Getting Inside the "Black Box" of Head Start Quality: What Matters and What Doesn't

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Abstract

Head Start, the national preschool program for low income children, has recently been subject to unprecedented criticism. Critics point to substantial variation in program content across sites, and contend that many programs spend too little money on educational services, and too much money on programs extraneous to education. On the other hand, defenders of Head Start argue that it is difficult to meet the needs of severely disadvantaged children without offering a broad range of services. Given the available evidence, it has been impossible to assess the validity of these claims.

In this study, we match detailed administrative data on Head Start program budgets and educational inputs with data on child outcomes from the National Longitudinal Survey of Youth 1979, including test scores, behavior problems, and grade repetition. We find that former Head Start children have higher reading scores and are less likely to have been retained in grade where Head Start spending was higher. However, when we divide Head Start budgets into the shares spent on educational, health and all other services, we find that additional spending on educational programming or specific educational inputs such as the share of teachers with qualifications, the pupil/teacher ratio, or teacher salaries has little impact on test scores or grade repetition, though lower pupil/teacher ratios decrease behavior problems. Instead, our results suggest that spending on health, nutrition, and services for the disabled are more strongly related to subsequent achievement.

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Introduction

Head Start is a preschool program for disadvantaged children that aims to provide early intervention so that children can begin schooling on an equal footing with their more advantaged peers. The program is designed to address a wide variety of needs in addition to providing early educational experiences. For example, federal guidelines mandate that children receive nutritious meals, that their medical needs be assessed, that they receive necessary medical attention, that children with disabilities make up 10 percent of the children served, and that parents be involved in the program. Begun in 1965 as part of President Johnson's "War on Poverty", in 2000 Head Start served 857,664 children in predominantly part-day programs, about 65% of eligible 3 and 4 year old poor children.[1] Over time, federal funding has increased from $96 million in 1965 to $5.3 billion in 2000.

There have been dozens of studies of Head Start and related preschool and early school enrichment programs.[2] These studies have established that early intervention programs can have a dramatic effect on children's lives. For example, the Perry Preschool Project and the Carolina Abecedarian Projects demonstrated long-term gains in academic achievement, as well as reductions in teen pregnancy and crime, in the context of well-executed randomized trials. Head Start Centers are typically of lower quality than these model programs, but of higher average quality than other child care available to low income parents. Research has shown that

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[1] Authors' calculations based on the 2000 Head Start Fact Sheet at http://www.acf.hhs.gov/programs/hsb/research/factsheets/00_hsfs.htm, and statistics on the number of children less than 6 in poverty at http://ferret.bls.census.gov/macro/032001/pov/new01_003.htm.

[2] See Currie (2001), Barnett (1995) and Karoly et al. (1998) for reviews.

Head Start has both short-run and long-run positive impacts on children, though it does not bring poor children up to the average levels of achievement of non-poor children.

The recognition that Head Start may not be enough to prevent the intergenerational transmission of poverty has led to divergent prescriptions for reform. On the one hand, critics argue that Head Start's core mission should be educational, and that in many centers funding on educational services has been diverted to, for example, programs for parents (Abell Foundation, 2000). A recent National Research Council (1998) report suggested that some Head Start centers were not focusing enough time on preventing reading difficulties in young children. Concern has also been expressed about low levels of teacher pay and qualifications. The Bush Presidential Campaign's proposal to transfer responsibility for the program from the Department of Health and Human Services to the Department of Education symbolized this view that the program should be focused more exclusively on education.

On the other hand, advocates argue that disadvantaged children have a wide range of needs that must be met before they can learn academic material effectively, so that it is appropriate for Head Start to offer a range of services. For example, in coordination with state agencies, Head Start currently provides disabled children (broadly defined to include children with developmental delays) with speech and language therapy, occupational and physcial therapy, special education, and mental health services.[3] Advocates argue that more funding is

[3] According to the Head Start performance standards laid out in the Federal Register, a disabled child is one with mental retardation, hearing or visiual impairments, autism, brain injury, and other health impairments or specific learning disabilities. At state discretion, the term may also be applied to children suffering developmental delays. States are mandated to provide services to disabled preschool children, and may choose to do so either through Head Start or in conjuction with Head Start. E.g. Head Start may be used to provide an "inclusive experience" for a child who receives more specialized therapy elsewhere.

necessary in order to raise Head Start quality while continuing to provide these services (Zigler and Styfco, 1994).

The Head Start reauthorization bill introduced by Representatives Castle and Boehner on May 22, 2003 takes a strong position on the way in which Head Start should be reformed. It includes language stressing the importance of academic preparation and focusing on teacher qualifications (requiring that 50 percent of teachers have a bachelor's degree within five years, as well as requiring all new teachers to have at least an associates degree within 3 years). Since the bill does not provide new resources for Head Start, money for improving teacher qualifications would have to be taken from other aspects of the program.

These considerations make it especially timely and important to "get inside the black box" of Head Start program quality, and determine which aspects of the program have the greatest impact on child outcomes. There has been little previous research on this question, primarily because of a paucity of data linking Head Start program characteristics to child outcomes.[4] This paper provides a look into the box, by linking administrative data on Head Start program quality to information about child test scores, behavior problems, and grade repetition from a large, national sample of children drawn from the National Longitudinal Survey of Youth 1979 Child and Young Adult Data (NLSY). We estimate models in which the key variable is

[4] The most recent federally-sponsored study of Head Start is the Family and Child Experiences Survey (Zill, Resnick and McKey, undated). Unfortunately this study took a short-term perspective, following children over the course of one year in Head Start, and had no control group. The study found that children showed gains in social skills over the course of the year. Cognitive gains were assessed by comparing the Head Start children to national norms. These findings were consistent with those of many other studies which have documented short-term gains, particularly to verbal skills. A large-scale, federally-sponsored, experimental evaluation of Head Start's effects on short-term outcomes is currently in the field.

the interaction between whether or not a child attended Head Start, and per capita spending on Head Start in the year and county that a child was 5. That is, we examine the difference between Head Start children in high and low spending areas, using the difference between non-Head Start children in high and low spending areas as a control.

We find that relative to other children who were in the same location at age 5, Head Start children have higher reading scores and are less likely to have been retained in grade where Head Start spending was higher. However, when we divide Head Start budgets into the shares spent on educational, health and "all other" services, we find that additional spending on educational programming or on specific educational inputs (such as the share of teachers with qualifications, the pupil/teacher ratio, or teacher salaries) has little impact on test scores or grade repetition, though lower pupil/teacher ratios reduce behavior problems. Instead, our results suggest that spending on health, nutrition, and services for the disabled are more strongly related to subsequent achievement. These findings suggest that current proposals for the reform of Head Start may not have the desired impact.

The rest of the paper is laid out as follows: Section II describes the data, section III discusses methods, results are presented in section IV, and section V offers some conclusions.

II. Data

Data about Head Start programs comes from two sources: Program Information Reports (PIRs) and an administrative data set on Head Start budgets called PCCOST. The PIRs are filled out by each Head Start grantee, delegate agency and Parent Child Center (PCC) in most years,

and cover the period 1988 to 2000.[5] They provide information about the educational qualifications of staff, teacher pay, teacher turnover, and much more.[6] The PCCOST data spans the period 1990 to 2001 and has information about the sources and disposition of Head Start program funds, breakdowns of enrollment by the type of children served, and information about the director and other administrative staff. The PCCOST data also has the FIPS county code, which enables us to merge it with the NLSY data.

The PCCOST data was generated by a computer program that many agencies used to fulfill their administrative reporting requirements. However, agencies were not required to use the program, and some did not do so in every year. Moreover, the program was phased in during the early 1990s, and started to be phased out around 1998 (in favor of a replacement program) so that the years 1996, 1997, and 1998 are those with the most complete reporting. Hence, in order to preserve sample size, we went through the data casting backward and forward as many as three years to fill in missing observations. The administrative data is also fairly noisy, necessitating some data cleaning and removal of outliers. For example, we deleted a small number of agency-year observations that reported enrollments of fewer than 10 children, or per capita expenditures of less than $500 per child.

The NLSY data tracks the children of the roughly 6,000 young women who took part in

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[5] As the names suggest, the federal government gives money to a Head Start grantee, which may or may not pass the money onto one or several "delegate agencies". (That is, the grantee could also be the agency that ran the center). A unit of observation in the administrative data is therefore defined by the grantee's number, the delegate agency's number, and the year.

[6] In principal, the administrative data contains information about many aspects of Head Start programs. However, in practice, data for many of the variables is often coded as missing or zero (when it could not be zero). In this paper, we focus on the budget data, which is relatively complete, and on selected inputs which do not suffer as greatly from missing data problems.

the original NLSY survey, which began in 1979, hence, a great deal of information is available about the characteristics of mothers, including their county of residence in each year, and their score on the Armed Forces Qualifications Test (AFQT), a test of job skills. Beginning in 1986, the children have been surveyed and assessed biannually. Mothers were asked whether the child had ever attended Head Start and whether (for children 10 and over only) the child had repeated any grades.[7] For each child, we have scores for tests of vocabulary (the Peabody Picture Vocabulary Test, or PPVT), reading (the Peabody International Assessment Tests for reading recognition (PIAT-RR) and reading comprehension (PIAT-RC)), mathematics (PIAT mathematics), as well as an index of behavior problems (normalized separately by sex).[8] There are different numbers of observations available for each test, given that they were administered to children in different age ranges. Also, the reading comprehension test was administered only to children who scored above a threshold level on the reading recognition test. We use all non-missing observations for each score, in order to preserve the maximum possible number of observations.[9]

It is important to examine a wide range of indicators. First, there is a good deal of controversy about the use of standardized tests to measure student achievement. Among the test

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[7] Mothers are also asked whether children attended some other form of preschool, which should help to clarify that Head Start is distinct from other preschools. In our data, 69 percent of children are reported to have attended other preschools, so that some children attended both Head Start and other preschools.

[8] The NLSY offers two normalizations of the Behavior Problems Index. Results using the index that is not normalized by sex produced very similar results.

[9] For further information about these data, see the NLSY79 Child and Young Adults User's Guide 2000 which is available at http://www.bls.gov/nls/y79cyaguide/nlsy79cusg.htm.

scores we examine, minority children perform particularly badly on the PPVT, and better (relative to white non-Hispanic children) on the PIATs. There is increasing evidence that non-cognitive skills are also important in determining eventual outcomes (c.f. Heckman et al., 2000). For example, evidence from evaluations of model preschool programs suggests that there may be improvements in long-term outcomes including educational attainment even in the absence of lasting gains in test scores. Hence, we examine grade repetition and behavior problems.

In order to merge the administrative data with the NLSY data, we proceeded as follows. First, we identified the last year that a child could have been enrolled in Head Start (i.e. their 5th year). Second, we retained scores only for children 60 months of age and older. In this way, we avoid using scores that could have been measured before the child attended Head Start. Third, we took the mean of all age-normalized percentile scores available for each child, in order to arrive at one observation per child. One advantage of this procedure relative to examining test scores at a particular age, is that there are many fewer missing values. For example, a child who was surveyed at age 4 in 1990, skipped an interview, and then was reassessed at age 8 in 1994 would not have any test score available for age 6. A second advantage is that averaging over several test scores is likely to give a more accurate measure of the child's abilities than taking a single test score. Previous analyses of these data have shown that as much as half of the total variation in test scores is within child, rather than between child (Currie and Thomas, 1995). We lose 327 children for whom information on Head Start attendance was missing, and a further 210 children for whom information on the mother's AFQT scores was missing, for a total usable sample of 4,687 children.

Two complications arose with the actual merge of the two data sets. First, while most

counties were served by only one Head Start program, some counties are served by more than one program. In these cases, we took a weighted average of the characteristics of programs serving the county, where the weights were the number of children in each program. Second, even after filling in missing values in the way described above, there were instances in which we could not find an appropriate administrative match for the NLSY data in a particular year. In these cases, we took data from the nearest available year. Eighty percent of NLSY observations could be matched to an administrative data point within plus or minus three years, while 95 percent of NLSY observations could be matched to an administrative data point within either three years prior to the child's last head start year, or within six years following the child's final Head Start year.[10] The results reported below are in fact slightly stronger if we keep only these observations and exclude the 5 percent of observations with especially poor matches.

The implicit assumption we have relied on in filling in missing administrative data, is that programs change relatively slowly over time within counties. In fact, if we decompose the variance in the administrative data into within and between components, we generally find that the lion's share of the variation is across agencies. For example, the between component of the variance in enrollments is 449 compared to a within component of 108, while the comparable figures for per capita expenditures are 1682 vs. 827. By smoothing within-agency variation in spending, we will tend to attenuate its effects, and thus the estimates presented below may be under-estimates of the true effects of Head Start expenditures on outcomes.

Table 1 shows means of the administrative data for all agency-years with information on

[10] The reason for this asymmetry is that more data is missing from the beginning of the sample than from the end of the sample. For instance, some children whose last Head Start year would have been 1988 could not be matched to an administrative observation until 1994.

per capita expenditures, for agency-years that are missing data on per capita expenditures (and thus are excluded from our analysis), and for the subset of the data that we match to NLSY children. The NLSY data are further broken out by race and ethnicity, as discussed further below. All dollar amounts are in real 1998 dollars.

Table 1 shows total enrollments, per capita funding "on the balance sheet", and total per capita funding including "in-kind" transfers.[11] Head Start centers are required to give breakdowns of the "on the balance sheet" portion of their budgets into ten categories including: administration, education, services for the disabled, occupancy costs (i.e. rent, utilities, etc.), health, parent services, social programming, nutrition programs, transportation and "other". We also include information about the race and ethnic breakdown of children served by the programs, as well as information about specific educational inputs that are often examined in the literature on school quality. These include pupil/teacher ratios, lead teacher salaries, and the fraction of teachers with qualifications. It is important to note that the qualifications in question involve credits in early childhood education, usually available from community colleges. Thus, we cannot use these data to assess the likely effects of requiring Head Start teachers to have Bachelor degrees, as the current reauthorization legislation proposes.

Table 1 shows first, that there is little difference in other respects between agency-years for which per capita funding data was reported, and agency-years for which it is missing. Table 1

[11] Cash on the balance sheet includes money from the Administration for Children, Youth, and Families, and "non-federal share cash". The total spending also includes a small amount of "other cash", money from USDA, "non-federal share" in-kind, and "other in-kind". One reason for keeping track of the budget in these categories is that programs are required to partially match federal contributions with cash and in-kind funding from other sources. There are also limits on how much can be spent on particular budget items. For example, programs cannot spend more than 15 percent of on the balance sheet funds on administration.

also shows that relative to all programs, the programs matched to NLSY children are larger (mean enrollments of 744 vs. 487) and funded at somewhat lower levels (total per capita funding of $4957 vs. $5260). We believe that the large difference in size reflects the sampling scheme in the NLSY–sampled children were apparently unlikely to be located in counties that had very small Head Start programs. They also have much lower fractions of white children, and higher fractions of black and Hispanic children, on average. Despite these differences, other aspects of the programs are quite similar–the main exceptions are that compared to the full sample, the NLSY children have teachers and directors who are slightly better paid, and have higher pupil/teacher ratios.

The Table indicates that despite concerns about teacher qualifications, 85 percent of teachers are qualified. The 1994 Head Start Reauthorization Act required that by September 30, 1996, Head Start classroom teachers had to have a Child Development Associate degree; a state-awarded certificate for preschool teachers; an associate, baccalaureate, or advanced degree in early childhood education; or a degree in a field related to early childhood, with experience in teaching and a state awarded certificate to teach in a preschool program. We do see an increase in the fraction of teachers with qualifications, from 80 percent in 1991/92 to 92 percent in 1997.

It is striking that despite their qualifications, teachers receive what seem to be very low pay, averaging $16,430 per year. It is possible that this reflects the part-time nature of the typical program. For example, at 5 hours per day, 34 weeks per year, this salary would imply an hourly wage rate of $18,33, which is actually higher than the average hourly wage of $17.93 ($1998) that workers with B.A. degrees received in 2001 (authors' computation from the May Current Population Survey). The average salary received by Head Start program directors is $36,882

which is similar to the salary of a typical worker with a BA.

Per capita funding levels in Table 1 can be compared to those for "model" programs that have demonstrated benefits. The part-day Perry Preschool intervention cost $12,884 per child (in 1999 dollars) for a program that lasted eight months a year over two years. Since 20 percent of the children participated only for one year, the figures imply that the cost per child was approximately $7,000 per year, so that Head Start costs about 71 percent of what Perry Preschool cost (Karoly et al., 1998). The preschool component of the Carolina Abecedarian project cost about $15,000 per child, per year, and this part of the intervention lasted five years.[12]

The last three columns of Table 1 explore differences in the programs serving children of different racial/ethnic backgrounds. Programs serving black and Hispanic children tend to be much larger, and are worse funded on average than those serving white children: Average total funding per child ranges is $5,070 for white children, $4,907 for Hispanic children, and $4,752 for black children. This finding is consistent with Resnick and Zill's (undated) findings regarding the lower quality of programs with higher shares of minority children. The share of the budget spent on different categories is quite similar across races, with the exception that black children tend to be in programs with higher educational expenditures, and lower expenditures on programs for parents. These differences are reflected in somewhat higher teacher salaries in programs attended by black students.

One of the most striking differences between programs is in the composition of peers. White children attend programs with the highest fraction white (47 percent), while black and

[12] Fewell and Scott (1999) report that the Infant Health and Development Program, another well-known early intervention whose long term effects are currently being assessed, also cost about $15,000 per year per child.

Hispanic children attend programs with low fractions of white children (29 and 23 percent, respectively), and high fractions of other minority children. An odd feature of our data is that black children apparently attend programs with higher fractions Hispanic than Hispanic children. We believe that this reflects a limitation of the NLSY data, which is that the Hispanic children in the sample were born to mothers already in the country as of 1978. Hence, children of more recent immigrants and child immigrants themselves are not represented. Appendix Table 1 shows that if we use the administrative data to divide programs into those serving a majority of black students, a majority of Hispanic students, and a majority white non-Hispanic students, a more typical pattern emerges: the majority black programs are 79 percent black, majority Hispanic programs are 73 percent Hispanic, and the remaining programs are 82 percent white.

Table 2 shows differences in the NLSY children's outcomes and background characteristics. Twenty-two percent of the children were reported to have ever attended Head Start. In recent years, about 800,000 have been enrolled in every year, which works out to about 14 percent of all 4 year old children and 7 percent of all three year old children being served at any point in time (ACYF, 1998). Given that children can attend Head Start over a two year window, the NLSY figures seem reasonably consistent with the administrative data. Participation rates are also much higher for black, and especially for Hispanic children than for white children, which again is not surprising given the other differences in family background.[13]

The test scores that we use are normalized so that the child's score is the percentile of the

[13] In 1998, the fractions of black, Hispanic, and white Head Start children were 36, 26, and 31 percent respectively–if all poor children had participated at equal rates, the corresponding fractions would have been 29, 31, and 35 (authors' calculation based on the assumption that poverty rates for white, black, and Hispanic children were 15, 40, and 40 percent, respectively.

national distribution for children of the same age. By this metric, we can see that NLSY children have average scores on the PIAT-Math, somewhat higher scores on the PIAT-Reading Recognition and Reading Comprehension tests, and quite low scores on the PPVT. This may be because the norms used for the PIAT tests are dated. They also have scores on the behavior problems index that are somewhat higher than the national norm, indicating a greater incidence of behavior problems. There are also striking differences in patterns of these scores across race and ethnic groups, with whites typically having better scores than blacks and Hispanics. Finally, 11.7 percent of children had ever repeated a grade by the time of the 2000 survey, and this rate varies from a low of 8 percent among whites to a high of almost 18 percent among Hispanic children.

Differences in mothers' backgrounds show the expected patterns across race and ethnicity. For example, white mothers have a permanent income (calculated as the mean over all reported incomes in the NLSY sample) of $60,419 compared to $32,884 for Hispanic mothers. Similarly, white mothers have much higher scores than black and Hispanic mothers (52.47, 25.07 and 20.59, respectively) on the AFQT (Armed Forces Qualifications Test), a test of skills that was administered to all of the original NLSY members. Children of black and Hispanic mothers also have more siblings than children of white mothers, and have mothers with less education on average.

Finally, the last two lines of Table 3 describe the matching of the NLSY and administrative data and show that on average, administrative data comes from one year after the last year that the child could have attended Head Start. This is because, as discussed above, administrative data is more likely to be missing in the early years than in the later years of the

sample.

IV. Methods

We estimate least squares regression models of the following form:

(1) $Outcome_{ict2} = a + a_1 Percap_{ct1} + a_2 HeadStart_{ict1} + a_3 Percap_{ct1} * HeadStart_{ict1} + a_4 X_{ic} + a_5 Cohort_{ict1} + e_{ict2}$,

where Outcome is a test score, the behavior problem index, or a measure of whether the child has repeated a grade; i indexes the individual, c indexes the county; t1 is the last year the child could have attended Head Start, and t2 is the time that the outcome was measured; Percap is per capita expenditure in the county's Head Start program; Head Start is an indicator equal to one if the child attended Head Start and zero otherwise; X is a vector of mother and child characteristics that includes all of the variables listed in Table 2; Cohort is a vector of dummy variables for the last year that the child could have attended Head Start (1988-89, 1990-91, 1992-93, 1994-95, 1996-97, 1998-99), which allow outcomes to vary for children of different cohorts; and e is an idiosyncratic error term.

Percap, the main effect of per capita spending, captures the overall effect of being in a high spending county, for both Head Start and non-Head Start children. Counties with high spending on Head Start could have unobserved characteristics that are associated with higher test scores for all children. For example, some counties might have generous community health programs in addition to Head Start. To the extent that counties with these characteristics also spend more on Head Start, the effects will be captured by Percap. Families also select into counties on the basis of their characteristics. Within a county, both Head Start and non-Head

Start families have selected the same location.

Previous research suggests that the coefficient on HeadStart, a_2, is likely to be negative because children who attend Head Start are negatively selected relative to other children (c.f. Currie and Thomas, 1995). In fact, Head Start program standards direct agencies to develop a recruitment process to help them reach "those most in need of Head Start services" and specify that the "use of referrals from other public and private agencies" is one way to achieve this goal (U.S. Dept. of Health and Human Services, 2003, Section 1305.5). Children on the waiting list are to be ranked in terms of each agency's selection criteria. Thus, we can view HeadStart as a proxy for the negative unobserved characteristics of children that are associated with attending Head Start.

Our main focus is on a_3, the coefficient on the interaction between Percap and HeadStart. This coefficient measures the effect of additional spending on children who attended Head Start. We are essentially examining the difference between Head Start children in high and low spending areas, using the difference between non-Head Start children in high and low spending areas as a control. We might find for example, that Head Start children did better in high spending areas than in low spending areas, but if non-Head Start children showed a similar pattern, then a_3 would not be statistically significant, and we would have to attribute the better results in the high spending areas to some other characteristic of those areas.

We are also interested in assessing the extent to which different types of expenditures have different effects on outcomes. In order to address this issue, we estimate models in which we break per capita expenditures into three broad categories: education, health, and "other". The health category is defined by summing expenditures on health care, nutrition, and services for the

disabled. As Table 1 indicates, these expenditures together account for approximately 11 percent of Head Start "cash on the balance sheet" expenditures. The model we estimate is similar to (1) except that Percap is now a vector of three expenditure measures, and Percap*HeadStart is defined conformably.

We also investigate the effect of some particular education inputs, including pupil-teacher ratios, pupil-classroom staff ratios, lead teacher salaries, and the fraction of teachers who have qualifications. Specifically, we estimate models of the form:

(2) $Outcome_{ict2} = a + a_1 Percap_{ct1} + a_2 HeadStart_{ict1} + a_3 Percap_{ct1} * HeadStart_{ict1} + a_4 Input + a_5 Input * HeadStart_{ict1} + a_6 X_{ic} + a_7 Cohort_{ict1} + e_{ict2}$,

where Input is one of the educational inputs and the other variables are defined as described above. This specification holds per capita spending constant. Hence, it asks what would happen if we increased one input holding the total budget constant (which is analogous to what legislation requiring increased spending on particular inputs without increasing overall budgets would do).

A possible problem with our research design is that per capita spending could affect the way that children were selected into Head Start. If, for example, higher per capita spending induces children who would have higher test scores in any case to enroll in Head Start, then such selection could generate a positive interaction between Percap and HeadStart even in the absence of any causal effect of spending on the Head Start children. Hence, we also investigate the determinants of enrollment in Head Start by estimating equations of the following form:

(3) $HeadStart_{ict1} = a + a_1 Percap_{ct1} + a_2 X_{ic} + a_3 Cohort_{ict1} + e_{ict2}$,

where the variables are defined as they are above.

This model asks whether Percap has any effect on the average probability of enrollment. However, if the number of Head Start places are fixed, then changes in funding could have an impact on the type of child enrolled, even if there was no effect on the average probability of enrollment. In order to address this issue, we also estimate models of the form:

(4) $HeadStart_{ict1} = a + a_1 Percap_{ct1} + a_2 Percap_{ct1} * AFQT_{ict1} + a_4 X_{ic} + a_5 Cohort_{ict1} + e_{ict2}$.

This model asks whether Percap has a differential effect on children of mothers with higher AFQT. We chose to focus on maternal AFQT because it is the single variable that is most predictive of children's test scores. Other things being equal, we would expect children of high AFQT mothers to have higher test scores, so if the coefficient on the interaction is positive, it indicates that selection may be a concern.

Finally, we estimate models similar to (3) and (4) except that they break Percap into educational, health, and other spending, and interact these components with maternal AFQT. These models will allow us to ask whether, for example, there are particular types of spending that are more or less attractive to high AFQT mothers.

Several previous studies compare siblings in the NLSY in order to identify the effect of Head Start on outcomes (c.f. Currie and Thomas, 1995; Currie and Thomas, 2000; Garces, Thomas, and Currie, 2002). The focus in this study is different–we wish to ask whether, conditional on having attended Head Start, the size of any estimated effect on outcomes is affected by per capita spending on Head Start? For our purposes, a sibling comparison would be less than ideal, given the imprecise nature of the matching between the NLSY and the administrative data. However, we will draw on these existing results to aid in the interpretation of our estimates.

V. Results

a) Effects of Head Start Spending on Child Outcomes

Estimates of the effects of per capita spending in Head Start on child outcomes are shown in Table 3. The measure of spending used here is cash on the balance sheet. As discussed above, the main effect of per capita spending captures the influence of unobservables associated with having lived in a particular county in the child's last possible Head Start year. These effects are not statistically significant, suggesting that the family background characteristics included in the model do a good job of proxying for these unobserved characteristics.

Similarly, the estimated effect of ever having attended Head Start captures unobservables associated with selection into the program. These "main effects" of Head Start are strongly negative, indicating that Head Start children are very negatively selected, relative to the average child. In terms of test scores, the difference between the Head Start children and other children is greatest for reading. The coefficient of -10 on PIAT-RR and PIAT-RC indicate that Head Start children are .4 of a standard deviation below other children. Differences on the PIAT-Math and PPVT are less pronounced, with Head Start children scoring about a fifth of a standard deviation below other children with similar observable characteristics. Perhaps unsurprisingly, Head Start children are much more likely to have ever repeated a grade. On the other hand, they are no more likely than other children to have behavior problems.

The main focus of inquiry however, is the interaction between ever having attended Head Start and per capita spending in the Head Start program. This interaction addresses the question of whether, given that a child attended Head Start, he or she did better in areas that had more spending. The estimates in the first row suggest that spending had statistically significant

positive effects on the reading scores of Head Start children, and a negative effect on the probability of having repeated a grade. The point estimates indicate that each $1,000 in spending was associated with increases of 1.66 points in PIAT-RR and 1.53 points in PIAT-RC. These estimates imply that per capita expenditures of between $6,200 and $6,500 would be required to bring Head Start children's reading up to the average level of children in the sample. Similarly, simple linear extrapolation suggests that expenditures of $7,350 per child (which is similar to expenditures in the Perry Preschool Project) would be necessary to reduce the probability of grade repetition among Head Start children to the level of observationally similar children.

The other variables included in the model have roughly the expected effects. For example, boys have lower reading scores and are more likely to have repeated grades, although they are actually somewhat less likely to be reported as having behavior problems. Maternal AFQT is associated with higher test scores and a lower probability of being retained in grade, though it increases the probability that behavior problems are reported. On the other hand, maternal education increases tests scores and reduces the incidence of reported behavior problems, but has relatively little effect on the probability of grade repetition. The older cohorts of children tend to have the lowest scores, which is consistent with the fact that they were born to the youngest mothers.

The reason for focusing on the "cash on the balance sheet" measure of spending, is that this measure can be broken out by type of expenditure. Table 4 establishes that our results are not sensitive to the use of this measure rather than total spending (compare the first and second panels). Moreover, the third panel of Table 4 shows that if we separate spending into cash on the balance sheet and other expenditures, only the former appears to have a statistically significant

effect on outcomes. Hence, we focus on the cash on the balance sheet measure in what follows. All of our results using per capita spending are robust to the choice of spending measure.

Table 5 shows estimates similar to those in Table 3, except that models are estimated separately for non-Hispanic whites, blacks, and Hispanics. As shown above, white, black, and Hispanic children have very different average outcomes. Hence, it might be the case that a given change in spending had different effects on children from different groups. Table 5 suggests that this is indeed the case.

For white children, the interaction between ever attending Head Start and per capita spending is large and significant for PIAT-RR, but no longer significant for PIAT-RC. The effect on grade repetition is also much larger than in the aggregate model. Combined with the main effects, the estimates suggest that participation in a Head Start program with expenditures on the order of $5000 per child would be sufficient to bring the white Head Start children up to the level of other white children. In contrast, none of the estimated effects are statistically significant for black children, while among Hispanic children we find evidence of positive effects of spending on both PIAT-MATH, and PIAT-RC.

This pattern of racial and ethnic differences in the effects of Head Start is consistent with evidence reported previously by Currie and Thomas (1995, 2000), and raises questions about its cause. Although black Head Start children are in centers that spend about 5 percent less per student than white Head Start students, they spend about the same amount as centers serving Hispanic children and Table 1 showed that there are few differences in the observable characteristics of centers serving white, black, and Hispanic children. Hence, it is not likely that differences in outcomes are due to differences in observable input levels. And although the

sample sizes for blacks are smaller than for whites, they are roughly comparable to sample sizes for Hispanics, so the lack of a significant effect for blacks cannot be explained purely in terms of sample size.

Several caveats are in order, however. First, Currie and Thomas (1995) report that blacks and whites experienced similar short-term gains in test scores, but that the benefits "faded out" more quickly among blacks, perhaps due to subsequent attendance at inferior schools.[14] Second, Garces, Thomas, and Currie (2002) show using data from the Panel Study of Income Dynamics that black children who attended Head Start were less likely than siblings who did not attend to have been booked or charged with a crime when they were in their early 20s, even though they did not find significant effects of Head Start on educational attainment among blacks. These findings suggests that Head Start may have positive short-term and long-term effects for black children, even if they are not manifested in our data. Third, as discussed above, there is considerable measurement error in the administrative data, which may be exacerbated by our matching procedures. Such measurement error would tend to bias all the estimated effects downwards, so that it is possible that effects for blacks are smaller than those for whites and Hispanics, but still positive.

In summary, these estimates suggest that attending Head Start has positive effects on the reading scores of white and Hispanic children, and that these effects are increasing in program expenditures. Among white children, gains associated with Head Start result in less grade

[14] Lee and Loeb (1995) show that many Head Start children go on to attend schools of poor quality. Currie and Thomas (2000) show that black Head Start children go on to attend worse schools than other black children, but that this is not true for whites. Currie and Thomas (2001) show using British cohort data that school quality can mediate the relationship between early test scores and future outcomes.

repetition. Increases in Hispanic children's test scores are large and statistically significant but apparently not sufficient to result in significant reductions in grade repetition.

b) Getting Inside the Black Box of Program Design

The results discussed thus far suggest, in contrast to much of the literature on primary and secondary education, that increasing per capita spending levels on Head Start might have positive effects in terms of promoting educational attainment. However, there are many different ways that additional spending could be allocated. As discussed above, some observers feel that Head Start should focus on the educational aspect of its mandate, spending more money on curriculum and qualified teachers, and less money on "extraneous" social, parenting, and other programs. Other observers feel strongly that, particularly for preschool children, it is important to offer a comprehensive package of services. In this section, we ask whether it is possible to shed light on this debate using data about the way that Head Start programs allocate their budgets.

Table 6 shows estimates from models in which per capita expenditures have been grouped into three categories: educational spending; health spending (which aggregates the health, nutrition, and disability portions of the budget); and all other spending (administration, occupancy, transportation, parenting programs, social programs, other). The most striking finding in the first panel of the table, which shows estimates for all children, is that the interaction between educational spending and attending Head Start is never statistically significant. In contrast, the interaction between per capita health spending (broadly defined) and Head Start attendance is statistically significant in those models where total per capita spending

was shown to be significant above: namely for reading scores, and grade repetition.

When we estimate models separately for whites, blacks, and Hispanics, the findings for whites follow the same general pattern, though the interaction between "other" expenditures and Head Start attendance is also marginally significant in the model for PIAT-RR, and the interaction between per capita health spending and Head Start is significant in the model for PIAT-RC even though total per capita spending had no significant effect in this model (as shown in Table 5).

The estimates for blacks and Hispanics are too weak to be conclusive, perhaps due to the smaller sample sizes. For blacks, there is a marginally significant interaction between per capita spending on education and Head Start in the model of PIAT-RR, and among Hispanics, the interaction between per capita health spending and Head Start has a significant negative effect on the probability of grade repetition.

On the whole then, these results provide little support for the argument that increasing expenditures on educational programming would benefit Head Start children, and point instead to the importance of early intervention in the areas of health, nutrition, and treatment of disabilities. We have also experimented with breaking out parent programs separately, but found no significant effect of these expenditures on children's outcomes. It is however, still possible that expenditures on specific educational inputs could be beneficial. This hypothesis is explored in Table 7 which looks at four inputs that are commonly examined in the literature on primary schools: pupil-teacher ratios, pupil-classroom staff ratios, the fraction of teachers who have qualifications, and lead teacher salaries.

We add the main effect for each of these variables, and the interaction of the variable with

whether the child attended Head Start, to models of the same form as those shown in Table 5. These models control for per capita expenditure, so the question asked is whether, holding per capita expenditure constant, children benefit from increasing spending on a particular input (and presumably decreasing spending on other inputs). That is, we examine the effect of reallocating given expenditures in a particular direction.

Table 7 shows that higher pupil-teacher ratios are associated with a higher incidence of behavior problems. The addition of one student per teacher (from a mean of about 24) is associated with an increase in the Behavior Problems Index of .591 from a mean of about 57. This suggests that if the average pupil-teacher ratio were halved, it would reduce the incidence of behavior problems by .3 standard deviations. It is interesting that this effect is not observed for pupil-classroom staff ratios, suggesting that having additional adults in the classroom who are not teachers has little effect on behavior problems.

The fraction of teachers with qualifications (which is high in Head Start centers, with a mean of about 85 percent) is actually estimated to have a negative effect on PIAT-RC and on the PPVT scores of Head Start children. It is possible that Head Start teachers without formal qualifications are more positively selected in terms of teaching ability. Finally, the last panel of Table 7 shows that we do not find any significant effect of lead teacher salaries on child outcomes. We have also estimated similar models looking at the following "inputs": Director salaries, director's years of experience, director's annual hours of work, whether the center is run by a public school (about 12.5 percent are), and teacher turnover. The results were similar to those reported in Table 7, in that we found no evidence of effects on student outcomes.

c) Effects of Expenditures on Selection into Head Start

Table 8 shows estimates of the effects of per capita spending on the probability that a child ever participated in Head Start. The spending measure used here is cash on the balance sheet. Using total spending produced very similar results. Also, because the effects were small, we have rescaled per capita expenditures to units of $10,000, rather than the $1,000 units used in previous tables.

Table 8 shows that on average, an increase in per capita expenditures on Head Start had no effect that a child was enrolled. This is true for the whole sample, as well as for the white, black and Hispanic subsamples. The other coefficients are consistent with previous research. For example, an additional $10,000 of mother permanent income is associated with a 6 percentage point decline in the probability of ever having attended Head Start. The main effect of AFQT shows that mothers with higher AFQT scores are also less likely to send their children to Head Start–a woman with an AFQT score of 50 would be 2.5 percentage points less likely to use Head Start than a woman with an AFQT score of 25, other things being equal. It is interesting to note that conditional on the other variables included in the model, race and ethnicity are not predictive of attending Head Start. Hence, the large differences in the probability of enrollment by race and ethnicity are entirely accounted for by observable differences in circumstances. Cohort effects are roughly as expected, given increasing enrollments in Head Start over the 1990s, that is, the probability of enrollment is highest for the youngest cohorts.

The even numbered columns of Table 8 suggest that increases in per capita spending are associated with small changes in the composition of Head Start enrollees. For example, column

(2) suggests that raising per capita spending from $4000 to $5000 would close the gap in the probability of participation between children of mothers with AFQT scores of 25 and children of mothers with AFQT scores of 50 because higher spending increases the probability of using Head Start more for high AFQT women than low AFQT women. Columns (4), (6), and (8) show that this pattern holds for white and Hispanic children, but not for black children–among black children AFQT has little effect on the probability of enrollment, and the interaction with per capita spending is not statistically significant. These results suggest that although higher per capita expenditures do not increase the probability that the average child is enrolled in Head Start, they do have some impact on the composition of children in Head Start centers because children of high AFQT mothers are more likely to enroll in high-spending programs.

The second panel of Table 8 looks at interactions between components of per capita expenditure and AFQT. These models ask whether the composition of children in Head Start changes in a way that might be related to higher test scores. These estimates suggest that among whites and Hispanics, programs with higher per capita expenditures on educational programming serve children with higher AFQT mothers. However, the relationship between maternal AFQT and per capita health expenditures is not statistically significant. Programs with higher per capita "other" expenditures also serve higher AFQT mothers, suggesting that they may value some of the other services provided by Head Start centers.

These results suggest that the selection of children with higher AFQT mothers into higher spending programs is not driving our estimates of the effects of Head Start on outcomes. Our estimates indicated that only expenditures on health had effects on outcomes, but the higher AFQT mothers do not appear to value additional spending on health. It is possible that they can

access similar health services elsewhere more easily than low AFQT mothers. Instead, the higher AFQT mothers appear to value spending on educational programming. However, despite this form of selection, we find little evidence that such spending is associated with better outcomes.

It is worth considering whether higher health spending might also lead to changes in the composition of Head Start children. This conjecture is difficult to test, because relatively few NLSY children have gross disabilities such as blindness, and problems such as developmental delays are not well measured (except perhaps via low test scores). However, we conjecture that larger expenditures on health would be most attractive to parents whose children had health problems, who we might expect to have worse outcomes, other things being equal. Hence, our estimates of the effects of health spending may well be lower bounds on the true effects.

V. Discussion and Conclusions

Our results have implications beyond the current debate over the reauthorization of Head Start. Overall, in 1995, 31 percent of America's three year-olds, 61 percent of four year-olds, and 90 percent of five year-olds received some form of center-based care or attended kindergarten (National Center for Education Statistics, 1996). Head Start has served as a model for state preschools targeted to low-income children in states such as California (U.S. General Accounting Office, 1995), and also for new (voluntary) universal preschool programs in Georgia and New York. The Children's Defense Fund (1999) reports that as of the 1998-99 school year, 724,610 children were participating in state-funded enriched preschool programs. Hence, the number of children in state-funded early education initiatives is roughly equal to the 800,000 participants in

Head Start. The current Head Start reauthorization bill would likely accelerate this trend, by allowing states to opt out of the program, and receive a block grant instead. As there would be no performance standards attached to the block grant, this provision could lead to substantial changes, or even the elimination of the program in many cash-strapped states. Hence, it is more important than ever before to determine what works, and what doesn't in early childhood intervention programs.

This study represents a first attempt to "get inside the black box" of Head Start program design to answer specific questions about the effectiveness of the program. Our results provide evidence consistent with both sides of the debate over the future of Head Start. On the one hand, we find evidence that higher spending programs are more effective. In particular, Head Start children in higher spending programs have larger gains on reading scores, and a lower probability of repeating grades. It has been argued that learning to read is the most important academic milestone for elementary school children, since all other learning rests on this foundation (National Research Council, 1998). Moreover, gaps between Head Start children and others are largest for reading scores, and are relatively small or non-existent for math scores, vocabulary, and behavior problems. Thus, it is not surprising that a program that improved reading scores would also reduce grade repetition. Although we need to be cautious about linear extrapolations, our estimates imply that funding Head Start programs at a per child level similar to the Perry Preschool Program than current levels (an increase in expenditures of roughly 50 percent), would essentially eliminate the gap in reading achievement scores between the average Head Start child and other children.

We find that spending on health, nutrition, and services for the disabled generate the

largest effects on future outcomes. This finding is consistent with a large body of evidence that poor health in childhood has negative impacts on educational attainment via mechanisms such as reduced schooling attendance (see Grossman and Kaestner (1997) for a survey). This result is supportive of those who feel that Head Start should focus on the "whole child", but raises the question of why this spending is important given that these types of services are widely available through other programs such as WIC (the Supplemental Feeding Program for Women, Infants, and Children), Food Stamps, EPDST (the Early and Periodic Diagnostic Screening and Treatment Program which is available to Medicaid-eligible children), and other state programs for the disabled. It is possible that Head Start acts as a "case coordinator" and helps insures that children who need these other programs actually receive the benefits to which they are entitled, or that the combination of specialized services with preschool education is especially helpful.

On the other hand, we find little evidence that higher spending on educational programming, or on specific educational inputs, is associated with improved child outcomes. The one exception is that lower pupil/teacher ratios are associated with a reduced incidence of behavior problems (an outcome that is not generally examined in studies of elementary schools). It is noteworthy that only additional teachers (rather than other less skilled classroom staff) generated this effect. These results are consistent with a large literature on elementary schools, which finds small or inconsistent effects of such inputs (c.f. Hanushek, 2002). Similarly, studies of quality in child care centers have shown that while "process based" measures of quality such as the Early Childhood Environment Rating Scale (ECRS) score are associated with better child outcomes (NICHD ERRN and Duncan, 2002), "structural" measures of child care quality such as

pupil/teacher ratios are only weakly related to the ECRS (Blau, 2000).[15]

This study is the first word on this topic, but should not be the last. There are several important limitations of our work. First, we cannot directly address the implications of dramatically increasing the fraction of Head Start teachers with Bachelors degrees as the current reauthorization legislation would require, although our results suggest that it is worth considering whether this is likely to be the best use of scarce Head Start dollars. The Administration for Children, Youth, and Families estimates that it would cost $4,000 per capita to extend the Head Start program to a full-year, full-day program (Bourdette, 1999). Funding could also be used to extend the existing program to currently unserved children.

Second, although the NLSY sample is large by the standards of Head Start research, it is small relative to the number of children in Head Start, and omits some categories of children (such as Hispanics whose mothers were not in the United States in 1978) entirely. Moreover, participation in Head Start is based on maternal reports, and is likely to be measured with some error. Similarly, the administrative data available to us was incomplete and also subject to measurement error. These limitations suggest that further research with better data is warranted.

[15] Process quality characterizes the interactions between children and their caregivers, their environment, and other children, while structural measures of quality include such easily measurable attributes as pupil/teacher ratios, the fraction of teachers with qualifications, etc.

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Table 8: Effect of Per Capita Spending on Probability of Head Start Participation

	1 All	2 All	3 White	4 White	5 Black	6 Black	7 Hispanic	8 Hispanic
1 Total Per Capita Spending								
Per capita spending	-0.029	-0.305	0.025	-0.377	0.02	0.076	-0.108	-0.547
10,000	[0.055]	[0.080]	[0.065]	[0.127]	[0.117]	[0.154]	[0.126]	[0.177]
Per capita spending*		0.008		0.008		-0.003		0.023
AFQT		[0.002]		[0.002]		[0.005]		[0.006]
Mother's AFQT	-0.001	-0.004	-0.001	-0.004	-0.001	0	-0.002	-0.01
	[0.000]	[0.001]	[0.000]	[0.001]	[0.001]	[0.002]	[0.001]	[0.003]
Mother black	0.016	0.017						
	[0.017]	[0.017]						
Mother Hispanic	0.18	0.18						
	[0.016]	[0.016]						
Mother permanent inc.	-0.064	-0.067	-0.049	-0.051	-0.113	-0.114	-0.224	-0.246
10,000	[0.013]	[0.013]	[0.012]	[0.012]	[0.042]	[0.042]	[0.065]	[0.065]
Child male	0.002	0.002	0.01	0.01	-0.024	-0.024	0.005	0.005
	[0.012]	[0.011]	[0.014]	[0.013]	[0.026]	[0.026]	[0.026]	[0.026]
Child first born	-0.034	-0.034	-0.019	-0.018	-0.024	-0.024	-0.058	-0.058
	[0.013]	[0.013]	[0.014]	[0.014]	[0.030]	[0.030]	[0.031]	[0.031]
Child >=5 sibs	0.008	0.012	-0.066	-0.068	0.012	0.01	0.049	0.048
	[0.032]	[0.032]	[0.057]	[0.057]	[0.058]	[0.058]	[0.060]	[0.060]
Mother drop out	0.275	0.282	0.029	0.03	0.186	0.185	0	0
	[0.197]	[0.196]	[0.031]	[0.031]	[0.201]	[0.201]	[0.000]	[0.000]
Mother high school	0.27	0.279	-0.019	-0.011	0.232	0.23	0.037	0.041
	[0.197]	[0.197]	[0.022]	[0.022]	[0.202]	[0.202]	[0.036]	[0.036]
Mother some college	0.229	0.238	-0.039	-0.031	0.187	0.185	-0.037	-0.03
	[0.197]	[0.197]	[0.021]	[0.022]	[0.203]	[0.203]	[0.042]	[0.042]
Mother college	0.261	0.263	0	0	0.227	0.229	-0.059	-0.042
	[0.198]	[0.198]	[0.000]	[0.000]	[0.209]	[0.209]	[0.061]	[0.061]
Number mother's sibs	0.01	0.01	0.011	0.011	0.021	0.021	0.001	0.001
	[0.003]	[0.003]	[0.005]	[0.005]	[0.006]	[0.006]	[0.007]	[0.007]
Last year HS, 1988-89	-0.265	-0.261	-0.253	0	-0.129	-0.131	-0.166	-0.161
	[0.035]	[0.035]	[0.030]	[0.000]	[0.058]	[0.058]	[0.091]	[0.091]
1990-91	-0.277	-0.271	-0.304	-0.049	-0.106	-0.108	-0.139	-0.137
	[0.034]	[0.034]	[0.029]	[0.023]	[0.055]	[0.055]	[0.090]	[0.090]
1992-93	-0.288	-0.281	-0.296	-0.038	-0.1	-0.103	-0.19	-0.185
	[0.034]	[0.034]	[0.028]	[0.024]	[0.055]	[0.055]	[0.088]	[0.088]
1994-95	-0.275	-0.267	-0.315	-0.055	-0.079	-0.082	-0.134	-0.13
	[0.033]	[0.033]	[0.027]	[0.025]	[0.055]	[0.055]	[0.086]	[0.086]
1996-97	-0.274	-0.268	-0.323	-0.064	-0.083	-0.084	-0.116	-0.108
	[0.033]	[0.033]	[0.026]	[0.027]	[0.054]	[0.054]	[0.087]	[0.086]
1998-99	-0.042	-0.039	0	0.257	0	0	0.018	0.029
	[0.034]	[0.034]	[0.000]	[0.030]	[0.000]	[0.000]	[0.088]	[0.088]
Observations	4643	4643	2344	2344	956	956	1343	1343
R-squared	0.13	0.13	0.13	0.14	0.05	0.05	0.05	0.06

Table 8, continued

	1 All	2 All	3 White	4 White	5 Black	6 Black	7 Hispanic	8 Hispanic
2. Per Capita Spending by Component								
PC spending educ.		0.018		0.012		0.016		0.022
* AFQT		[0.004]		[0.005]		[0.010]		[0.013]
Per capita spending	-0.086	-0.713	0.258	-0.422	-0.319	-0.732	-0.398	-0.837
education	[0.110]	[0.172]	[0.140]	[0.312]	[0.246]	[0.352]	[0.231]	[0.349]
PC spending health		-0.02		-0.006		-0.048		0.055
* AFQT		[0.013]		[0.016]		[0.045]		[0.052]
Per capita spending	0.38	1.098	-0.408	-0.121	0.846	1.979	2.04	0.933
health	[0.367]	[0.626]	[0.408]	[0.929]	[0.902]	[1.393]	[0.908]	[1.348]
PC spending admin.		0.005		0.009		-0.011		0.018
* AFQT		[0.004]		[0.005]		[0.013]		[0.014]
Per capita spending	-0.068	-0.234	-0.073	-0.557	0.174	0.499	-0.129	-0.475
administration	[0.114]	[0.185]	[0.137]	[0.293]	[0.287]	[0.442]	[0.241]	[0.363]
AFQT	-0.001	-0.004	-0.001	-0.004	-0.001	0	-0.002	-0.01
	[0.000]	[0.001]	[0.000]	[0.001]	[0.001]	[0.002]	[0.001]	[0.003]
Observations	4643	4643	2344	2344	956	956	1343	1343
R-squared	0.13	0.13	0.14	0.14	0.06	0.06	0.06	0.07

Notes: Standard errors in brackets. Spending measures are for cash on balance sheet in $10,000.
Models with per capita spending by component are of the same form as those for total per capita spending.

Table 1: Comparison Agency Characteristics in Administrative Data Set and in NLSY Sample

Variable	1 Agencies w Funding	2 Agencies w/o Fund.	3 NLSY All	4 NLSY White	5 NLSY Black	6 NLSY Hispanic
Enrollment	486.931	472.081	743.690	596.655	944.102	857.426
	[521.554]	[510.106]	[725.097]	[559.592]	[967.791]	[725.190]
Per Capita Funding	3938		3686	3770	3606	3598
	[1298]		[1306]	[1310]	[1275]	[1312]
Per Cap. Funding + In Kind	5260		4957	5070	4752	4907
	[1723]		[1887]	[1922]	[1525]	[2038]
% spent - administration	0.123	0.121	0.124	0.124	0.120	0.125
	[0.034]	[0.028]	[0.032]	[0.033]	[0.031]	[0.030]
% spent - education	0.409	0.408	0.417	0.406	0.441	0.420
	[0.093]	[0.092]	[0.099]	[0.095]	[0.098]	[0.103]
% spent - disabled	0.030	0.028	0.029	0.030	0.028	0.027
	[0.023]	[0.021]	[0.021]	[0.022]	[0.014]	[0.022]
% spent - occupancy	0.123	0.122	0.136	0.129	0.130	0.153
	[0.060]	[0.059]	[0.062]	[0.058]	[0.056]	[0.067]
% spent - health	0.046	0.043	0.044	0.045	0.046	0.042
	[0.024]	[0.023]	[0.021]	[0.021]	[0.022]	[0.020]
% spent - parent programs	0.048	0.048	0.043	0.046	0.040	0.039
	[0.034]	[0.031]	[0.028]	[0.030]	[0.026]	[0.023]
% spent - social programs	0.054	0.058	0.055	0.056	0.057	0.051
	[0.031]	[0.030]	[0.033]	[0.030]	[0.042]	[0.031]
% spent - nutrition programs	0.042	0.043	0.034	0.036	0.033	0.032
	[0.028]	[0.026]	[0.023]	[0.024]	[0.020]	[0.022]
Fraction white, non Hisp.	0.602	0.593	0.363	0.468	0.289	0.232
	[0.345]	[0.347]	[0.321]	[0.342]	[0.272]	[0.242]
Fraction black	0.283	0.292	0.412	0.349	0.229	0.654
	[0.327]	[.0329]	[0.327]	[0.298]	[0.249]	[0.283]
Fraction Hispanic	0.115	0.115	0.189	0.139	0.438	0.100
	[0.211]	[0.210]	[0.250]	[0.190]	[0.311]	[0.167]
Pupil/classroom staff ratio	9.779	9.731	11.007	10.948	11.107	11.036
	[2.693]	[2.891]	[3.129]	[2/925]	[3.495]	[3.194]
Pupil/teacher ratio	22.738	22.384	24.524	25.202	24.386	23.451
	[9.802]	[9.285]	[8.501]	[9.119]	[8.208]	[7.423]
Lead teacher salary	16430	15700	18436	18397	19225	17938
	[5688]	[6100]	[6719]	[6666]	[6732]	[6752]
Fraction qualified teachers	0.848	0.867	0.858	0.865	0.857	0.846
	[0.186]	[0.182]	[0.172]	[0.171]	[0.191]	[0.158]
# Observations	14538.000	4739.000	4687.000	2365	965	1357

Notes: Standard deviations in brackets. Number of observations is for enrollments, other variables may have

e more missing values.

Table 2: NLSY Children's Outcomes and Background Characteristics

Variable	All Mean	White Mean	Black Mean	Hispanic Mean
Ever Head Start?	0.225	0.145	0.206	0.380
	[0.417]	[0.353]	[0.405]	[0.486]
Outcomes				
Piat-Math	51.922	59.991	45.814	42.089
	[24.012]	[22.615]	[22.477]	[22.461]
Piat-Reading Recognition	59.239	65.041	54.413	52.479
	[24.671]	[23.172]	[24.628]	[24.808]
Piat-Reading Comprehension	54.999	61.894	50.503	46.605
	[24.059]	[22.635]	[24.108]	[22.916]
PPVT	38.674	51.860	30.683	22.600
	[28.917]	[26.851]	[26.454]	[23.089]
Behavior Problems Index	56.742	54.561	57.495	60.111
	[25.351]	[25.969]	[24.249]	[24.601]
Ever Repeat Grade?	0.117	0.080	0.127	0.176
	[0.322]	[0.271]	[0.333]	[0.381]
Background				
Mother's Permanent Income	48.910	60.419	42.563	32.884
	[50.243]	[61.675]	[35.637]	[24.785]
Child Male	0.510	0.511	0.538	0.488
	[0.500]	[0.500]	[0.499]	[0.500]
Child First born	0.357	0.415	0.315	0.284
	[0.479]	[0.493]	[0.465]	[0.451]
Child five or more sibs	0.035	0.015	0.058	0.055
	[0.185]	[0.122]	[0.234]	[0.229]
Mother's AFQT	37.774	52.473	25.068	20.588
	[27.741]	[26.184]	[21.962]	[18.126]
Mother drop out	0.200	0.127	0.326	0.239
	[0.400]	[0.334]	[0.469]	[0.427]
Mother high school	0.388	0.404	0.351	0.385
	[0.487]	[0.491]	[0.478]	[0.487]
Mother some college	0.241	0.229	0.235	0.267
	[0.428]	[0.421]	[0.424]	[0.442]
Mother college	0.170	0.239	0.084	0.110
	[0.376]	[0.427]	[0.277]	[0.312]
# of siblings mother	1.917	1.475	2.324	2.417
	[1.802]	[1.408]	[2.028]	[2.042]
Mother Black	0.204			
	[0.403]			
Mother Hispanic	0.286			
	[0.452]			
Head Start year and Administrative Data Year				
Administrative data year	1994.172	1994.508	1993.644	1993.960
	[2.739]	[2.816]	[2.569]	
Child's last possible HS year	1993.212	1993.541	1992.954	1992.807
	[3.524]	[3.633]	[3.324]	

Note: Standard deviations in brackets.

Table 3: Effect of Head Start on Outcomes
Full Sample, Spending Measure is Cash on Balance Sheet in $1,000

	1	2	3	4	5	6
	PIAT-Math	**PIAT-RR**	**PIAT-RC**	**PPVT**	**Behavior Problems**	**Repeated Grade**
Ever Head Start*per capita spending	0.572	1.662	1.532	0.633	0.21	-0.02
	[0.523]	[0.544]	[0.592]	[0.682]	[0.626]	[0.011]
Per capita spending	0.142	0.084	-0.551	-0.204	-0.234	-0.003
	[0.324]	[0.338]	[0.346]	[0.405]	[0.384]	[0.006]
Ever Head Start?	-4.468	-10.334	-10.259	-4.729	2.538	0.147
	[2.108]	[2.192]	[2.294]	[2.605]	[2.511]	[0.042]
Mother black	-3.656	0.552	0.483	-7.724	0.723	-0.027
	[0.902]	[0.939]	[0.945]	[1.132]	[1.059]	[0.017]
Mother Hispanic	-6.185	0.216	-1.74	-13.923	3.05	0.019
	[0.888]	[0.924]	[0.935]	[1.115]	[1.040]	[0.016]
Mother permanent inc.	0.04	0.043	0.02	0.042	-0.064	0
	[0.009]	[0.010]	[0.010]	[0.012]	[0.009]	[0.000]
Child male	-0.804	-5.264	-3.755	0.012	-1.435	0.03
	[0.614]	[0.638]	[0.644]	[0.774]	[0.721]	[0.011]
Child first born	2.982	5.95	6.216	7.214	0.578	-0.012
	[0.679]	[0.706]	[0.707]	[0.847]	[0.798]	[0.013]
Child >=5 sibs	-7.933	-7.003	-3.248	-6.351	-3.945	0.043
	[1.716]	[1.784]	[1.925]	[2.253]	[2.047]	[0.031]
Mother's AFQT	0.254	0.254	0.282	0.343	0.042	-0.001
	[0.017]	[0.018]	[0.018]	[0.022]	[0.020]	[0.000]
Mother drop out	0.916	-7.016	-8.044	7.324	-12.16	0.225
	[10.304]	[10.711]	[10.207]	[13.261]	[12.210]	[0.181]
Mother high school	5.576	-1.676	-1.954	11.818	-19.275	0.124
	[10.314]	[10.721]	[10.220]	[13.269]	[12.221]	[0.181]
Mother some college	6.445	0.6	-1.605	12.772	-19.116	0.108
	[10.329]	[10.736]	[10.234]	[13.288]	[12.238]	[0.181]
Mother college	9.211	0.348	-2.269	14.379	-24.389	0.113
	[10.370]	[10.779]	[10.281]	[13.342]	[12.286]	[0.182]
Number mother's sibs	-0.253	0.079	-0.195	-0.687	-0.833	-0.002
	[0.177]	[0.184]	[0.186]	[0.223]	[0.209]	[0.003]
Last year HS, 1988-89	-4.202	-14.438	-28.663	-3.313	9.729	0.076
	[1.895]	[1.971]	[7.260]	[2.227]	[2.239]	[0.033]
1990-91	-2.994	-14.169	-28.622	-2.176	10.109	0.028
	[1.864]	[1.938]	[7.247]	[2.173]	[2.201]	[0.026]
1992-93	-2.808	-14.947	-27.65	-3.168	7.509	0.011
	[1.832]	[1.905]	[7.238]	[2.131]	[2.163]	[0.025]
1994-95	-2.667	-12.479	-23.198	0.172	5.451	-0.02
	[1.808]	[1.880]	[7.232]	[2.112]	[2.135]	[0.024]
1996-97	-2.334	-10.445	-18.943	-1.33	2.709	-0.021
	[1.797]	[1.868]	[7.230]	[3.009]	[2.121]	[0.024]
1998-99	-2.549	-8.862	-15.555	-3.004	-3.505	0
	[1.829]	[1.902]	[7.247]	[2.325]	[2.165]	[0.000]
Observations	4483	4476	3986	3518	4557	3102
R-squared	0.27	0.26	0.29	0.37	0.09	0.09

Note: Standard errors in brackets.

Table 4: Effects of Head Start on Outcomes, Full Sample
Alternative Specifications of Per Capita Spending

	1	2	3	4	5	6
	PIAT-Math	**PIAT-RR**	**PIAT-RC**	**PPVT**	**Behavior Problems**	**Repeated Grade**
Per Capita Spending Includes "Cash on Balance Sheet Only"						
Ever Head Start*per capita spending	0.572	1.662	1.532	0.633	0.21	-0.02
	[0.523]	[0.544]	[0.592]	[0.682]	[0.626]	[0.011]
Per capita spending	0.142	0.084	-0.551	-0.204	-0.234	-0.003
	[0.324]	[0.338]	[0.346]	[0.405]	[0.384]	[0.006]
Ever Head Start?	-4.468	-10.334	-10.259	-4.729	2.538	0.147
	[2.108]	[2.192]	[2.294]	[2.605]	[2.511]	[0.042]
Observations	4483	4476	3986	3518	4557	3102
R-squared	0.27	0.26	0.29	0.37	0.09	0.09
Per Capita Spending Includes all Cash and In-Kind Revenues						
Ever Head Start*per capita spending	0.301	1.21	0.983	0.212	-0.228	-0.016
	[0.403]	[0.419]	[0.451]	[0.527]	[0.480]	[0.008]
Per capita spending	0.162	0.113	-0.158	0.117	0.319	-0.002
	[0.202]	[0.210]	[0.209]	[0.256]	[0.239]	[0.003]
Ever Head Start?	-3.819	-10.144	-9.471	-3.475	4.488	0.151
	[2.159]	[2.244]	[2.334]	[2.683]	[2.567]	[0.043]
Observations	4483	4476	3986	3518	4557	3102
R-squared	0.27	0.26	0.29	0.37	0.09	0.09
Per Capita Spending Includes Cash on Balance Sheet, Difference=Other Expenditures						
Ever Head Start*per capita spending	0.97	1.854	1.568	0.987	0.505	-0.018
	[0.613]	[0.638]	[0.700]	[0.801]	[0.741]	[0.013]
Per capita spending	0.092	0.05	-0.577	-0.296	-0.392	-0.002
	[0.328]	[0.342]	[0.349]	[0.410]	[0.388]	[0.006]
Difference*Ever Head Start	-1.912	-0.927	-0.181	-1.729	-1.453	-0.007
	[1.526]	[1.587]	[1.699]	[2.032]	[1.837]	[0.031]
Difference	0.225	0.17	0.155	0.485	0.912	-0.002
	[0.295]	[0.307]	[0.295]	[0.382]	[0.349]	[0.005]
Ever Head Start?	-3.559	-9.885	-10.158	-3.888	3.309	0.149
	[2.225]	[2.313]	[2.403]	[2.769]	[2.639]	[0.044]
Observations	4483	4476	3986	3518	4557	3102
R-squared	0.27	0.26	0.29	0.37	0.09	0.09

Standard errors in parentheses

Table 5: Separate Estimates by Race and Ethnicity
Per Capita Measure is Cash on Balance Sheet

	1	2	3	4	5	6
	PIAT-Math	**PIAT-RR**	**PIAT-RC**	**PPVT**	**Behavior Problems**	**Repeated Grade**
White						
Ever Head Start*per capita spending	0.814	2.145	0.92	-0.503	-0.091	-0.047
	[0.826]	[0.833]	[0.924]	[1.154]	[0.988]	[0.014]
Per capita spending	0.111	0.086	0.008	0.857	0.355	-0.009
	[0.449]	[0.454]	[0.483]	[0.602]	[0.539]	[0.007]
Ever Head Start?	-6.923	-12.455	-7.708	-0.355	5.316	0.237
	[3.537]	[3.569]	[3.905]	[4.741]	[4.237]	[0.059]
Observations	2245	2241	1954	1713	2305	1560
R-squared	0.18	0.21	0.2	0.18	0.1	0.08
Black						
Ever Head Start*per capita spending	-1.815	1.027	1.023	0.64	1.13	0.02
	[1.332]	[1.429]	[1.562]	[1.746]	[1.512]	[0.026]
Per capita spending	0.792	0.661	-0.827	-2.005	-1.337	-0.011
	[0.667]	[0.715]	[0.733]	[0.850]	[0.767]	[0.013]
Ever Head Start?	0.948	-9.214	-11.563	-6.807	-3.498	0.042
	[5.188]	[5.562]	[5.819]	[6.463]	[5.873]	[0.102]
Observations	925	922	841	743	933	633
R-squared	0.2	0.22	0.23	0.24	0.1	0.08
Hispanic						
Ever Head Start*per capita spending	1.85	1.39	1.976	1.431	0.516	-0.009
	[0.867]	[0.934]	[0.968]	[0.983]	[1.054]	[0.022]
Per capita spending	-0.434	-0.26	-1.191	-0.439	-0.397	0.019
	[0.672]	[0.724]	[0.696]	[0.722]	[0.795]	[0.014]
Ever Head Start?	-6.067	-8.481	-10.272	-6.347	1.378	0.106
	[3.345]	[3.603]	[3.554]	[3.581]	[4.034]	[0.081]
Observations	1313	1313	1191	1062	1319	909
R-squared	0.19	0.24	0.29	0.26	0.07	0.1

Notes: Standard errors in parentheses.

Table 6: Effects of Different Budget Components on Outcomes

	1	2	3	4	5	6
All	PIAT-Math	PIAT-RR	PIAT-RC	PPVT	Behavior Problems	Repeated Grade
Per Capita Educational	-0.214	0.474	-0.666	-0.976	-1.511	0.01
Spending	[0.686]	[0.714]	[0.732]	[0.884]	[0.811]	[0.013]
Ever Head Start*Percap	-0.121	0.232	0.138	-2.132	-0.227	0.018
Educational Spending	[1.244]	[1.293]	[1.412]	[1.644]	[1.489]	[0.025]
Per Capita	-0.665	-1.813	-0.353	7.266	-0.309	0.025
Health Spending	[2.194]	[2.282]	[2.375]	[2.973]	[2.589]	[0.038]
Ever Head Start*Percap	-0.394	11.054	11.098	1.891	-2.79	-0.321
Health Spending	[4.708]	[4.887]	[5.095]	[6.337]	[5.614]	[0.091]
Per Capita Other	0.609	0.25	-0.555	-1.28	0.942	-0.021
Spending	[0.705]	[0.734]	[0.757]	[0.925]	[0.830]	[0.012]
Ever Head Start*Percap	1.431	1.095	0.928	3.001	1.364	0.013
Other Spending	[1.333]	[1.386]	[1.496]	[1.741]	[1.580]	[0.027]
Ever Head Start?	-4.142	-10.493	-10.526	-4.382	2.71	0.151
	[2.092]	[2.174]	[2.264]	[2.582]	[2.495]	[0.042]
Observations	4483	4476	3986	3518	4557	3102
R-squared	0.27	0.26	0.29	0.38	0.09	0.09
White						
Per Capita Educational	0.41	2.65	1.276	1.783	-1.758	-0.007
Spending	[1.014]	[1.023]	[1.102]	[1.406]	[1.205]	[0.016]
Ever Head Start*Percap	-2.977	-2.82	-0.278	-6.857	2.628	-0.029
Educational Spending	[2.072]	[2.089]	[2.355]	[3.020]	[2.546]	[0.038]
Per Capita	-1.641	-3.492	-1.52	6.355	3.104	0.006
Health Spending	[2.846]	[2.870]	[3.040]	[3.988]	[3.419]	[0.042]
Ever Head Start*Percap	8.626	13.116	15.205	-0.018	-12.385	-0.353
Health Spending	[7.212]	[7.246]	[7.832]	[10.238]	[8.729]	[0.125]
Per Capita Other	0.31	-0.819	-0.529	-1.095	1.533	-0.017
Spending	[0.966]	[0.974]	[1.040]	[1.336]	[1.161]	[0.014]
Ever Head Start*Percap	2.344	3.779	-1.569	4.378	0.325	0.014
Other Spending	[2.243]	[2.262]	[2.489]	[3.125]	[2.684]	[0.038]
Ever Head Start?	-6.289	-11.179	-7.605	1.706	5.632	0.223
	[3.491]	[3.516]	[3.847]	[4.660]	[4.177]	[0.059]
Observations	2245	2241	1954	1713	2305	1560
R-squared	0.18	0.22	0.2	0.19	0.1	0.08
Black						
Per Capita Educational	-1.883	-2.457	-4.251	-4.658	-3.336	0.007
Spending	[1.426]	[1.534]	[1.568]	[1.857]	[1.633]	[0.028]
Ever Head Start*Percap	-2.958	5.492	2.718	1.114	-0.96	0.091
Educational Spending	[3.078]	[3.302]	[3.669]	[4.239]	[3.507]	[0.059]
Per Capita	-4.314	-0.042	0.341	9.144	-1.614	0.031
Health Spending	[5.298]	[5.693]	[5.762]	[7.571]	[6.103]	[0.102]
Ever Head Start*Percap	-0.692	3.683	11.879	-2.358	-1.687	-0.128
Health Spending	[12.245]	[13.134]	[13.595]	[16.362]	[13.793]	[0.224]
Per Capita Other	4.348	4.051	2.502	-1.426	0.224	-0.029
Spending	[1.694]	[1.826]	[1.897]	[2.263]	[1.905]	[0.031]
Ever Head Start*Percap	-2.013	-3.873	-3.251	-0.041	3.742	-0.029
Other Spending	[3.713]	[3.988]	[4.415]	[5.149]	[4.201]	[0.070]
Ever Head Start?	2.055	-10.205	-12.356	-5.754	-2.716	0.06
	[5.261]	[5.643]	[5.883]	[6.578]	[5.966]	[0.104]
Observations	925	922	841	743	933	633
R-squared	0.21	0.23	0.24	0.25	0.11	0.09

Hispanic						
Per Capita Educational	-0.444	-1.213	-1.022	-0.914	0.893	0.052
Spending	[1.287]	[1.387]	[1.339]	[1.478]	[1.533]	[0.028]
Ever Head Start*Percap	3.171	1.552	0.019	-0.383	-3.363	0.007
Educational Spending	[1.938]	[2.088]	[2.151]	[2.220]	[2.319]	[0.047]
Per Capita	1.798	2.451	1.863	4.064	-11.703	0.048
Health Spending	[4.863]	[5.238]	[5.626]	[6.148]	[5.706]	[0.099]
Ever Head Start*Percap	-8.937	7.69	6.417	6.84	14.923	-0.327
Health Spending	[8.075]	[8.697]	[8.833]	[9.880]	[9.671]	[0.182]
Per Capita Other	-0.873	0.219	-1.894	-0.915	0.356	-0.024
Spending	[1.359]	[1.464]	[1.411]	[1.588]	[1.597]	[0.028]
Ever Head Start*Percap	2.797	0.273	3.317	2.515	1.944	0.047
Other Spending	[2.028]	[2.184]	[2.213]	[2.341]	[2.411]	[0.049]
Ever Head Start?	-5.115	-9.143	-10.573	-6.915	0.126	0.113
	[3.329]	[3.586]	[3.524]	[3.580]	[4.016]	[0.080]
Observations	1313	1313	1191	1062	1319	909
R-squared	0.19	0.24	0.29	0.27	0.08	0.1

Table 7: Effects of Individual Educational Inputs

	1	2	3	4	5	6
	PIAT-Math	PIAT-RR	PIAT-RC	PPVT	Behavior Problems	Repeated Grade
Pupil-Teacher Ratio						
Pupil-Teacher Ratio	-0.098	0.013	-0.084	0.168	0.591	-0.002
* Ever Head Start	[0.263]	[0.280]	[0.279]	[0.325]	[0.310]	[0.005]
Pupil-Teacher Ratio	0.255	0.111	0.217	0.199	-0.108	0
	[0.117]	[0.125]	[0.121]	[0.143]	[0.137]	[0.002]
Ever Head Start *	1.325	1.477	1.801	1.117	0.306	-0.02
Per Capita Expenditure	[0.674]	[0.719]	[0.736]	[0.867]	[0.806]	[0.014]
Per Capita Expenditure	0.121	0.163	-0.313	0	-0.742	-0.003
	[0.364]	[0.388]	[0.383]	[0.445]	[0.429]	[0.007]
Observations	3698	3692	3462	3122	3762	2669
R-squared	0.28	0.25	0.28	0.38	0.08	0.09
Pupil-Classroom Staff Ratio						
Pupil-Classroom Staff Ratio	0.045	0.047	0.003	0.047	0.155	-0.001
* Ever Head Start	[0.098]	[0.104]	[0.104]	[0.121]	[0.115]	[0.002]
Pupil-Classroom Staff Ratio	-0.001	-0.021	0.034	0.102	-0.089	0
	[0.042]	[0.045]	[0.044]	[0.051]	[0.049]	[0.001]
Ever Head Start *	1.429	1.536	1.845	1.086	0.249	-0.02
Per Capita Expenditure	[0.672]	[0.716]	[0.731]	[0.863]	[0.804]	[0.014]
Per Capita Expenditure	-0.03	0.066	-0.404	-0.023	-0.801	-0.003
	[0.362]	[0.386]	[0.381]	[0.443]	[0.426]	[0.007]
Observations	3697	3691	3461	3121	3761	2668
R-squared	0.28	0.25	0.28	0.38	0.08	0.09
Fraction of Teachers with Qualifications						
Fraction Qualified Teachers	-6.404	-7.393	-9.327	-12.653	1.741	0.026
* Ever Head Start	[4.812]	[5.130]	[5.046]	[5.848]	[5.699]	[0.094]
Fraction Qualified Teachers	2.438	3.807	3.5	4.023	-5.244	0.001
	[2.102]	[2.243]	[2.193]	[2.563]	[2.483]	[0.039]
Ever Head Start *	1.476	1.594	1.956	1.254	0.048	-0.02
Per Capita Expenditure	[0.669]	[0.714]	[0.727]	[0.863]	[0.801]	[0.014]
Per Capita Expenditure	-0.079	0.012	-0.505	-0.202	-0.613	-0.004
	[0.362]	[0.386]	[0.381]	[0.443]	[0.426]	[0.007]
Observations	3697	3691	3461	3121	3761	2668
R-squared	0.28	0.25	0.28	0.38	0.08	0.09
Lead Teacher Salary ($1,000)						
Lead Teacher Salary	-0.068	-0.051	-0.181	0.068	0.061	0
* Ever Head Start	[0.139]	[0.148]	[0.147]	[0.179]	[0.164]	[0.003]
Lead Teacher Salary	0.125	0.033	0.068	0.021	-0.201	0
	[0.059]	[0.063]	[0.062]	[0.074]	[0.069]	[0.001]
Ever Head Start *	0.967	1.442	2.244	1.054	0.276	-0.013
Per Capita Expenditure	[0.821]	[0.877]	[0.904]	[1.084]	[0.967]	[0.016]
Per Capita Expenditure	-0.292	0.06	-0.368	-0.257	-0.353	0
	[0.426]	[0.455]	[0.450]	[0.528]	[0.500]	[0.008]
Observations	3524	3518	3307	2990	3582	2533
R-squared	0.28	0.26	0.29	0.38	0.08	0.1

Table 8: Effect of Per Capita Spending on Probability of Head Start Participation

	1 All	2 All	3 White	4 White	5 Black	6 Black	7 Hispanic	8 Hispanic
1 Total Per Capita Spending								
Per capita spending	-0.029	-0.305	0.025	-0.377	0.02	0.076	-0.108	-0.547
10,000	[0.055]	[0.080]	[0.065]	[0.127]	[0.117]	[0.154]	[0.126]	[0.177]
Per capita spending*		0.008		0.008		-0.003		0.023
AFQT		[0.002]		[0.002]		[0.005]		[0.006]
Mother's AFQT	-0.001	-0.004	-0.001	-0.004	-0.001	0	-0.002	-0.01
	[0.000]	[0.001]	[0.000]	[0.001]	[0.001]	[0.002]	[0.001]	[0.003]
Mother black	0.016	0.017						
	[0.017]	[0.017]						
Mother Hispanic	0.18	0.18						
	[0.016]	[0.016]						
Mother permanent inc.	-0.064	-0.067	-0.049	-0.051	-0.113	-0.114	-0.224	-0.246
10,000	[0.013]	[0.013]	[0.012]	[0.012]	[0.042]	[0.042]	[0.065]	[0.065]
Child male	0.002	0.002	0.01	0.01	-0.024	-0.024	0.005	0.005
	[0.012]	[0.011]	[0.014]	[0.013]	[0.026]	[0.026]	[0.026]	[0.026]
Child first born	-0.034	-0.034	-0.019	-0.018	-0.024	-0.024	-0.058	-0.058
	[0.013]	[0.013]	[0.014]	[0.014]	[0.030]	[0.030]	[0.031]	[0.031]
Child >=5 sibs	0.008	0.012	-0.066	-0.068	0.012	0.01	0.049	0.048
	[0.032]	[0.032]	[0.057]	[0.057]	[0.058]	[0.058]	[0.060]	[0.060]
Mother drop out	0.275	0.282	0.029	0.03	0.186	0.185	0	0
	[0.197]	[0.196]	[0.031]	[0.031]	[0.201]	[0.201]	[0.000]	[0.000]
Mother high school	0.27	0.279	-0.019	-0.011	0.232	0.23	0.037	0.041
	[0.197]	[0.197]	[0.022]	[0.022]	[0.202]	[0.202]	[0.036]	[0.036]
Mother some college	0.229	0.238	-0.039	-0.031	0.187	0.185	-0.037	-0.03
	[0.197]	[0.197]	[0.021]	[0.022]	[0.203]	[0.203]	[0.042]	[0.042]
Mother college	0.261	0.263	0	0	0.227	0.229	-0.059	-0.042
	[0.198]	[0.198]	[0.000]	[0.000]	[0.209]	[0.209]	[0.061]	[0.061]
Number mother's sibs	0.01	0.01	0.011	0.011	0.021	0.021	0.001	0.001
	[0.003]	[0.003]	[0.005]	[0.005]	[0.006]	[0.006]	[0.007]	[0.007]
Last year HS, 1988-89	-0.265	-0.261	-0.253	0	-0.129	-0.131	-0.166	-0.161
	[0.035]	[0.035]	[0.030]	[0.000]	[0.058]	[0.058]	[0.091]	[0.091]
1990-91	-0.277	-0.271	-0.304	-0.049	-0.106	-0.108	-0.139	-0.137
	[0.034]	[0.034]	[0.029]	[0.023]	[0.055]	[0.055]	[0.090]	[0.090]
1992-93	-0.288	-0.281	-0.296	-0.038	-0.1	-0.103	-0.19	-0.185
	[0.034]	[0.034]	[0.028]	[0.024]	[0.055]	[0.055]	[0.088]	[0.088]
1994-95	-0.275	-0.267	-0.315	-0.055	-0.079	-0.082	-0.134	-0.13
	[0.033]	[0.033]	[0.027]	[0.025]	[0.055]	[0.055]	[0.086]	[0.086]
1996-97	-0.274	-0.268	-0.323	-0.064	-0.083	-0.084	-0.116	-0.108
	[0.033]	[0.033]	[0.026]	[0.027]	[0.054]	[0.054]	[0.087]	[0.086]
1998-99	-0.042	-0.039	0	0.257	0	0	0.018	0.029
	[0.034]	[0.034]	[0.000]	[0.030]	[0.000]	[0.000]	[0.088]	[0.088]
Observations	4643	4643	2344	2344	956	956	1343	1343
R-squared	0.13	0.13	0.13	0.14	0.05	0.05	0.05	0.06

Table 8, continued

	1 All	2 All	3 White	4 White	5 Black	6 Black	7 Hispanic	8 Hispanic
2. Per Capita Spending by Component								
PC spending educ.		0.018		0.012		0.016		0.022
* AFQT		[0.004]		[0.005]		[0.010]		[0.013]
Per capita spending	-0.086	-0.713	0.258	-0.422	-0.319	-0.732	-0.398	-0.837
education	[0.110]	[0.172]	[0.140]	[0.312]	[0.246]	[0.352]	[0.231]	[0.349]
PC spending health		-0.02		-0.006		-0.048		0.055
* AFQT		[0.013]		[0.016]		[0.045]		[0.052]
Per capita spending	0.38	1.098	-0.408	-0.121	0.846	1.979	2.04	0.933
health	[0.367]	[0.626]	[0.408]	[0.929]	[0.902]	[1.393]	[0.908]	[1.348]
PC spending admin.		0.005		0.009		-0.011		0.018
* AFQT		[0.004]		[0.005]		[0.013]		[0.014]
Per capita spending	-0.068	-0.234	-0.073	-0.557	0.174	0.499	-0.129	-0.475
administration	[0.114]	[0.185]	[0.137]	[0.293]	[0.287]	[0.442]	[0.241]	[0.363]
AFQT	-0.001	-0.004	-0.001	-0.004	-0.001	0	-0.002	-0.01
	[0.000]	[0.001]	[0.000]	[0.001]	[0.001]	[0.002]	[0.001]	[0.003]
Observations	4643	4643	2344	2344	956	956	1343	1343
R-squared	0.13	0.13	0.14	0.14	0.06	0.06	0.06	0.07

Notes: Standard errors in brackets. Spending measures are for cash on balance sheet in $10,000.
Models with per capita spending by component are of the same form as those for total per capita spending.