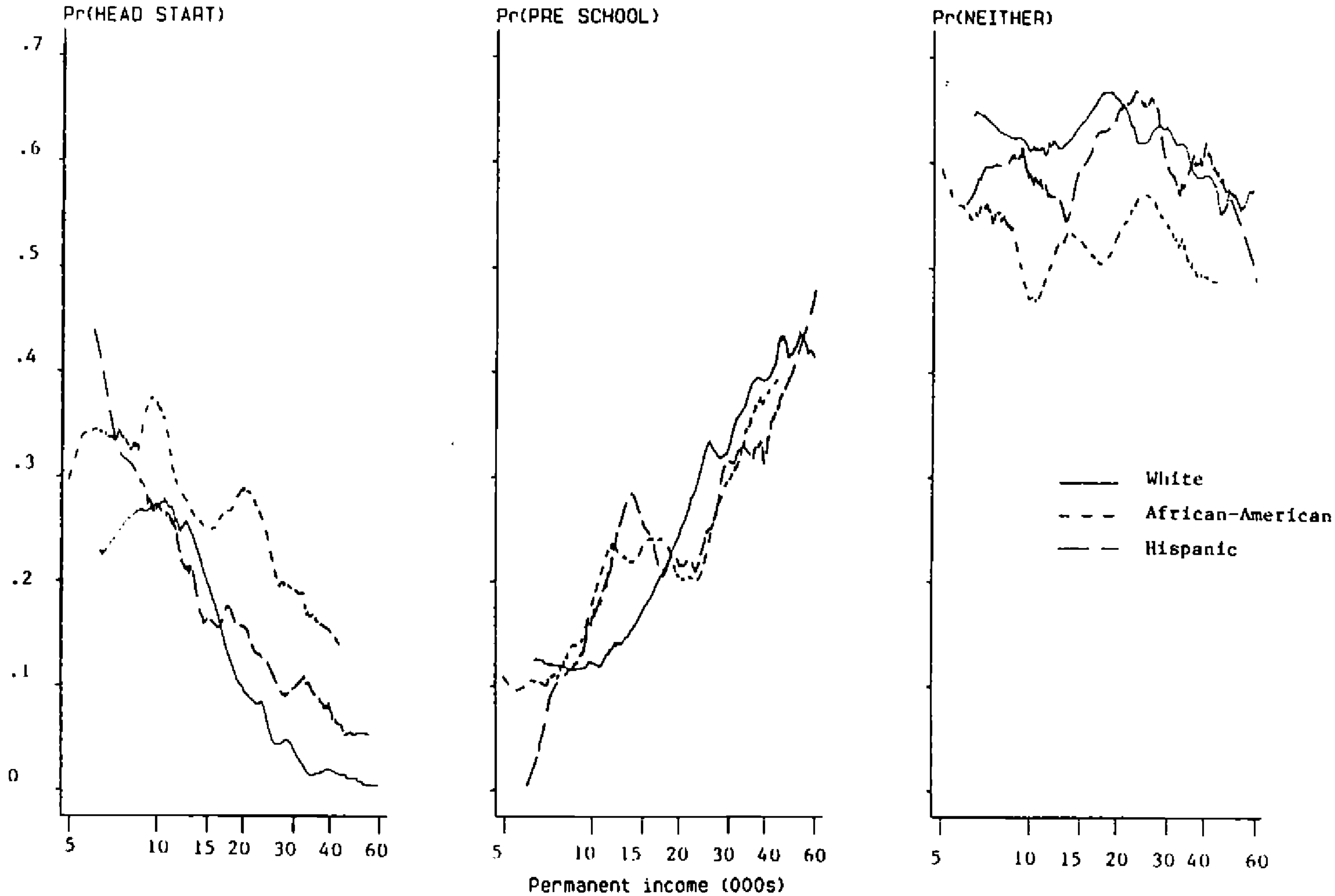


Figure 2: Non-Parametric Estimates of the Relationships Between PIAT-Math Scores, Type of Preschool, and Income

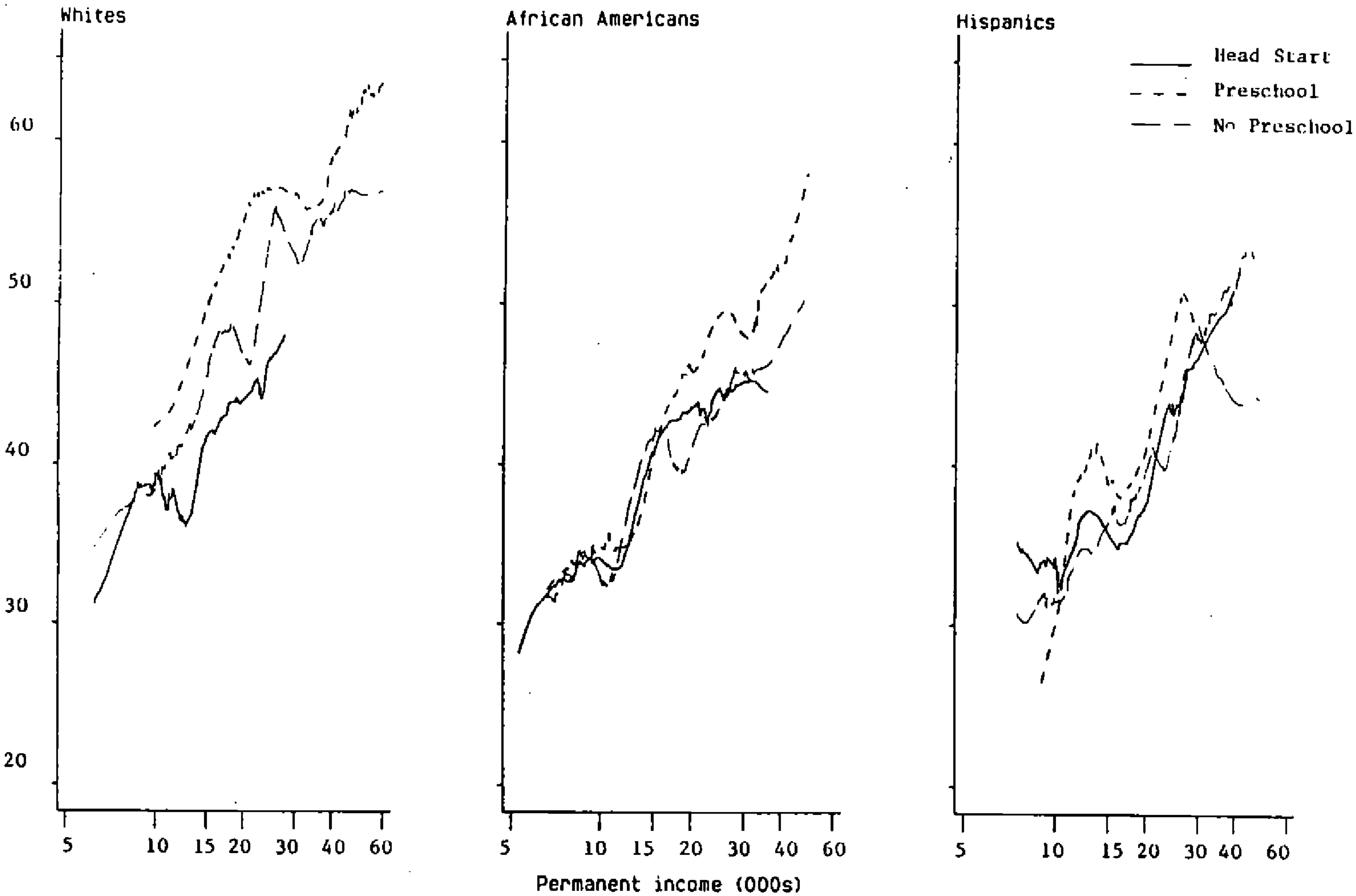


Figure 3: Non-Parametric Estimates of the Relationships Between
PIAT-Reading Comprehension Scores, Type of Preschool, and Income

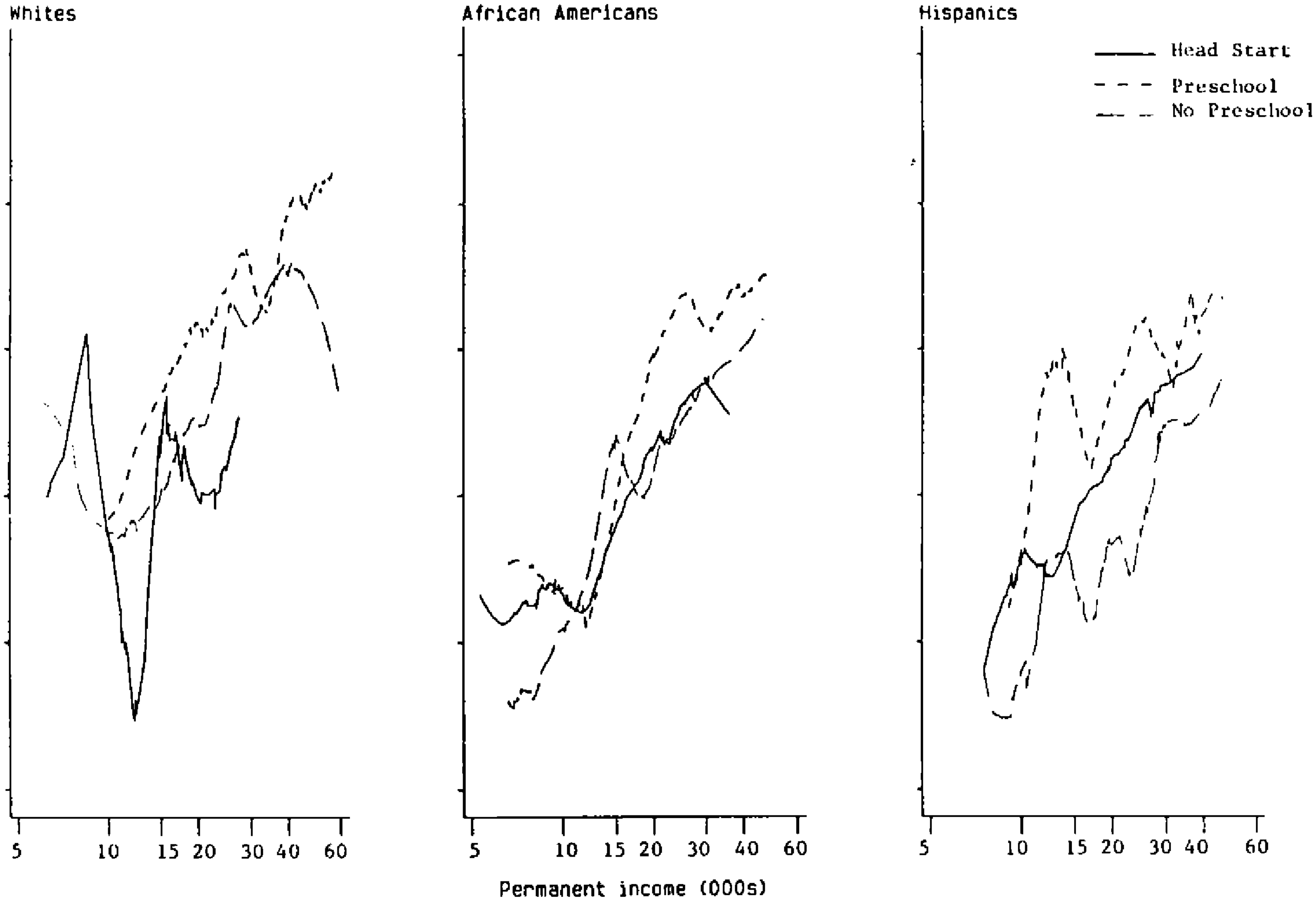


Figure 4: Non-Parametric Estimates of the Relationships Between PPVT Scores, Type of Preschool, and Income

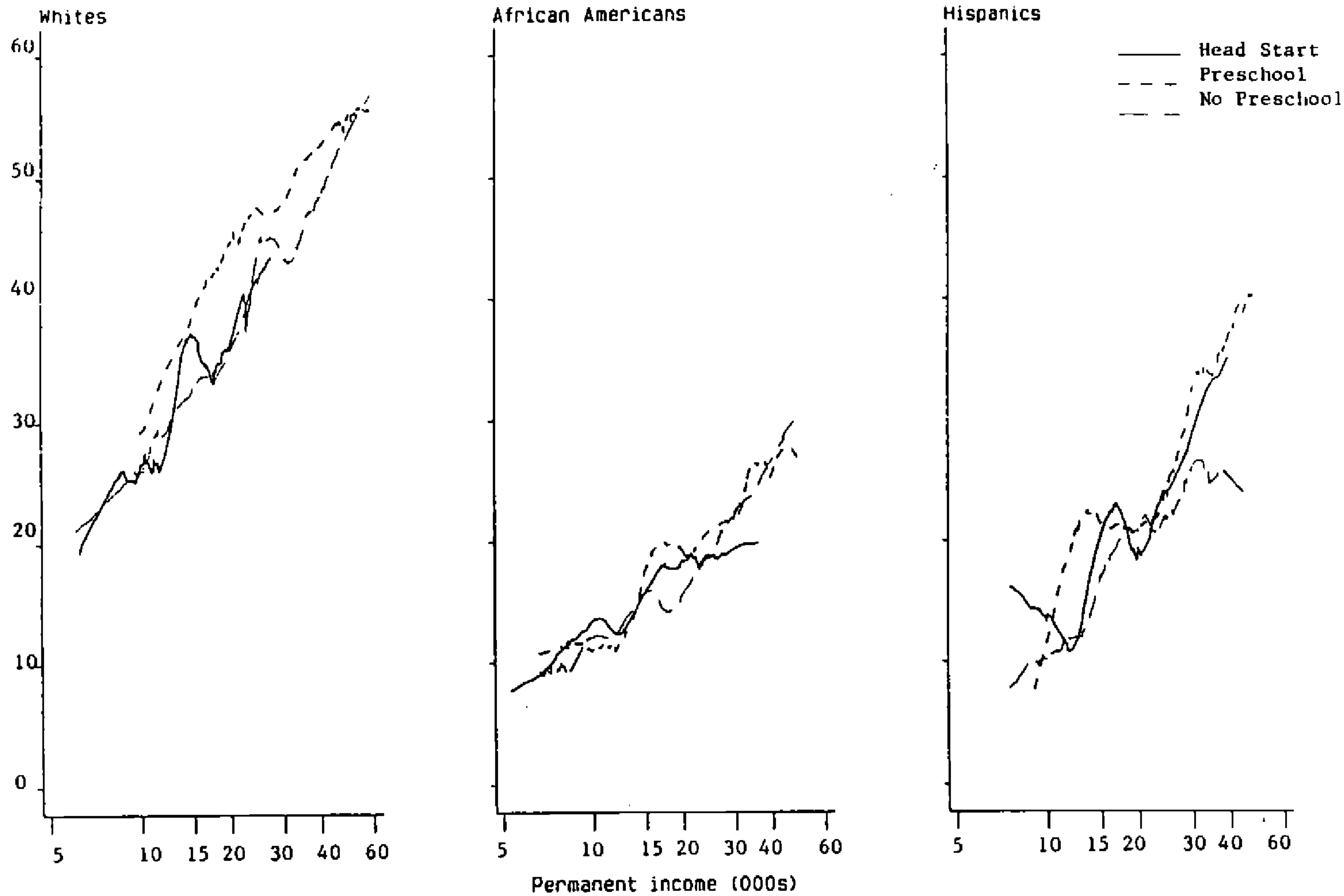


Figure 5: Non-Parametric Estimates of the Relationships Between the Probability of Grade Retention, Type of Preschool, and Income

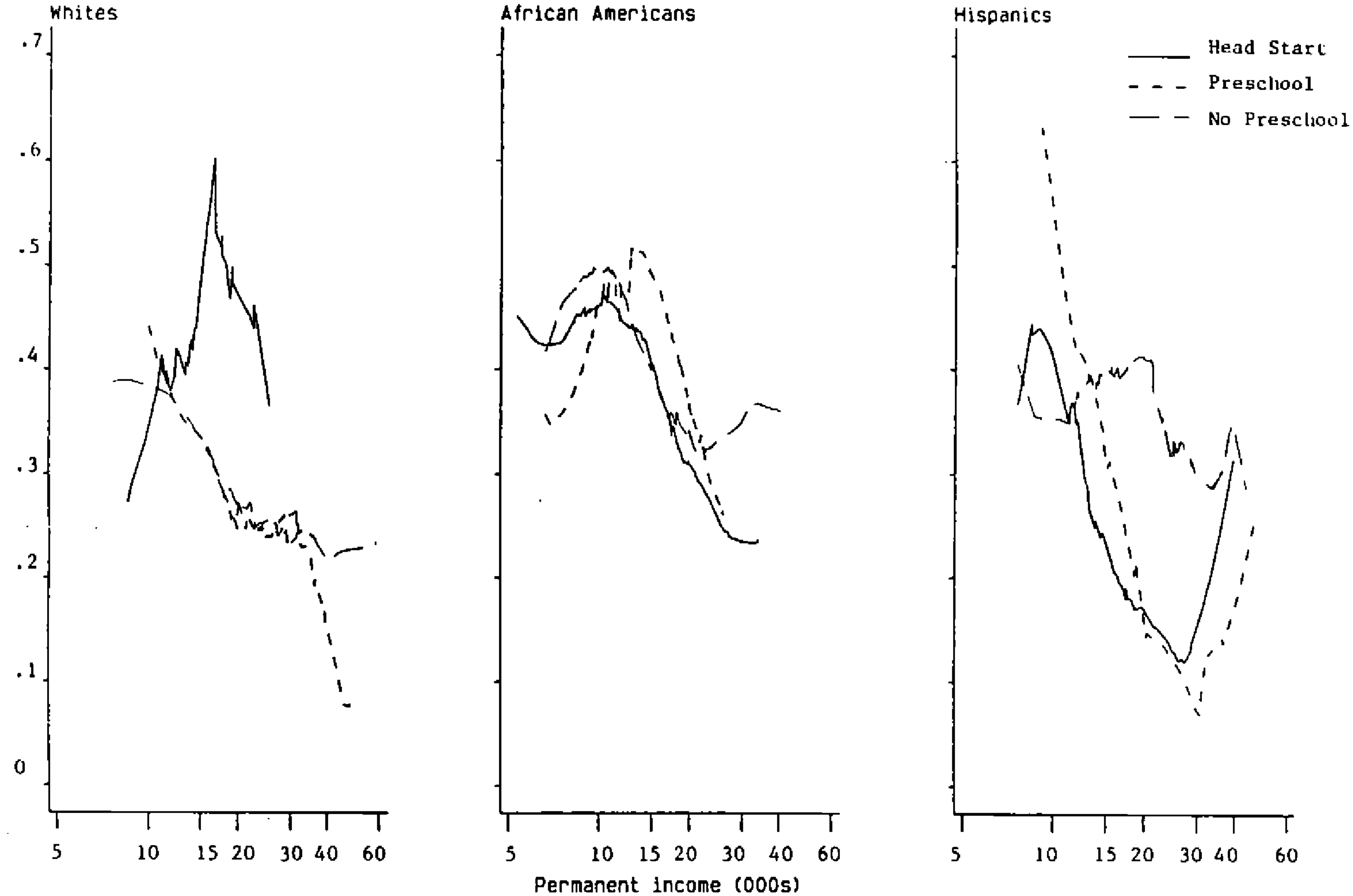


Figure 6: Non-Parametric Estimates of the Relationships Between the Probability of a Measles Shot, Type of Preschool, and Income

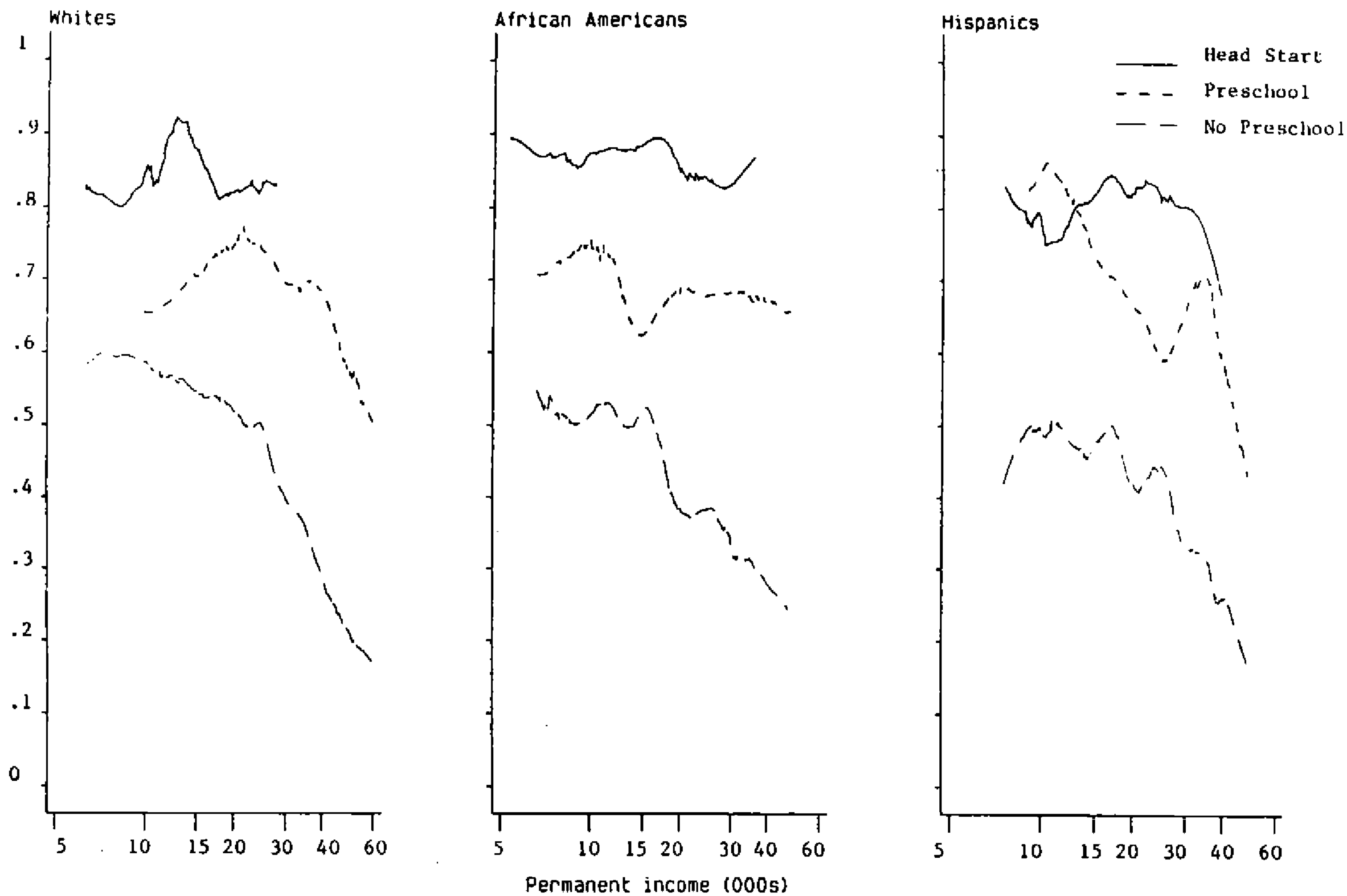
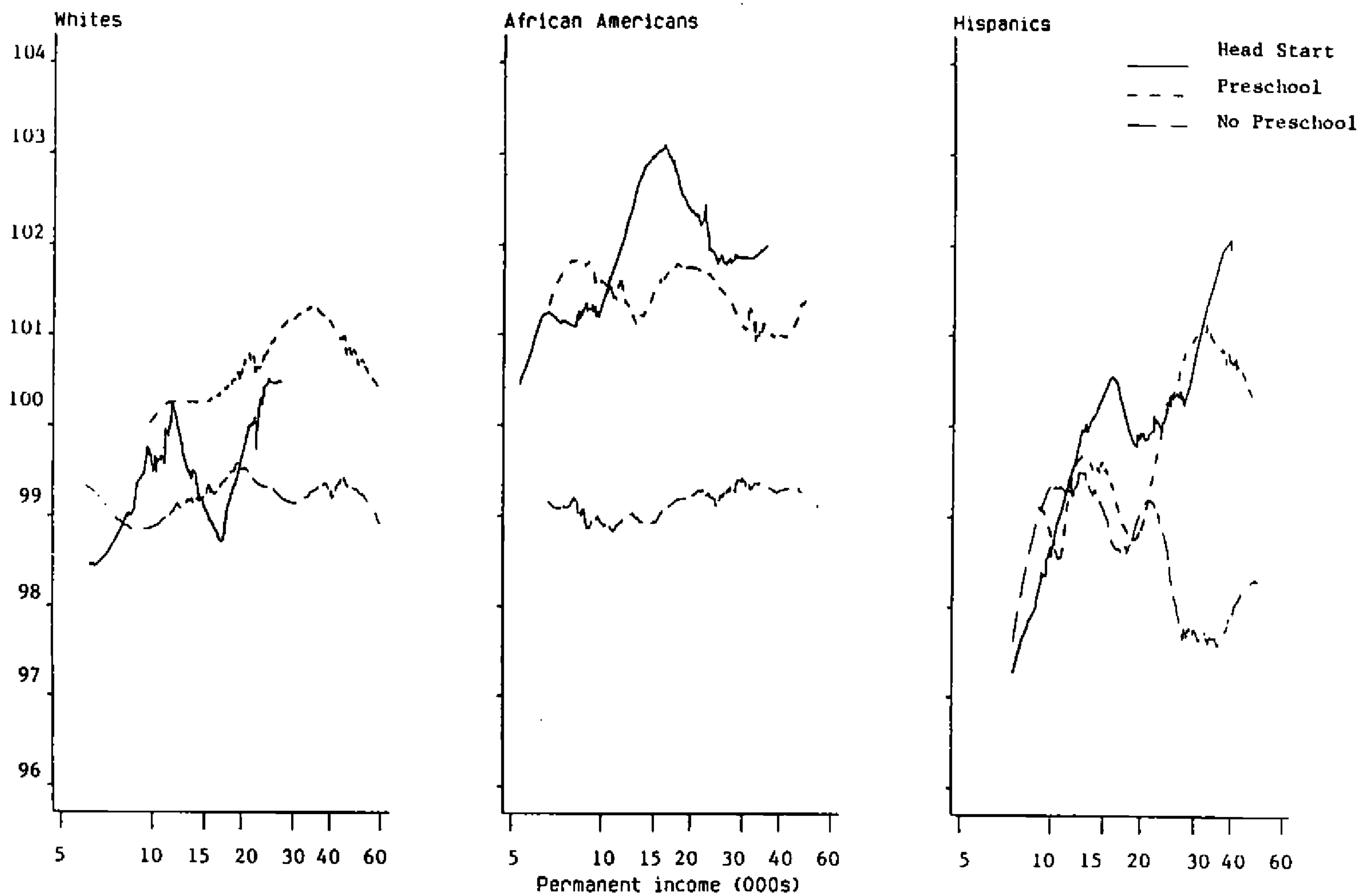
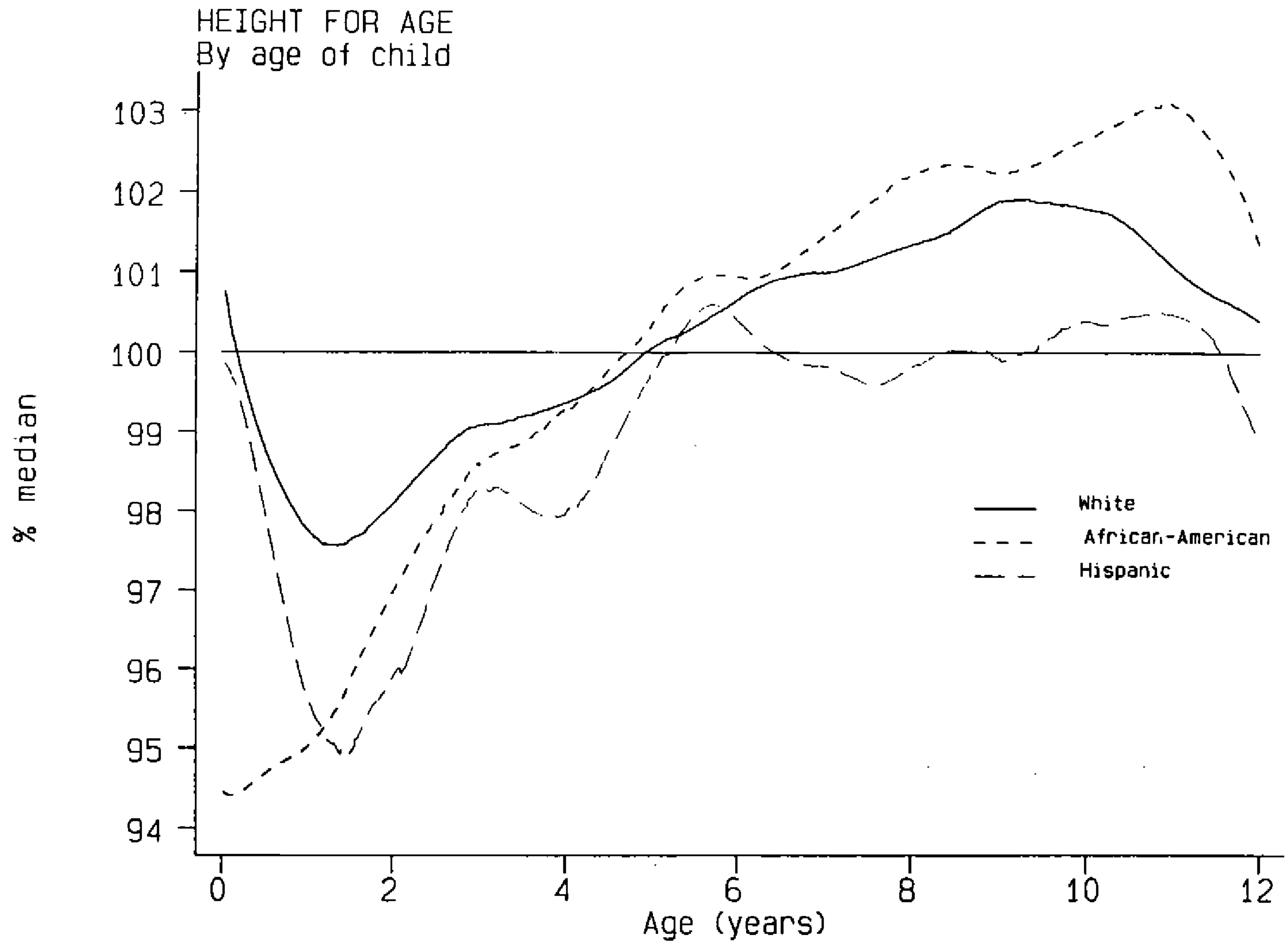


Figure 7: Non-Parametric Estimates of the Relationships Between the Height-for-Age, Type of Preschool, and Income



Appendix Figure I: Non parametric estimates



Appendix Figure 2: Disributions of education and AFQT