Online Appendix for *Long-Term Impacts of Compensatory Preschool on Health and Behavior: Evidence from Head Start*

Pedro Carneiro * Rita Ginja†

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A Sensitivity Analysis and Additional Results

A.1 Additional Results

In this Appendix we include additional results that support our analysis. We start by presenting an analysis of the main results separated by race groups and cohorts, although in this case we focus on males alone. We do not to include these results in the main text given the

*University College London, CEMMAP, and IFS
†Uppsala University and UCLS.

substantial decrease in precision when the sample is divided. These results are presented in Table (B.16) in the Appendix.

We find that for children ages 12-13 the overall effects are driven by the non-black with an improvement on the summary index. Regarding individual outcomes, the effects on reduction of chronic health conditions are present on both races, but HS impacts on BPI are driven by the non-Black, whereas the effects on obesity come from the Black sample. One additional effect (robust to multiple hypotheses testing) found for non-Black children is a decrease in the probability of enrolment in special education, which is consistent with improvement in white children's school performance also find by Currie and Thomas (1995). Among adolescents 16-17, the effects are mainly driven by the Black sample, with an improvement in the summary index. The effects on being overweight are driven by Black adolescents (which is consistent with the findings of Frisvold, 2011), whereas the impacts on mental health come from the non-Black sample. Finally, the effects on crime related activities among young adults are due to reduced engagement in criminal activities by the non-Black.

It would also be interesting to check whether there are differences in program impacts across cohorts of children, because they may tell us something about changes in the program over time. We only do this for the youngest age group (12-13), for whom we have a larger sample. When looking at cohort differences, one needs to be careful about changes occurring in the control group across cohorts. In particular, we mention in the main text (table 3) that, relative to the younger cohorts, there is a stronger substitution of Head Start for informal care in the older cohorts. This is consistent with the recent expansion in state provided care.

Our estimates are shown in Table (B.17). We separated children 12-13 years of age into two groups: those who could have been eligible to attend the program in the 1980s (born between 1977 and 1984), and those who could have attended it in the 1990s (born in 1985-2000). The reduced form estimates for the four individual outcomes presented in the table (indicators for a health condition that requires the use of special equipment, being overweight, grade retention, enrolment in special education classes, and an index of behavioral problems-BPI) and for the summary index show that most of the effects we find in the overall sample are driven by the set of children who attended the program in the 1980s. This is interesting and perhaps surprising, given the large increase in expenditure in Head Start in recent years, but which can perhaps be explained by the change in the control group over time.[1]

We now turn to understand more about the mechanisms behind the effects found. We start by studying whether Head Start is associated with a response in parental labor supply around Head Start age, and if it exists a reinforcing or compensatory response of parents with respect to child investments as a response to the program (see Gelber and Isen, 2013). We start by analyzing labor supply of mothers and her spouses in the years prior and during Head

[1]Since eligibility cutoffs vary with income and family size, in principle we could examine how the impacts of Head Start varied with these two variables, within the support of the cutoffs. This would be an extra dimension of heterogeneity. Our attempts to do so resulted in imprecise estimates, as we show in the Appendix G. Estimates for equation (2) are presented in Figures (G.2)-(G.3) and they show larger effects for children living in larger families.

Start age in table B.18 with the aim of learning whether parents (especially, mothers) use the fact that children are in child care for job search. Studying the parental labor supply is also useful since in the years subsequent to Head Start children will be enrolled in school, and thus parents can use the Head Start years to improve their current and future employment prospects, through the services offered by the program. Table B.18 includes three sets of vertical panels, which include estimates for the average number of hours worked per week by the mother and her spouse in the years prior to the Head Start age, at the moment eligibility is assessed and during the HS period. The table further includes three horizontal panels with the estimates for the whole sample of children used in the estimates presented in table 5 (and by child's gender). This table shows that there no relation between the weekly hours worked by mother prior to age 3 and eligibility at age 4. When children become eligible there is a drop in the number of weekly hours worked by mothers at the cutoff, especially among mothers of boys, which is consistent with the fact that the effect identified in this paper is driven by participation in the program of children whose parents suffered a labor market shock that cause their eligibility to the program.[2] Interestingly, during the period in which children can attend HS there is still a drop in the weekly hours worked by mothers of boys at the cutoff, suggesting that there is not an immediate recover of labor market prospects for mothers of children that just become eligible.

Finally, table B.19 presents estimates using as outcome a measure of parental investments, the HOME score. This table includes three vertical panels, with the estimates for the whole sample of children and for each gender separately. We use the panel dimension of the CNLSY and include multiple estimates per child between ages 4 (HS age) and 14. We estimate a version of equation (1), but since we have multiple observations per child we include an interaction between eligibility at age 4 and the child's age group (6-9 or 10-14; 4-5 being the omitted category). Column 1 shows that eligibility at age 4 is associated to a mild improvement in parental investments for the whole sample after age 10 relatively to HS age, which is driven by males (column 2). However, the p-values in the bottom of the table show that we cannot rule out a zero relation between of eligibility at age 4 and HOME score between ages 10-14.

Other Robustness Analysis We present here three additional robustness tests. First, we test for discontinuities in outcomes at non-discontinuity points and we are unable to detect non-zero impacts where impacts do not exist (see Table B.21). Columns (1) and (2) of Table B.21 include estimates of size of the discontinuity when we set the cutoff to be 50% above and below, respectively, of the original cutoff. We estimate that only 2 out of the 18 coefficients that should be zero is statistically significant, and they have the opposite sign to the original estimate. In columns (3) and (4) the fake and the real discontinuities and only two of the 18 coefficients that should be zero are found to be statistically different from zero.).

Second, we allow for serial correlation in state specific shocks by clustering the standard

[2]The mother suffers a labor market shock, since there is no association between spouses labor supply and eligibility at age 4.

errors at state level. A version of the results presented in Tables (B.9)-(B.11) with these standard errors is presented in Table (B.22) and the estimates of the standard errors of the coefficients are very similar to those in our main results.

Finally, we re-estimate equation (1) including only the individuals we observe for all three age groups (12-13, 16-17 and 20-21), i.e., forcing the sample to be the same for regressions at different ages. It is useful to see how our results would change if we were to use exactly the same sample of children to estimate the impacts of Head Start at different ages, since we would then be able to isolate age effects (assuming time effects are not important), but only for a limited set of cohorts. Our estimates for this exercise are presented in Table B.23, and show that our main conclusions hold in this smaller sample, although they become more imprecise either when we study individual outcomes or use the summary indexes.

A.2 Measurement Error in Income

Our estimates of the size of discontinuity in participation and effects of Head Start at the cutoff might be underestimated due to measurement error in the running variable. This is especially problematic here because we are measuring income using survey data. Therefore, we assess the robustness of our results to alternative measures of family income constructed in the CNLSY.

The family income measure we use in our main specification is the Total Net Family Income for the years of 1981-2000. This variable includes the following components if all are not missing: respondent's and spouse's military income, their salaries and farm/business income and spouse's unemployment insurance; alimony; child support (own and spouse's); AFDC and other public assistance; respondent's and spouse's educational benefits and other kinds of scholarships, fellowships, or grants; other veteran benefits; worker compensation or disability payments received by respondent; total amount of money received by the respondent (or wife/husband) from any source excluding the previous categories, such as savings, payments from Social Security, net rental income or any other regular or periodic sources of income; total income received by the respondent from adults that also live in the household and are related to her (excluding spouse and children); total amount of money received by the respondent (or wife/husband) from persons living outside household (if living in the same dwelling), outside her home in city of permanent residence (if living in Dorm, fraternity or sorority) or not living with respondent (if in military); and, finally, food stamps.[3]

We consider two additional income measures in our sensitivity analysis. The first one is the same as the one above subtracting Food Stamps, which is perhaps a better approximation

[3]Cole and Currie (1994) document inconsistencies in the income measures reported in NLSY79. Therefore, we follow their recommendations to minimize these inconsistencies. First, we check if income categories reported by siblings living with parents are consistent among them. If not, we choose the mode among the values reported by the siblings. If there is no unique mode, we use the value reported by the oldest child that lives with parents (this consistency check is only performed between 1979-1986, which are the years with information for whether the member of NLSY79 is living with the parents). Second, whenever we use individual components of income, we identify those cases in which both spouses are present in the NLSY79, and if the reported earnings for one spouse are not consistent with the own report, we use the own report.

to the measure of income officially used to determine eligibility than the one we use in the baseline specification. The second one is the sum of the non-missing income components described in the previous paragraph. This is very much like the baseline measure of income used in the paper, but with the inclusion of non-missing components as opposed to requiring that each of them is not missing to allow for a larger sample size. The three income measures analyzed in this paper are highly correlated but they are not exactly the same.

Estimates of the equation describing participation in Head Start when we use these two alternative measures of income are included in Tables A.1. These are very similar to those reported in Table 2. The impact of Head Start eligibility on outcomes estimated for alternative income measures is presented in Table A.2 for the samples ages 12-13, 16-17 and 20-21. There is some sensitivity across different measures of income, but overall the main results remain the same.

References

[1] Nancy Cole and Janet Currie, 1994. "Reported Income in the NLSY: Consistency Checks and Methods for Cleaningthe Data," NBER Technical Working Papers 0160, National Bureau of Economic Research, Inc.

Table A.1: First Stage: Alternative measures of income.

	(1)	(2)	(3)	(4)	(5)	(6)
Age group	12-13		16-17		20-21	
Sample	Males	Females	Males	Females	Males	Females
			Panel A: Alternative 1			
1[HS Eligible at 4]	0.496***	0.0311	0.518***	0.102	0.664***	-0.0935
	[0.186]	[0.208]	[0.190]	[0.212]	[0.210]	[0.238]
Marginal Effect	0.149	0.009	0.157	0.032	0.201	-0.0285
Observations	1,057	1,035	1,003	978	764	867
Control Mean	0.227	0.255	0.221	0.263	0.200	0.252
			Panel B: Alternative 2			
1[HS Eligible at 4]	0.536***	0.119	0.424**	0.181	0.599***	0.141
	[0.195]	[0.182]	[0.201]	[0.188]	[0.227]	[0.208]
Marginal Effect	0.164	0.037	0.130	0.058	0.186	0.0439
Observations	1,052	1,065	989	1,017	769	901
Control Mean	0.264	0.284	0.267	0.307	0.214	0.287

Note: Probit estimates of Head Start participation on income eligibility. Controls excluded: cubic in log family income and family size at age 4, an interaction between these two variables, a dummy indicating the presence of a father figure in the household at age 4, dummies for race, child's age and for year and state of residence at age 4. *Alternative measure 1* is equal to the measure of income used in paper, excluding Food Stamps. *Alternative 2* is equal to the sum of different income components. Robust standard errors are reported in brackets clustered at state-year at age four level. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table A.2: Reduced Form Estimates with alternative income measures (sample: boys).

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Age groups		12-13			16-17		20-21
Variables	Overweight	Use of Special Equipment	BPI	Overweight	CESD	Ever Sentenced	Idle
				Panel A: Alternative 1			
1[HS Eligible at 4]	-0.422**	-0.831**	-0.333***	-0.293	-0.213*	-0.244	-0.233
	[0.166]	[0.336]	[0.105]	[0.200]	[0.123]	[0.293]	[0.328]
Marginal Effect	-0.100	-0.111		-0.070		-0.069	-0.039
Observations	957	853	947	916	822	748	693
				Panel B: Alternative 2			
1[HS Eligible at 4]	-0.108	-0.543*	-0.368***	-0.233	-0.250**	-0.349	0.0375
	[0.136]	[0.288]	[0.114]	[0.203]	[0.103]	[0.218]	[0.263]
Marginal Effect	-0.028	-0.071		-0.058		-0.100	0.006
Observations	1,210	1,068	1,180	1,123	1,025	921	863

Note: Probit estimates for several outcomes (OLS estimates for BPI and CESD). Controls excluded from table include cubic in log family income and family size at age 4, an interaction between these two variables, cubic in log of average family income and family size for ages 0-2, the interaction between these two variables, cubic on child's birth weight, a dummy indicating the presence of a father figure in the household at age 4, race and age dummies, and dummies for year and state of residence at age 4. Marginal effect is average marginal change in outcome across individuals as the eligibility status changes and all other controls are kept constant. "Control Mean" is the mean outcome among observations just above the cutoff, that is, at most 25% above the cutoff. Robust standard errors are reported in brackets clustered at state-year at age four level.
* significant at 10%; ** significant at 5%; *** significant at 1%.

B Tables

Table B.1: Summary of legislation

Date	Law Number	Title	Description
1964	88-452	Economic Opportunity Act	Anti-poverty bill to "strengthen, supplement, and coordinate efforts in furtherance" of a policy of the U.S. "to eliminate the paradox of poverty in the midst of plenty". Head Start was not mention in the original act, but it was considered part of the Community Action Program.
1966	P.L. 89-794	Economic Opportunity Act Amendments of 1966	A section was added to Title II making Head Start a part of the Economic Opportunity Act.
1967	P.L. 90-222	Economic Opportunity Act Amendments of 1967	"Follow Through" was added in Title II, to continue services for Head Start children when they enter kindergarten and elementary school. This program was administered by the Office of Education.
1969	P.L. 91-177	Economic Opportunity Act Amendment of 1969	A provision was added allowing children from families above the poverty level to receive Head Start services for a fee.
1972	P.L. 92-424	Economic Opportunity Act Amendment of 1972	A fee schedule for non-poor participants in Head Start was required; fees were prohibited for families below the poverty line. Added a requirement that at least 10 percent of Head Start's enrollment include children with disabilities.
1973	93-202	Postponement of a Head Start Fee Schedule	Prior approval by Congress was required before any Head Start fee schedule could be established.
1974	P.L. 93-644	Head Start, Economic Opportunity, and Community Partnership Act of 1974	Reauthorized Head Start through the fiscal year of 1978. Head Start funds should be allocated to states proportionately based upon each state's relative number of children living in families with income below the poverty line and the relative number of public assistance recipients in each state.
1978	P.L. 95-568	Economic Opportunity Act Amendment of 1978	Reauthorized Head Start for three more years. Minor changes to the law.
1981	P.L. 97-35 (42 USC 9831 et. Seq.)	Economic Opportunity Amendment of 1981	The Head Start Act was attached to the OBRA of 1981. To "promote school readiness by enhancing the social and cognitive development of low-income children."
1984	P.L. 98-558	Human Services Reauthorization Act of 1984	Head Start Reauthorization for 2 years. In 1984, the Indian and Migrant branches of Head Start became separate regions; prohibited changes in methods for determining eligibility for low income if they would reduced participation of persons in the program. HS may provide services to children age 3 to the age of compulsory school attendance.
1989	P.L. 101-120	Head Start Supplemental Authorization Act of 1989	Reauthorized Head Start for FY of 1990.
1990	P.L. 101-597	National Health Service Corps Revitalization Amendments of 1990	Minor amend to Head Start Act (library of congress 101th congress pub laws)
1990	P.L. 101-501	Head Start Reauthorization Act of 1990.	Reinforced importance of parental involvement, improved information on Head Start programs.
1992	P.L. 102-763	Head Start Improvement Act	Facilities purchase; Extended waivers for non-federal regulations; Establishment of transportation regulations; Health services to younger siblings; Protection of the quality set-aside; Literacy and child development training to parents; Elimination of priority status to a grantee once funded.
1994	P.L. 103-218	Head Start Act Amendments of 1994	Reauthorized Head Start for the years of 1995 through 1998. Required the development of quality standards (including revising the Program Performance Standards), the development of performance measures, and improved monitoring of local programs. It authorized family-centered programs for infants and toddlers. It established new standards for classroom teachers and family service workers.
1998	P.L. 105-285	Coats Human Services Reauthorization Act of 1998	Reauthorized Head Start for 5 years.
2007	110-134	Improving Head Start for School Readiness Act of 2007	Allows grantees to serve additional children from families with income up to 130% of poverty to be served; formula allocation remains at 100% of poverty; expansion of both Head Start and Early Head Start programs with additional funds going to states serving fewer than 60 percent of eligible children; establishes standards for the curriculum of teachers.

Note: Source of regulations relevant to Head Start: 45 CFR (Code of Federal Regulations), Parts 1301 to 1311. Additional Program Instructions and Information Memorandums can be found at the Early Childhood Learning and Knowledge Center web site: http://eclkc.ohs.acf.hhs.gov/hslc.

Table B.2: Descriptive Statistics: Outcomes.

	(1)	(2)	(3)
Variable	Obs	Mean	SD
Age 12-13			
BPI	2392	0.58	1.02
Overweight	2438	0.19	0.39
Special Education	2464	0.23	0.42
Grade Repetition	2537	0.29	0.45
Health: Use special equipment	2049	0.06	0.23
Health: needs doctor	2472	0.16	0.37
Health: needs medicine	2428	0.16	0.37
Any health limitation	2212	0.08	0.27
PIAT-Math	2376	-0.20	0.89
PIAT-RR	2376	-0.07	1.05
PIAT-RC	2349	-0.39	0.89
School damage	2357	0.15	0.36
Alcohol Use	2516	0.39	0.49
Drug Use	2424	0.15	0.36
Ever smoke	2530	0.35	0.48
Index: Global	2550	-0.14	1.02
Index: Cognitive	2384	-0.29	0.98
Index: Behaviors	2550	-0.20	1.04
Index: Health	2550	0.00	1.01
Age 16-17			
Overweight	2267	0.17	0.37
Ever sentenced	2173	0.11	0.32
CESD	2063	0.04	0.98
In High School	2151	0.92	0.27
Birth control	1836	0.60	0.49
Ever Drunk	2236	0.13	0.33
Ever Sex	2377	0.65	0.48
Health Status	2390	0.63	0.48
Index: Global	2416	-0.19	1.04
Age 20-21			
Ever sentenced	1904	0.19	0.39
High School Diploma	1965	0.70	0.46
Idle	1854	0.11	0.32
Birth control	1639	0.59	0.49
Ever worked	1932	0.74	0.44
Ever in college	1969	0.49	0.50
Index: Global	1977	-0.23	1.07

Note: This table reports means and standard deviations for outcome variables in our sample. Statistics are reported for males and females whose controls are all not missing and whose family income at age four is between 15% and 185% of the maximum level of income that would allow participation in Head Start. We report means and standard deviation using only one observation per individual.

Table B.3: Participation in Head Start and eligibility.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Eligibility age at 3			Eligibility age at 4			Eligibility age at 5		
Sample	All	Males	Females	All	Males	Females	All	Males	Females
1[HS Eligible]	0.189	0.128	0.124	0.278**	0.684***	-0.048	0.206*	0.457***	-0.031
	[0.119]	[0.177]	[0.171]	[0.118]	[0.169]	[0.170]	[0.121]	[0.171]	[0.179]
Marginal Effect	0.060	0.0389	0.039	0.248	0.209	-0.015	0.068	0.148	-0.01
Observations	2,302	1,190	1,112	2,550	1,294	1,256	2,123	1,082	1,041
Control Mean	0.264	0.282	0.239	0.432	0.216	0.272	0.270	0.233	0.302
SD	0.442	0.451	0.428	0.089	0.413	0.446	0.445	0.424	0.461

Note: Table of probit estimates of Head Start participation between ages 3-5 on income eligibility between ages 3-5. The sample includes children ages 12-13 included in the analysis.
The controls excluded from the table include cubic in log family income and family size at age 4, an interaction between these two variables, a dummy indicating the presence of a father figure in the household at age 4, race and age dummies, and dummies for year and state of residence at age 4. Robust standard errors are reported in brackets clustered at state-year at eligibility. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table B.4: First Stage Estimates.

	(1)	(2)	(3)	(4)
Sample	Black		Non-Black	
	Males	Females	Males	Females
		Panel A: ages 12-13		
1[HS Eligible at 4]	0.873***	0.172	0.474**	-0.293
	[0.259]	[0.260]	[0.234]	[0.238]
Marginal Effect	*0.273*	*0.058*	*0.126*	*-0.077*
Observations	563	566	708	655
Control Mean	0.359	0.348	0.140	0.225
SD	0.484	0.480	0.349	0.420
		Panel B: ages 16-17		
1[HS Eligible at 4]	0.811***	0.115	0.450*	-0.127
	[0.274]	[0.268]	[0.243]	[0.254]
Marginal Effect	*0.255*	*0.040*	*0.124*	*-0.035*
Observations	535	550	664	599
Control Mean	0.361	0.348	0.150	0.223
SD	0.484	0.480	0.359	0.419
		Panel C: ages 20-21		
1[HS Eligible at 4]	1.062***	0.229	0.496*	-0.183
	[0.327]	[0.296]	[0.261]	[0.281]
Marginal Effect	*0.314*	*0.076*	*0.134*	*-0.049*
Observations	413	484	518	509
Control Mean	0.300	0.346	0.144	0.209
SD	0.464	0.480	0.353	0.409

Note: The table reports results of probit regressions of Head Start participation on income eligibility. The marginal effect is the average marginal change in the probability of Head Start participation across individuals as the eligibility status changes and all other controls are kept constant. The controls excluded from the table are cubic in log family income and family size at age 4, an interaction between these two variables, a dummy indicating the presence of a father figure in the household at age 4, race and age dummies, and dummies for year and state of residence at age 4. Robust standard errors are reported in brackets clustered at state-year at age four level. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table B.5: First Stage: Head Start Impact Study.

	(1)	(2)
Panel A: Full Sample		
HS Assignment	0.689***	0.662***
	[0.01]	[0.02]
HS Assignment x Child is Male		0.054*
		[0.02]
N	4442	4442
Panel B: Age 4 Cohort		
HS Assignment	0.671***	0.627***
	[0.02]	[0.02]
HS Assignment x Child is Male		0.090**
		[0.03]
N	1993	1993
Panel C: Age 3 Cohort		
HS Assignment	0.703***	0.692***
	[0.01]	[0.02]
HS Assignment x Child is Male		0.022
		[0.03]
N	2449	2449

Note: Data from the Head Start Impact Study. Table reports the coefficients of regressions of HS participation indicator on an indicator of HS assignment (no controls). In column (2) we also include an indicator for a male child (and its interaction with HS assignment). Standard errors shown below coefficient estimates in brackets. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table B.6: Gender gap in parental investments and maternal labor supply.

	(1) Annual weeks worked by mother	(2) HOME score	(3) Cognitive Stimulation	(4) Emotional Support
		Panel A: All		
1[Male]	-0.379	-0.105***	-0.121***	-0.041**
	[0.323]	[0.018]	[0.018]	[0.016]
Observations	111,304	48,353	45,485	42,898
		Panel B: Multi-children families		
1[Male]	-0.048	-0.090***	-0.100***	-0.038***
	[0.100]	[0.008]	[0.008]	[0.009]
Observations	73,888	32,373	30,542	28,707

Note: This table presents coefficients for the male dummy from a regression of the dependent variable on gender, age and year indicators. The sample is restricted to children ages 0-14, when HOME score is constructed. Panel B of the table controls also for mother fixed effects. Robust standard errors clustered by child are presented in brackets. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table B.7: Compliers characteristics for eligibility and siblings instruments.

Instrument Variable	(1) $P[X_i = 1]$	(2) Eligibility $P[X_i = 1 \mid HS_{1i} > HS_{0i}] / P[X_i = 1]$	(3) Siblings $P[X_i = 1 \mid HS_{1i} > HS_{0i}] / P[X_i = 1]$
Family Characteristics			
Poor family (age 0-2)	0.48	1.35	1.58
Mother's Education before age 3			
Mom is High School dropout	0.27	0.95	1.50
Mom is High School graduate	0.51	0.98	0.99
Father-figure at home (age 4)	0.71	0.62	0.73
Mothers AFQT above sample median	0.50	0.84	0.55
Child's Characteristics			
Child was breastfed	0.44	1.08	0.60
Motor score before age 3 above sample median	0.49	0.60	0.86

Note: Column (1) reports the distribution of the population by characteristics, $P[X_i = 1]$, for the sample of boys (2765 children that we observe at ages 12-13, 16-17 and 20-21). We use this data to perform separate estimations of the first stage equation for each group. Columns (2) and (3) reports the relative likelihood of an individual belonging to a particular group (in the compliers group) compared to the population at large. These figures are obtained from the first stage coefficient for each group divided by the overall first stage coefficient. For column (2) we use the same specification than in table 2 and the sample is also restricted around cutoff. In column (3) we present the relative probability for those children with siblings (one in Head Start and other in other preschool or home care).

Table B.8: Reduced Form Estimates: Effect of Head Start. Subindexes measured at ages 12-13.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Male	Female	All	Male	Female	All	Male	Female	All
Index		Cognitive			Only behaviors			Health	
1[HS Eligible at 4]	-0.136	-0.031	-0.099	0.233*	0.146	0.149*	0.236*	0.135	0.169**
	[0.117]	[0.099]	[0.074]	[0.122]	[0.111]	[0.083]	[0.133]	[0.099]	[0.081]
Observations	1,201	1,183	2,384	1,294	1,256	2,550	1,294	1,256	2,550

Note: This table presents estimates for γ in equation 1. Controls excluded from table: cubic in log family income and family size at age 4, an interaction between these two variables, cubic in log of average family income and family size for ages 0-2, interaction between these two variables, cubic on child's birth weight, dummy for the presence of a father figure in the household at age 4, race and age dummies, and year and state of residence at age 4 effects. Robust standard errors are reported in brackets clustered at state-year at age four level. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table B.9: Reduced Form Estimates: Ages 12-13.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	All				Males				Girls			
	Control Mean	N	ITT	RW pv<0.1	Control Mean	N	ITT	RW pv<0.1	Control Mean	N	ITT	RW pv<0.1
Behaviors												
Drug Use	0.140	2,424	0.0170	No	0.156	1,268	0.118	No	0.123	1,156	-0.262	No
			[0.141]				[0.189]				[0.198]	
marginal effect			*0.004*				*0.027*				*-0.045*	
Overweight	0.190	2,438	-0.308**	Yes	0.198	1,242	-0.379**	Yes	0.182	1,196	-0.218	No
			[0.120]				[0.165]				[0.172]	
marginal effect			*-0.080*				*-0.095*				*-0.056*	
Grade Retention	0.251	2,537	-0.130	No	0.286	1,285	-0.243	No	0.216	1,252	-0.0605	No
			[0.119]				[0.161]				[0.181]	
marginal effect			*-0.041*				*-0.079*				*-0.017*	
Alcohol Use	0.415	2,516	-0.163	No	0.467	1,289	-0.249	No	0.359	1,227	-0.118	No
			[0.107]				[0.160]				[0.142]	
marginal effect			*-0.056*				*-0.085*				*-0.039*	
School Damage	0.134	2,357	-0.121	No	0.143	1,209	0.0334	No	0.124	1,148	-0.401*	No
			[0.135]				[0.161]				[0.208]	
marginal effect			*-0.027*				*0.008*				*-0.072*	
Ever smoke	0.342	2,530	-0.0876	No	0.359	1,281	-0.146	No	0.324	1,249	-0.151	No
			[0.115]				[0.160]				[0.169]	
marginal effect			*-0.029*				*-0.048*				*-0.049*	
Special Education	0.218	2,464	-0.147	No	0.239	1,254	-0.250	No	0.197	1,210	-0.134	No
			[0.118]				[0.169]				[0.180]	
marginal effect			*-0.041*				*-0.075*				*-0.032*	
BPI	0.573	2392	-0.0809	No	0.654	1,211	-0.274**	Yes	0.486	1,181	0.118	No
			[0.0832]				[0.125]				[0.120]	

Reduced Form Estimates: Ages 12-13 (cont.).

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
			All				Males				Girls	
	Control Mean	N	ITT	RW pv<0.1	Control Mean	N	ITT	RW pv<0.1	Control Mean	N	ITT	RW pv<0.1
Health												
Health requires use sp. equip.	0.0751	2,049	-0.535***	Yes	0.0938	1,111	-0.777***	Yes	0.0526	938	-0.595**	No
			[0.191]				[0.287]				[0.273]	
marginal effect			*-0.064*				*-0.101*				*-0.058*	
Health requires freq. visits to doctor	0.153	2,472	-0.253*	No	0.190	1,273	-0.323*	No	0.114	1,199	-0.242	No
			[0.138]				[0.184]				[0.207]	
marginal effect			*-0.059*				*-0.083*				*-0.046*	
Health requires use of medicines	0.165	2,428	-0.0966	No	0.207	1,251	-0.214	No	0.120	1,177	-0.0436	No
			[0.131]				[0.179]				[0.201]	
marginal effect			*-0.023*				*-0.056*				*-0.008*	
Health limitations	0.0639	2,212	-0.230	No	0.0683	1,115	-0.168	No	0.0592	1,097	-0.441**	No
			[0.162]				[0.216]				[0.221]	
marginal effect			*-0.033*				*-0.028*				*-0.047*	
Cognitive												
PIAT-M	-0.044	2376	-0.080	No	0.047	1,197	0.027	No	-0.138	1,179	-0.181**	No
			[0.065]				[0.100]				[0.0899]	
PIAT-R	0.088	2376	-0.055	No	0.156	1,196	-0.238*	No	0.017	1,180	0.169	No
			[0.087]				[0.133]				[0.113]	
PIAT-RC	-0.236	2349	-0.114	No	-0.161	1,181	-0.144	No	-0.312	1,168	-0.049	No
			[0.0730]				[0.113]				[0.097]	

Note: Probit (OLS for BPI, PIAT) estimates. Controls excluded from table: cubic in log family income and family size at age 4, an interaction between these two variables, cubic in log of average family income and family size for ages 0-2, interaction between these two variables, cubic on child's birth weight, dummy for the presence of a father figure in the household at age 4, race and age dummies, and year and state of residence at age 4 effects. "Control Mean" is the mean outcome among observations just above the cutoff (at most 25% above the cutoff). Marginal effects for discrete outcomes in italic. Robust standard errors are reported in brackets clustered at state-year at age four level. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table B.10: Reduced Form Estimates: Ages 16-17.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
			All				Males				Girls	
	Control Mean	N	ITT	RW pv<0.1	Control Mean	N	ITT	RW pv<0.1	Control Mean	N	ITT	RW pv<0.1
In High School	0.924	2,151	0.075	No	0.914	1,080	0.070	No	0.935	1,071	0.076	No
			[0.161]				[0.229]				[0.245]	
marginal effect			*0.010*				*0.009*				*0.009*	
Overweight	0.190	2,267	-0.275**	Yes	0.230	1,167	-0.471**	Yes	0.145	1,100	0.004	No
			[0.134]				[0.191]				[0.186]	
marginal effect			*-0.067*				*-0.118*				*0.001*	
Birth Control	0.580	1,836	0.099	No	0.612	904	0.093	No	0.548	924	0.117	No
			[0.121]				[0.172]				[0.194]	
marginal effect			*0.037*				*0.033*				*0.042*	
Health Status	0.593	2,390	0.239**	Yes	0.669	1,213	0.206	No	0.510	1,177	0.262	No
			[0.114]				[0.169]				[0.164]	
marginal effect			*0.087*				*0.070*				*0.100*	
Ever Drunk	0.104	2,236	-0.180	No	0.108	1,167	-0.234	No	0.100	1,069	-0.276	No
			[0.158]				[0.192]				[0.237]	
marginal effect			*-0.035*				*-0.046*				*-0.047*	
Ever Sex	0.658	2,377	-0.002	No	0.688	1,214	-0.076	No	0.624	1,163	0.049	No
			[0.123]				[0.164]				[0.173]	
marginal effect			*-0.0005*				*-0.023*				*0.017*	
Ever Sentenced	0.112	2,173	0.026	No	0.136	1,165	-0.092	No	0.0827	1,008	0.064	No
			[0.155]				[0.193]				[0.227]	
marginal effect			*0.004*				*-0.018*				*0.008*	
CESD	0.0134	2061	-0.113	No	-0.099	1,053	-0.333***	Yes	0.146	1,008	0.098	No
			[0.089]				[0.108]				[0.155]	

Note: Probit (OLS for CESD) estimates. Controls excluded from table: cubic in log family income and family size at age 4, an interaction between these two variables, cubic in log of average family income and family size for ages 0-2, interaction between these two variables, cubic on child's birth weight, dummy for the presence of a father figure in the household at age 4, race and age dummies, and year and state of residence at age 4 effects. "Control Mean" is the mean outcome among observations just above the cutoff (at most 25% above the cutoff). Marginal effects for discrete outcomes in italic. Robust standard errors are reported in brackets clustered at state-year at age four level. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table B.11: Reduced Form Estimates: Young Adults.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
			All				Males				Girls	
	Control Mean	N	ITT	RW pv<0.1	Control Mean	N	ITT	RW pv<0.1	Control Mean	N	ITT	RW pv<0.1
In High School Diploma	0.716	1,965	0.088	No	0.669	943	0.282	No	0.763	1,022	-0.082	No
			[0.123]				[0.189]				[0.189]	
marginal effect			*0.028*				*0.090*				*-0.023*	
Birth Control	0.550	1,639	0.087	No	0.567	765	0.125	No	0.536	874	0.065	No
			[0.125]				[0.197]				[0.186]	
marginal effect			*0.033*				*0.045*				*0.024*	
Ever Sentenced	0.212	1,904	-0.239	No	0.284	943	-0.402**	Yes	0.138	961	-0.286	No
			[0.154]				[0.200]				[0.228]	
marginal effect			*-0.060*				*-0.114*				*-0.054*	
Idle	0.102	1,854	-0.146	No	0.112	874	-0.525**	Yes	0.092	980	0.044	No
			[0.178]				[0.250]				[0.255]	
marginal effect			*-0.026*				*-0.090*				*0.007*	
Ever in College	0.536	1,969	-0.074	No	0.462	948	-0.052	*No*	0.607	1,021	-0.076	No
			[0.125]				[0.175]				[0.187]	
marginal effect			*-0.027*				*-0.018*				*-0.027*	
Ever worked	0.309	1,931	0.007	No	0.229	934	0.192	No	0.389	997	-0.169	No
			[0.145]				[0.206]				[0.184]	
marginal effect			*0.002*				*0.060*				*-0.057*	

Note: Probit estimates. Controls excluded from table: cubic in log family income and family size at age 4, an interaction between these two variables, cubic in log of average family income and family size for ages 0-2, interaction between these two variables, cubic on child's birth weight, dummy for the presence of a father figure in the household at age 4, race and age dummies, and year and state of residence at age 4 effects. "Control Mean" is the mean outcome among observations just above the cutoff (at most 25% above the cutoff). Marginal effects for discrete outcomes in italic. Robust standard errors are reported in brackets clustered at state-year at age four level. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table B.12: Mother Fixed Effects

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Year of birth	1972-1986	1986-2000	1972-1986	1986-2000	1972-1986	1986-2000	1972-1986	1986-2000
	Test Score		PPVT		PIAT-RR		BPI	
Head Start	0.134	0.132	0.215*	-0.058	0.200**	0.193	0.033	0.036
	[0.087]	[0.122]	[0.126]	[0.204]	[0.095]	[0.121]	[0.083]	[0.091]
Head StartXAge 7-10	-0.096	-0.193**	-0.169	-0.188	-0.117	-0.209*	0.007	-0.035
	[0.081]	[0.092]	[0.128]	[0.204]	[0.090]	[0.108]	[0.077]	[0.089]
Head StartXAge 11-14	-0.085	-0.183*	-0.085	-0.052	-0.197**	-0.164	-0.060	-0.088
	[0.085]	[0.100]	[0.121]	[0.201]	[0.095]	[0.119]	[0.087]	[0.096]
Preschool	0.155	-0.203	0.095	0.176	0.013	-0.114	0.022	0.055
	[0.142]	[0.142]	[0.195]	[0.260]	[0.146]	[0.146]	[0.133]	[0.119]
PreschoolXAge 7-10	-0.233*	0.174	-0.097	-0.378	-0.230*	0.061	-0.063	0.017
	[0.139]	[0.114]	[0.202]	[0.293]	[0.134]	[0.113]	[0.130]	[0.094]
PreschoolXAge 11-14	-0.276*	0.195	-0.046	-0.184	-0.213	0.016	-0.070	0.031
	[0.146]	[0.122]	[0.185]	[0.259]	[0.144]	[0.129]	[0.128]	[0.122]
Observations	5,276	3,228	2,804	1,311	5,008	3,085	4,944	3,051
control mean	-0.440	-0.285	-1.147	-1.077	-0.125	0.0109	0.679	0.388
SD	0.881	0.942	1.179	1.361	0.955	0.967	0.997	1.074
P-Value Test: HS 7-10	0.487	0.526	0.590	0.266	0.193	0.885	0.454	0.986
P-Value Test: HS 11-14	0.373	0.605	0.102	0.559	0.956	0.792	0.646	0.555

Note: Controls excluded from table include child's gender, first born status, and age at test and year fixed effects and mother fixed effects.

We restrict the sample to children who were over four years old by 1990 (in the first column for each outcome) and to children born after 1986 (on the second column for each outcome). We further restrict the sample to children to whom it is possible to recover information for pre-Head Start age (in particular, on birth weight and on whether a child was breastfed). Finally, we restrict the sample to families with at least two age-eligible children. The sample used in includes only children aged 5-14 years old. The unit of observation is child-by-age.

Robust standard errors are reported in brackets clustered at family level. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table B.13: Reduced Form Estimates: Other specifications (only boys).

	(1)	(2)	(3)	(4)	(5)
	Basic	No-Pre HS age controls	All controls	Quadratic	Quartic
			Panel A: Ages 12-13		
			A.1: BPI		
1[HS Eligible at 4]	-0.274**	-0.250**	-0.252*	-0.261**	-0.312**
	[0.125]	[0.125]	[0.141]	[0.124]	[0.127]
			A.2: Overweight		
1[HS Eligible at 4]	-0.379**	-0.380**	-0.488**	-0.358**	-0.398**
	[0.165]	[0.159]	[0.204]	[0.160]	[0.170]
Marginal Effect	-0.0950	-0.0966	-0.115	-0.0904	-0.0997
			A.3: Health condition that requires use of special equipment		
1[HS Eligible at 4]	-0.777***	-0.632**	-1.001***	-0.706***	-0.779***
	[0.287]	[0.275]	[0.336]	[0.260]	[0.281]
Marginal Effect	-0.101	-0.0839	-0.139	-0.0927	-0.103
			Panel B: Ages 16-17		
			B.1: Overweight		
1[HS Eligible at 4]	-0.471**	-0.493***	-0.412*	-0.483**	-0.470**
	[0.191]	[0.187]	[0.216]	[0.190]	[0.194]
Marginal Effect	-0.118	-0.126	-0.102	-0.122	-0.118
			B.2: CESD		
1[HS Eligible at 4]	-0.333***	-0.329***	-0.348***	-0.327***	-0.325***
	[0.108]	[0.108]	[0.120]	[0.106]	[0.112]
			Panel C: Ages 20-21		
			Ever Sentenced		
1[HS Eligible at 4]	-0.402**	-0.312	-0.477**	-0.403**	-0.443**
	[0.200]	[0.199]	[0.229]	[0.198]	[0.208]
Marginal Effect	-0.114	-0.0928	-0.133	-0.115	-0.126
			C.2: Idle		
1[HS Eligible at 4]	-0.525**	-0.486**	-0.576**	-0.513**	-0.454*
	[0.250]	[0.247]	[0.276]	[0.242]	[0.261]
Marginal Effect	-0.090	-0.084	-0.097	-0.088	-0.076

Note: "Basic" is specification used throughout the paper (cubic in log family income and family size at age 4, an interaction between these two variables, a dummy for the presence of a father figure in the child's household at age 4, cubic in average log family income and average family size between ages 0 and 2, an interaction between the two, and cubic in birth weight, race and age dummies and dummies for year and state of residence at age 4). "No pre-Head Start age controls" includes the same controls than in column (1), except those measured before age 3. "All Controls" includes the same controls than in column (1) and dummies for highest grade completed by mother before child turned 3, maternal AFQT score, maternal grandmother's highest grade completed and indicators of maternal situation at 14 years old (whether the mother lived in a Southern, whether she lived with parents and whether she lived in a rural area). "Quadratic" and "Quartic" are the same specification as "Basic" but using polynomials up to the second and fourth order, respectively, in (log) income, family size and birth weight variables. Robust standard errors in brackets clustered at state-year at age four level. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table B.14: Reduced Form Estimates: Trimming around cutoff (only boys).

	(1) [75%-125%]	(2) [50%-150%]	(3) [25%-175%]	(4) [15%-185%]	(5) 300%	(6) Full Sample
			Panel A: Ages 12-13			
			A.1: BPI			
1[HS Eligible at 4]	0.123	-0.168	-0.323**	-0.274**	-0.169*	-0.0693
	[0.205]	[0.153]	[0.134]	[0.125]	[0.0936]	[0.0818]
Observations	359	774	1,110	1,211	1,793	2,327
			A.2: Overweight			
1[HS Eligible at 4]	-1.008***	-0.461**	-0.399**	-0.379**	-0.0147	-0.0924
	[0.368]	[0.204]	[0.167]	[0.165]	[0.135]	[0.112]
Observations	300	772	1,128	1,242	1,852	2,392
			A.3: Health condition that requires use of special equipment			
1[HS Eligible at 4]	-0.506	-0.698**	-0.779***	-0.777***	-0.246	-0.244
	[0.499]	[0.352]	[0.293]	[0.287]	[0.195]	[0.166]
Observations	244	588	985	1,111	1,811	2,360
			Panel B: Ages 16-17			
			B.2: Overweight			
1[HS Eligible at 4]	-0.760**	-0.577**	-0.445**	-0.471**	-0.377***	-0.360***
	[0.337]	[0.239]	[0.195]	[0.191]	[0.145]	[0.131]
Observations	303	724	1,076	1,167	1,755	2,248
			B.2: CESD			
1[HS Eligible at 4]	-0.453**	-0.249**	-0.303***	-0.333***	-0.178**	-0.0919
	[0.208]	[0.124]	[0.111]	[0.109]	[0.0825]	[0.0683]
Observations	315	671	973	1,054	1,534	1,960
			Panel C: Ages 20-21			
			Ever Sentenced			
1[HS Eligible at 4]	-0.0346	-0.574**	-0.457**	-0.402**	-0.0568	-0.0574
	[0.396]	[0.244]	[0.213]	[0.200]	[0.146]	[0.127]
Observations	256	590	867	943	1,378	1,694
			C.2: Idle			
1[HS Eligible at 4]	-3.337***	-0.535*	-0.711**	-0.525**	-0.264	-0.262
	[1.173]	[0.284]	[0.277]	[0.250]	[0.212]	[0.187]
Observations	173	503	806	874	1,246	1,529

Note: Estimates using the same specification as table (5), but different trimming of data around the cutoff. The sample includes only males. Robust standard errors are reported in brackets clustered at state-year at age four level. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table B.15: Income eligibility to Head Start at ages 0-7 (only boys).

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Eligible at age	0	1	2	3	4	5	6	7
				Panel A: Ages 12-13				
				A.1: BPI				
1[HS Eligible at 4]	-0.000322	-0.0768	0.128	0.167	-0.274**	-0.236*	0.0533	-0.0978
	[0.142]	[0.146]	[0.139]	[0.136]	[0.125]	[0.136]	[0.123]	[0.141]
Observations	984	1,087	1,172	1,110	1,211	1,012	1,093	983
				A.2: Overweight				
1[HS Eligible at 4]	0.0365	-0.129	0.0649	-0.0200	-0.379**	-0.294	-0.112	0.143
	[0.214]	[0.195]	[0.183]	[0.198]	[0.165]	[0.201]	[0.191]	[0.218]
Observations	946	1,092	1,211	1,126	1,242	1,029	1,130	970
				A.3: Health condition that requires use of special equipment				
1[HS Eligible at 4]	0.539**	0.845***	-0.349	0.0767	-0.777***	-0.426	-0.000698	-0.744***
	[0.271]	[0.280]	[0.255]	[0.298]	[0.287]	[0.304]	[0.231]	[0.263]
Observations	848	910	1,123	1,041	1,111	863	1,039	866
				Panel B: Ages 16-17				
				B.1: Overweight				
1[HS Eligible at 4]	-0.303	-0.159	-0.0379	-0.130	-0.471**	-0.471**	0.0993	-0.0337
	[0.224]	[0.203]	[0.198]	[0.212]	[0.191]	[0.194]	[0.212]	[0.211]
Observations	912	1,045	1,089	1,090	1,167	1,019	1,045	942
				B.2: CESD				
1[HS Eligible at 4]	0.0463	0.104	-0.00376	-0.0413	-0.333***	0.0333	-0.103	-0.0535
	[0.121]	[0.111]	[0.133]	[0.120]	[0.108]	[0.108]	[0.124]	[0.130]
Observations	831	974	1,009	990	1,053	923	939	840
				Panel C: Ages 20-21				
				Ever Sentenced				
1[HS Eligible at 4]	0.115	0.373*	0.286	-0.0419	-0.402**	-0.236	0.317*	0.0761
	[0.212]	[0.206]	[0.197]	[0.204]	[0.200]	[0.188]	[0.187]	[0.225]
Observations	767	871	913	914	943	926	931	833
				C.2: Idle				
1[HS Eligible at X]	-0.0939	-0.327	0.817**	-0.0369	-0.525**	-0.0229	0.179	0.503**
	[0.284]	[0.286]	[0.325]	[0.317]	[0.250]	[0.232]	[0.259]	[0.248]
Observations	691	793	834	829	874	864	864	775

Note: Table includes reduced form results of table (5) with income eligibility measured at different ages between 0 and 7. The sample includes only males.
Robust standard errors are reported in brackets clustered at state-year at age four level. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table B.16: Reduced Form Estimates: Ages 12-13 and 16-17 (by race; only boys).

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Ages 12-13					Ages 16-17				Ages 20-21		
	Index	Overweight	Special Education	Health condition requires sp. equip.	BPI	Index	Overweight	Arrested or Convicted	CESD	Index	Ever Sentenced	Idle
						Panel A: Black						
1[HS Eligible at 4]	0.253	-0.830***	0.152	-0.905*	-0.110	0.407**	-0.714**	-0.656*	-0.219	0.333	-0.103	-0.782*
	[0.223]	[0.272]	[0.284]	[0.473]	[0.213]	[0.184]	[0.303]	[0.365]	[0.151]	[0.271]	[0.364]	[0.412]
RW algorithm												
H0 rejected at 10%	NA	Yes	No	No	No	NA	No	No	No	NA	No	No
Observations	563	535	528	386	523	535	499	494	456	413	409	360
Control Mean	-0.189	0.305	0.196	0.186	0.541	-0.109	0.321	0.0417	-0.233	-0.330	0.0811	0.250
Marginal Effect		-0.213	0.044	-0.151			-0.183	-0.121			-0.026	-0.171
						Panel B: Non Black						
1[HS Eligible at 4]	0.380**	-0.259	-0.670***	-1.299***	-0.379**	0.153	-0.272	0.0856	-0.315*	0.195	-0.497*	-0.579
	[0.180]	[0.229]	[0.242]	[0.442]	[0.176]	[0.161]	[0.256]	[0.242]	[0.162]	[0.160]	[0.261]	[0.435]
RW algorithm												
H0 rejected at 10%	NA	No	Yes	Yes	No	NA	No	No	No	NA	No	No
Observations	708	668	684	469	648	664	596	569	559	518	503	390
Control Mean	-0.333	0.153	0.265	0.0822	0.722	-0.240	0.181	0.227	-0.0653	-0.287	0.367	0.0870
Marginal Effect		-0.062	-0.176	-0.155			-0.066	0.018			-0.136	-0.070

Note: Probit (OLS for BPI, CESD and index) estimates. Males only.
Controls excluded from table: cubic in log family income and family size at age 4, an interaction between these two variables, cubic in log of average family income and family size for ages 0-2, interaction between these two variables, cubic on child's birth weight, dummy for the presence of a father figure in the household at age 4, race and age dummies, and year and state of residence at age 4 effects. "Control Mean" is the mean outcome among observations just above the cutoff (at most 25% above the cutoff). Marginal effects for discrete outcomes in italic. "NA" means Not Applicable. Robust standard errors are reported in brackets clustered at state-year at age four level. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table B.17: Reduced Form Estimates: Ages 12-13 (effects by year of birth; only boys).

Year of birth	(1) 1977-1984	(2) 1985-2000	(3) 1977-1984	(4) 1985-2000	(5) 1977-1984	(6) 1985-2000	(7) 1977-1984	(8) 1985-2000
				Panel A: Indexes				
	Cognitive		Only behaviors		Health		Global	
1[HS Eligible at 4]	-0.145	-0.0531	0.258**	0.0142	0.184*	0.154	0.293***	0.109
	[0.0959]	[0.128]	[0.108]	[0.143]	[0.103]	[0.142]	[0.0983]	[0.139]
Observations	1,394	989	1,501	1,052	1,501	1,052	1,501	1,052
				Panel B: Individual Variables				
	Health condition requires special equipment		Overweight		Special Education		BPI	
1[HS Eligible at 4]	-0.823***	-0.322	-0.317**	-0.294	-0.290*	-0.0161	-0.0395	-0.126
	[0.265]	[0.292]	[0.160]	[0.195]	[0.160]	[0.185]	[0.106]	[0.143]
Observations	1,289	826	1,434	1,007	1,421	1,029	1,419	1,007
Control Mean	0.0640	0.0787	0.169	0.217	0.177	0.263	0.676	0.456
Marginal Effect	-0.090	-0.040	-0.076	-0.082	-0.076	-0.005		

Note: Probit (and OLS for BPI, index) estimates. Sample: Males. Controls excluded from table include cubic in log family income and family size at age 4, an interaction between these two variables, cubic in log of average family income and family size for ages 0-2, the interaction between these two variables, cubic on childs birthweight, a dummy indicating the presence of a father figure in the household at age 4, race and age dummies, and dummies for year and state of residence at age 4. Marginal effect is average marginal change in the probability of Head Start participation across individuals as the eligibility status changes and all other controls are kept constant. Control Mean is the mean outcome among observations just above the cutoff, that is, at 25% above the cutoff. Robust standard errors are reported in brackets clustered at state-year at age four level. *, **, *** significant at 10%, 5% and 1%, respectively.

Table B.18: Labor market outcomes of mother and her spouse.

	(1)	(2)	(3)	(4)	(5)	(6)
Age	Prior to eligibility		At eligibility		At HS age	
Variable	Hours per week		Hours per week		Hours per week	
	mother	spouse	mother	spouse	mother	spouse
			Panel A: All sample			
Eligible 4	-1.746	-0.479	-4.440***	-1.285	-4.000***	-1.176
	[1.335]	[1.251]	[1.227]	[1.368]	[1.317]	[1.321]
Observations	2,736	1,483	2,864	1,507	2,855	1,496
Control Mean	27.25	43.36	27.57	43.30	27.44	42.97
			Panel B: Males			
Eligible 4	-1.474	-1.747	-5.265***	-3.371	-5.082***	-1.282
	[1.734]	[1.717]	[1.655]	[2.060]	[1.755]	[2.006]
Observations	1,388	757	1,448	772	1,446	762
Control Mean	26.43	42.24	26.95	43.49	26.73	43.52
			Panel C: Females			
Eligible 4	-2.069	-0.078	-3.644**	0.483	-3.178	-1.083
	[2.061]	[1.776]	[1.843]	[1.832]	[1.951]	[1.910]
Observations	1,348	726	1,416	735	1,409	734
Control Mean	28.07	44.57	28.18	43.09	28.14	42.41

Note: The age groups per column are as follow: "Prior to eligibility" includes labor supply of parents when the child is 0-1 years old; "At eligibility" includes labor supply of parents when child is 3-4 years old; and "At HS age" includes labor supply of parents when the child is 4-5 years old. Notice that eligibility at age four is determined using income from the calendar year prior to that in which the child turn 4 (and, therefore, incorporates parental labor market outcomes also in the previous calendar year).
Controls excluded from table include cubic in log family income and family size at age 4, an interaction between these two variables, dummy for the presence of a father figure in the household at age 4, race, gender and age dummies, and year and state of residence at age 4 effects.
"Control Mean" is the mean outcome among observations just above the cutoff (at most 25% above the cutoff). * significant at 10%; ** significant at 5%; *** significant at 1%.

Table B.19: Parental investments in children: HOME score.

	(1)	(2)	(3)
Sample	All	Males	Females
Eligible 4	-0.062	-0.114	0.014
	[0.061]	[0.085]	[0.089]
Eligible 4XAge6-9	0.001	0.016	-0.020
	[0.040]	[0.060]	[0.057]
Eligible 4XAge10-14	0.096**	0.135**	0.051
	[0.045]	[0.064]	[0.063]
Observations	14,642	7,392	7,250
Control Mean	-0.487	-0.548	-0.427
P-Values			
Joint test on "Eligible 4"	0.021	0.047	0.398
Effect ages 6-9	0.294	0.212	0.944
Effect ages 10-14	0.560	0.786	0.442

Note: The dependent variable is the HOME score. Controls excluded from table include cubic in log family income and family size at age 4, an interaction between these two variables, dummy for the presence of a father figure in the household at age 4, race, gender and age dummies, and year and state of residence at age 4 effects and indicators for age group (6-9 and 10-14; 4-5 is the omitted category).
"Control Mean" is the mean outcome among observations just above the cutoff (at most 25% above the cutoff). The unit of observation is child-by-age. Robust standard errors are reported in brackets clustered at state (at age 4) level. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table B.20: Reduced Form Estimates: Functions of distance to cutoff as running variable.

	(1)	(2)
	Distance to cutoff	
	Quadratic	Cubic
		Panel A: Ages 12-13
		A.1: Index
1[HS Eligible at 4]	0.104	0.143
	[0.109]	[0.126]
		A.2: BPI
1[HS Eligible at 4]	-0.117	-0.150
	[0.106]	[0.126]
		A.3: Overweight
1[HS Eligible at 4]	-0.149	-0.155
	[0.145]	[0.173]
Marginal Effect	-0.0379	-0.0395
		A.4: Health condition that requires use of special equipment
1[HS Eligible at 4]	-0.319	-0.315
	[0.208]	[0.244]
Marginal Effect	-0.0400	-0.0395
		Panel B: Ages 16-17
		B.1: Index
1[HS Eligible at 4]	0.136	0.280**
	[0.112]	[0.133]
		B.2: Overweight
1[HS Eligible at 4]	-0.329**	-0.390**
	[0.166]	[0.188]
Marginal Effect	-0.0838	-0.0997
		B.3: CESD
1[HS Eligible at 4]	-0.270***	-0.197*
	[0.0921]	[0.114]
		Panel C: Ages 20-21
		C.1: Index
1[HS Eligible at 4]	0.096	0.158
	[0.128]	[0.138]
		C.2: Ever Sentenced
1[HS Eligible at 4]	-0.267	-0.465**
	[0.182]	[0.200]
Marginal Effect	-0.0807	-0.139

Note: Table includes reduced form estimates for selected outcomes using several specifications. The sample includes only males.

Controls excluded from the table include polynomials of the difference between family income and cutoff instead of polynomials in log income and family size at age 4, a dummy for the presence of a father figure in the child's household at age 4, race and age dummies and dummies for year and state of residence at age 4. Robust standard errors in brackets clustered at state-year at age four level. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table B.21: Reduced Form estimates using fake income cutoff.

	(1)	(2)	(3)	(4)
Cutoff at	0.5	-0.5	0,0.5	-0.5,0
			Panel A: Ages 12-13	
			A.1: BPI	
Fake cutoff	-0.009	0.332***	-0.074	0.284**
	[0.131]	[0.122]	[0.139]	[0.126]
1[HS Eligible at 4]			-0.294**	-0.212*
			[0.133]	[0.128]
			A.2: Overweight	
Fake cutoff	0.020	0.047	-0.082	-0.044
	[0.177]	[0.176]	[0.180]	[0.184]
1[HS Eligible at 4]			-0.426**	-0.415**
			[0.169]	[0.172]
			A.3: Special Equipment	
Fake cutoff	-0.275	0.260	-0.448	0.090
	[0.262]	[0.235]	[0.278]	[0.240]
1[HS Eligible at 4]			-0.880***	-0.753***
			[0.325]	[0.288]
			A.4: Global Index	
Fake cutoff	0.041	-0.197	0.116	-0.131
	[0.118]	[0.136]	[0.120]	[0.138]
1[HS Eligible at 4]			0.346***	0.289**
			[0.131]	[0.129]
			Panel B: Ages 16-17	
			B.1: Overweight	
Fake cutoff	-0.251	0.153	-0.366*	0.042
	[0.187]	[0.179]	[0.196]	[0.191]
1[HS Eligible at 4]			-0.588***	-0.495**
			[0.205]	[0.201]
			B.2: CESD	
Fake cutoff	0.134	0.117	0.073	0.037
	[0.096]	[0.117]	[0.094]	[0.120]
1[HS Eligible at 4]			-0.316***	-0.322***
			[0.108]	[0.111]
			B.3: Global Index	
Fake cutoff	-0.044	-0.273**	0.005	-0.225
	[0.107]	[0.139]	[0.109]	[0.142]
1[HS Eligible at 4]			0.261**	0.207*
			[0.123]	[0.123]
			Panel C: Ages 20-21	
			Ever Sentenced	
Fake cutoff	-0.060	0.112	-0.151	0.038
	[0.218]	[0.191]	[0.222]	[0.196]
1[HS Eligible at 4]			-0.412**	-0.369*
			[0.204]	[0.203]
			C.2: Global Index	
Fake cutoff	0.161	-0.200	0.208	-0.172
	[0.138]	[0.139]	[0.139]	[0.141]
1[HS Eligible at 4]			0.217	0.132
			[0.139]	[0.142]

Note: Estimates using the same specification as table (5), but different cutoffs are set at the relative distance indicated in each column. The sample includes only males. Robust standard errors are reported in brackets clustered at state-year at age four level. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table B.22: Reduced Form clustering SE by state of residence at age 4.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Age groups	12-13				16-17			20-21		
Variables	Index	Overweight	Use of Special Equipment	BPI	Index	Overweight	CESD	Index	Ever Sentenced	Idle
1[HS Eligible at 4]	0.313***	-0.379***	-0.777**	-0.274**	0.266**	-0.471**	-0.333***	0.194	-0.402*	-0.525*
	[0.103]	[0.127]	[0.306]	[0.120]	[0.118]	[0.213]	[0.104]	[0.123]	[0.209]	[0.291]
Marginal Effect		-0.095	-0.101			-0.118			-0.114	-0.090

Note: Estimates using the same specification as table (5). The sample includes only males. Robust standard errors are reported in brackets clustered by state at age four level. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table B.23: Reduced Form accounting for attrition: Children surveyed at ages 12-13, 16-17 and 20-21.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Age groups	12-13				16-17			20-21		
Variables	Index	Overweight	Use of Special Equipment	BPI	Index	Overweight	CESD	Index	Ever Sentenced	Idle
1[HS Eligible at 4]	0.389**	-0.309	-0.487	-0.235	0.370**	-0.304	-0.409***	0.202	-0.552***	-0.399
	[0.167]	[0.228]	[0.397]	[0.165]	[0.151]	[0.244]	[0.149]	[0.146]	[0.214]	[0.293]
Observations	776	724	588	713	776	710	622	776	768	713
Control Mean	-0.360	0.206	0.0899	0.721	-0.275	0.182	-0.127	-0.278	0.303	0.097
Marginal Effect		*-0.0747*	*-0.0592*			*-0.071*			*-0.156*	*-0.066*

Note: This table presents estimates for γ in equation (1). Controls excluded from table: cubic in log family income and family size at age 4, an interaction between these two variables, cubic in log of average family income and family size for ages 0-2, interaction between these two variables, cubic on child's birth weight, dummy for the presence of a father figure in the household at age 4, race and age dummies, and year and state of residence at age 4 effects. "Control Mean" is the mean outcome among observations just above the cutoff (at most 25% above the cutoff). Marginal effects for discrete outcomes in italic.
Sample restricted to children used in to estimate effects of Head Start at ages 12-13, 16-17 and 20-21. The sample includes only males.
Robust standard errors are reported in brackets clustered at state-year at age four level. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table B.24: Linear Probability Model: Two Stage Least Squares Estimates.

	(1)	(2)	(3)	(4)	(5)
	Ages 12-13		Ages 16-17	Ages 20-21	
	Overweight	Special Equipment	Overweight	Ever Sentenced	Idle
Head Start	-0.357**	-0.322**	-0.432**	-0.149	-0.099
	[0.169]	[0.138]	[0.205]	[0.191]	[0.142]
Observations	1,242	1,111	1,167	943	874

Note: Participation in program is instrumented with eligibility status at age four. Controls excluded from table include cubic in log family income and family size at age 4, an interaction between these two variables, cubic in log of average family income and family size for ages 0-2, the interaction between these two variables, cubic on child's birth weight, a dummy indicating the presence of a father figure in the household at age 4, race and age dummies, and dummies for year and state of residence at age 4. The standard errors are obtained by block-bootstrap (500 replications; block is the cell year-state of residence at age 4). * significant at 10%; ** significant at 5%; *** significant at 1%.

C Figures

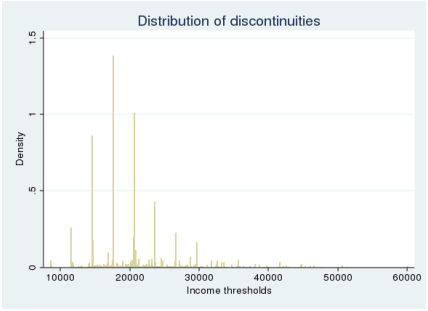


Figure C.1: Distribution of Income thresholds at age 4.
Note: Figure includes all children used in the regressions whose family income at age 4 was 15-185% of the discontinuity level of income.

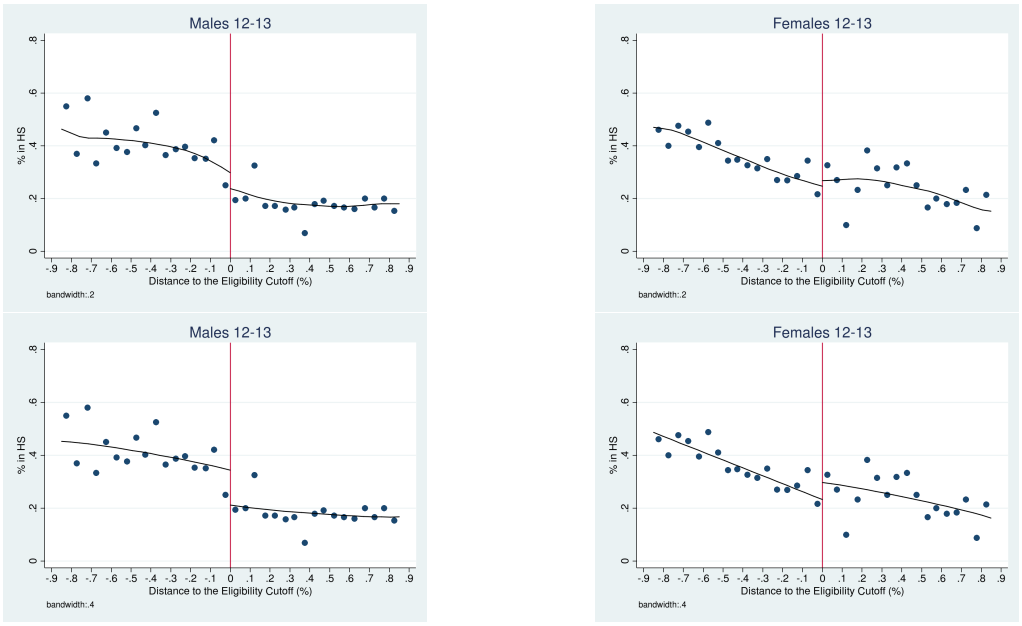


Figure C.2: Proportion of children in Head Start, by eligibility status.

Note: The continuous lines in figure are local linear regression estimates of HS participation on percentage distance to cutoff. The bandwidth is 0.2 in the first two graphs and 0.4 in the bottom two. Circles in figures represent mean participation by cell within intervals of 0.05 of distance to cutoff. The kernel used was Epanechnikov.

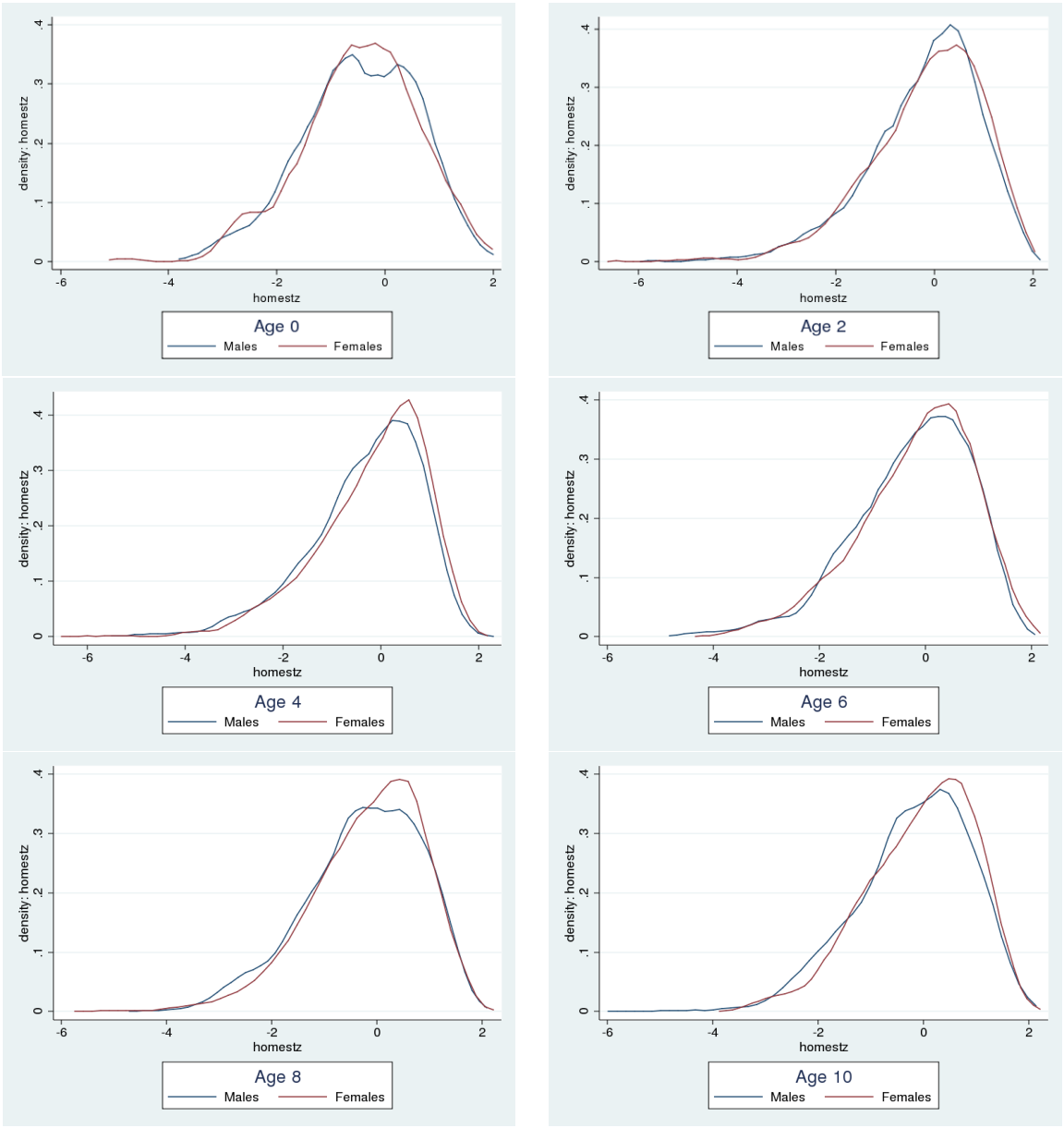


Figure C.3: Density estimates of maternal investments by gender.

Note: The graphs density estimates for HOME score by gender for several ages. For each age we perform the KolmogorovSmirnov test for the equality of the distributions for the score of the two genders. The p-values are the following: 0.339 (age 0), 0.067 (age 2), 0.000 (age 4), 0.157 (age 6), 0.017 (age 8) and 0.002 (age 10).



Figure C.4: Average outcomes by eligibility status: Falsification, Bandwidth = 0.3.
Note: The continuous lines in figure present local linear regression estimates of several outcomes on percentage distance to cutoff. The graphs in the first two rows present estimates for males and the graphs in the bottom two rows present estimates for females. The kernel used was Epanechnikov.

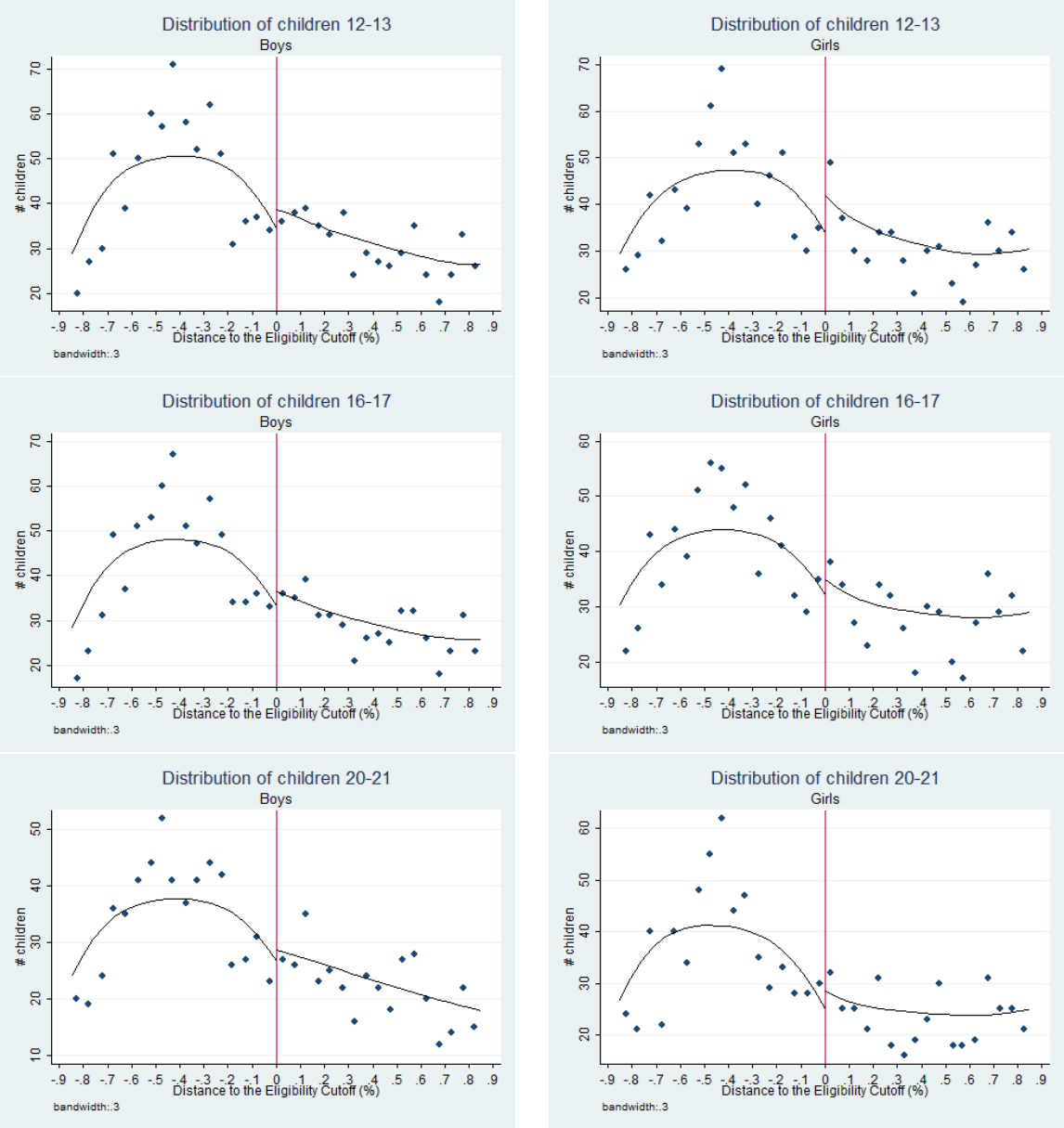


Figure C.5: Distribution of children around the cutoff.

Note: The continuous lines in figure are local linear regression estimates of the number of children per interval of width 0.05 of relative income-distance to cutoff; regressions were run separately on both sides of the cutoff and the bandwidth was set to 0.3. Circles in figures represent mean number of children by cell within intervals of 0.05 of distance to cutoff. The kernel used was Epanechnikov.

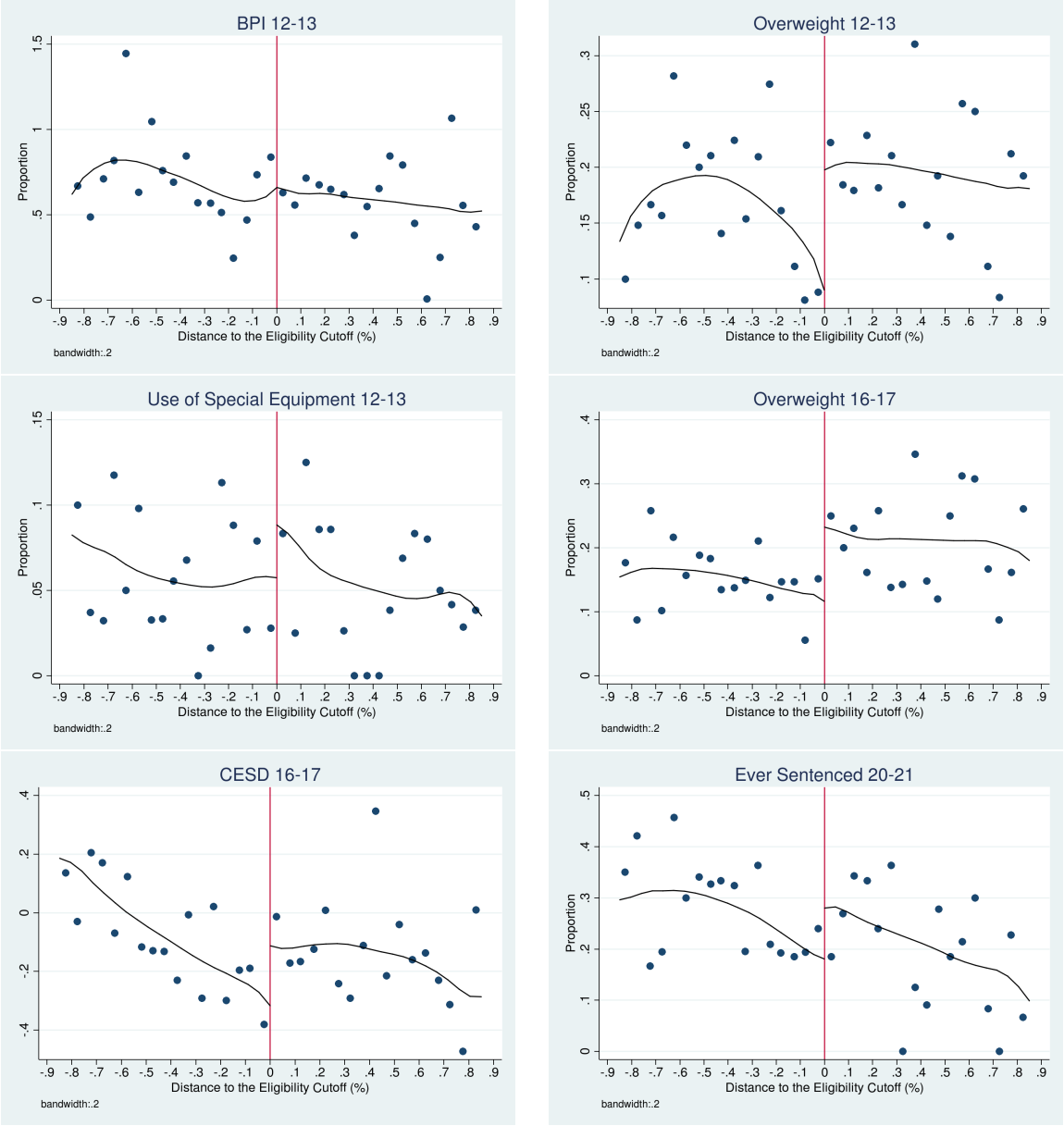


Figure C.6: Average outcomes by eligibility status, Bandwidth = 0.2.

Note: The continuous lines in figure present local linear regression estimates of several outcomes on percentage distance to cutoff. This figure replicates estimates of figure (2), using a bandwidth of 0.2. Circles in figures represent the mean outcome by cell within intervals of 0.05 of distance to cutoff. The kernel used was Epanechnikov. The sample only includes boys.

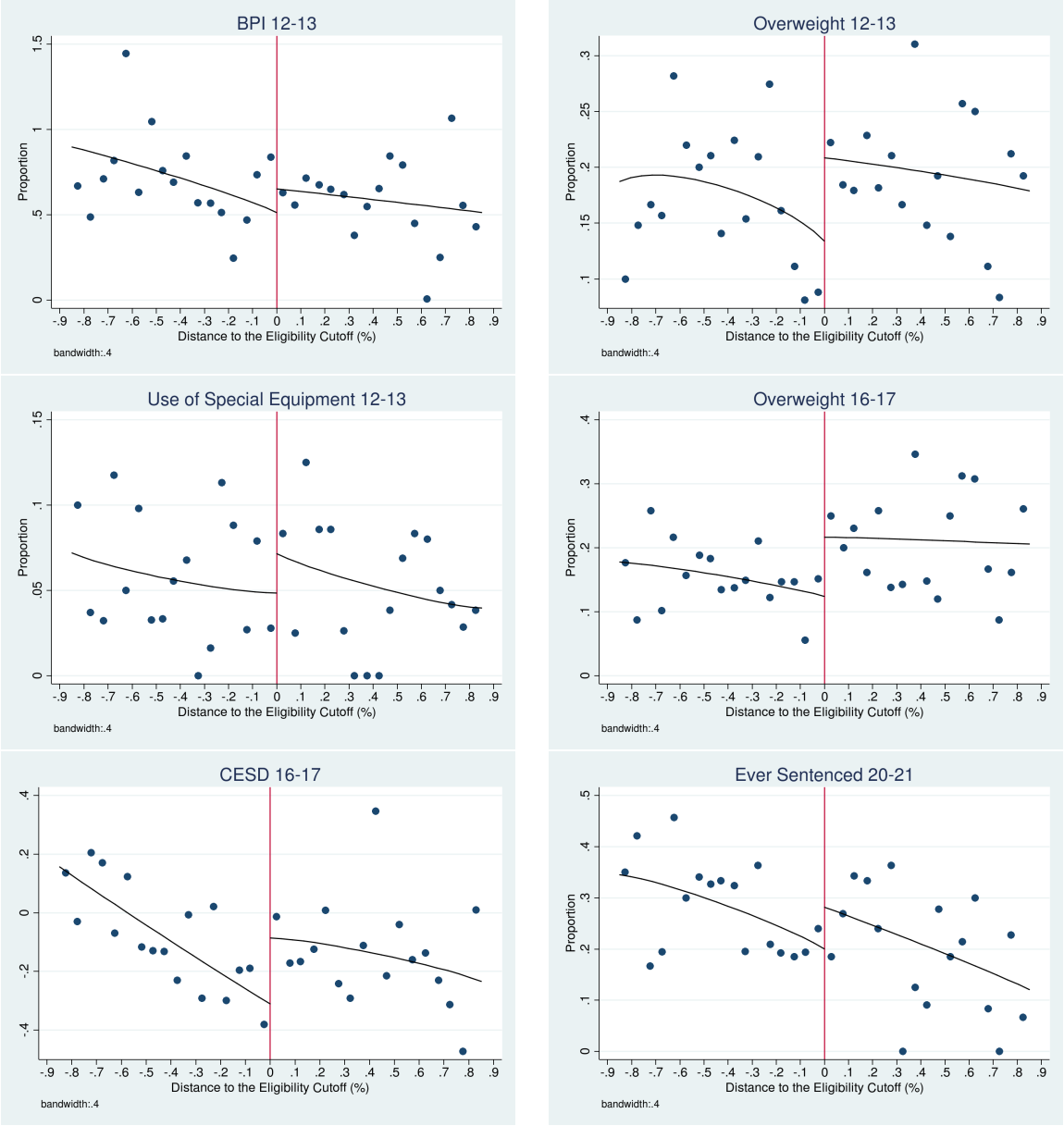


Figure C.7: Average outcomes by eligibility status, Bandwidth = 0.4.

Note: The continuous lines in Figure present local linear regression estimates of several outcomes on percentage distance to cutoff. This figure replicates estimates of figure (2), using a bandwidth of 0.4. Circles in figures represent the mean outcome by cell within intervals of 0.05 of distance to cutoff. The kernel used was Epanechnikov. The sample only includes boys.

D Data Construction

This Appendix includes the details about the construction of the sample used.

Table D.1: Sample selection in the CNSLY.

	Number of children	Dropped
Original sample	11,495	
Dropped:		
No information on HS participation	9,210	2,285
Missing information: income, family size and state of residence at age 4	7,236	1,974
Missing information: income, family size 0-2 and birth weight	6,381	855
Children observed at ages 12-13 or 16-17 or 20-21 to whom at least one outcome is observed	5433	948
Total sample	5,433	
Sample around cutoff at age 4 (15%-185%)	2,875	
After dropping children not used in first stage estimation due to multicolinearity	2,833	
By age		
12-13	2,550	
16-17	2,416	
20-21	1,977	
At all ages	1,595	

Of the 2285 children dropped from the sample because of lack Head Start information, (i) 507 are dropped because the mother was not interviewed after 1986 (of these 398 are children of the mothers in the military subsample which was discontinued in 1985), (ii) 617 are children not interviewed after 1986 (of these 80 died before the CNLSY began), (iii) 362 children were interviewed after 1986 but the last time they were interviewed they were too young (less than 3 years old) for the Head Start question to be applied, (iv) 630 children are dropped for the sample simply because they have missing information in Head Start variable in the raw data, and (v) finally, 169 children are not included in the sample because despite having information about Head Start participation, they do not have information about the time spent in program.

Table D.2: Missing information before age 3.

	(1)	(2)
Sample	Male	Female
1[Eligible at 4]	0.022	0.187
	[0.241]	[0.227]
Observations	1,203	1,160
Control Mean	0.035	0.079
SD	0.185	0.270
Marginal Effect	0.003	0.022

Note: The table reports results of probit estimates of an indicator for whether the child has missing information on any of the pre-age 3 controls that we add to specification of table (5), that is, log of average family income and family size for ages 0-2 or child's birth weight. The controls excluded from the table are: cubic in log family income and family size at age 4, an interaction between these two variables, a dummy indicating the presence of a father figure in the household at age 4, race and age dummies, and dummies for year and state of residence at age 4.
The sample used in estimation includes only children ages 12-13. Robust standard errors are reported in brackets clustered at state-year at age four level. * significant at 10%; ** significant at 5%; *** significant at 1%.

E Cost-benefit Analysis

We here the details of our simple cost-benefit calculation. As we showed in Table 2, eligibility to Head Start is a associated with an increase in the probability of participation at the margin of 19-22% among males (we use 21% for the calculations presented here). Thus, when comparing costs and benefits we take into account that eligibility does not imply participation and vice-versa. The calculations are simpler to present if we focus on a single cohort of participants, and we choose the cohort of children entering Head Start in 1992 (born in 1988), as it is the most contemporaneous year that allows an analysis to all three age groups we studied. As a comparison, we also consider the cost-effectiveness of the version of the program available in 2003, computing the costs in that year but assuming the same expected benefits associated to the 1992-cohort.[4]

We computed the cost of attendance per child in 1992 using the federal appropriation and the number of enrolled children obtained from the Head Start Fact Sheets. These figures were $1,439,903,924 for the former and 621,078 for the later. We then discount the annual cost of attendance at age four to age 0 (using an interest rate of 4%). Since by expanding eligibility cutoffs $1 boys will be 21% more likely to participate, the expected cost of participation is $416.

Concerning the potential benefits, we start by focusing on health. We showed that Head Start is associated with improvements in mental health among adolescents, a reduction in the incidence of a chronic condition that requires the use of special equipment (a brace, crutches, a wheelchair, special shoes, a helmet, a special bed, a breathing mask, an air filter, or a catheter), and a reduction in the probability of being overweight. We provide an estimate for the lower bound of the benefits associated with an improvement in health conditions, by considering only the savings associated with reduction in obesity (for which we can get more reliable figures).

Childhood and adolescence obesity increases the risk of developing diseases such as high cholesterol, hypertension, respiratory ailments, orthopedic problems, depression, and type 2 diabetes. The cost of obesity is estimated to be US$2741 per year by Cawley and Meyerhoefer, 2012 (their calculations use 2005 USD, which is equivalent to US$3011 in 2009 USD). We assume an equal cost across all obese individuals. Since obese adolescents have 70 percent chance of becoming overweight or obese adults[5] we also estimate the present value of costs for a child who is obese throughout adolescence and young adulthood, in particular between ages 13 and 30. Therefore, even if we exclude the days lost of work and college due to conditions related to obesity, the discounted value of direct health expenses with diseases associated to obesity between the ages of 13 and 30 adds up to $23,808 (see Panel "Alternative 1" of Table E.1). Using the more conservative measure presented in the previous paragraph, the present value of savings associated with a reduced probability of being obese at just age 13 adds up to $1808 (see Panel "Alternative 2" of Table E.1).

To compute the savings associated to reduction in criminality we use the direct expendi-

[4] All monetary values are measured in 2009 dollars.

[5] See http://aspe.hhs.gov/health/reports/child_obesity. Access on January 3, 2012.

tures in criminal justice for 2007, which are part of *Justice Expenditure and Employment Statistical Extracts for 2007*.[6] We use the direct expenditures per year for criminal corrections, which include correctional supervision (adults supervised in the community on probation or parole and those incarcerated in state or federal prisons and local jails). The total expenditure in correctional supervision adds up to 72 billion dollars (in 2009 USD). This figure ignores direct judicial and police expenditures, which together with correctional supervision add up to $219 billion dollars.[7] Note that we obtain the savings associated with reduction in criminal activity in just one year, in which the individual is taken to be at 20 years old.

To obtain the cost per criminal offence we use the total number of offenders supervised by correctional authorities in 2007: 7,267,500 offenders. The average cost by offender including only the costs associated with supervision is about $9,867 per year ($4,683 after discount to age 0 - see Panel "Alternative 2"). If we also include court and policy costs, then the average annual cost per offender reaches $30,269 ($14,364 after discounted for age 0). The marginal individual due to expanding eligibility by $1 is 11% less likely to have been sentenced of any criminal charge by age 20, therefore the expected saving in justice functions due to reduced criminal activity ranges between $515 and $1580, depending on whether we use a narrower or wider definition of expenditures.

The net benefits of the policy are present in Table E.1. Even conservative cost-benefit calculation shows that expanding Head Start is cost effective. If one considers only the static returns on health (the reduction on the health costs associated with childhood obesity at age 13), relaxing the eligibility thresholds implies that the marginal child by age 13 will be 10% less likely to be obese, which represents an expected saving of $181. By age 20 she will be 11% less likely to be under correctional supervision, and the expected discounted saving adds up to $515. Thus, the program reaches the break-even point, even without accounting for its benefits on mental health, reduction in probability of presenting a chronic condition, and future days lost of work due to worse health (the present value of net savings add up to $280). These calculations are presented in Panel "Alternative 2". When we account for the savings associated with (1) improvement in health through reducing the likelihood of obesity during adolescence and early adulthood and (2) for a broader measure of criminal expenses, which includes court and police protection costs, the present value of net savings associated to expanding eligibility to Head Start reaches $3545 (see Panel "Alternative 1" in table E.1). These calculations suggest that the internal rate of return of the program is at least 4%.

The current version of Head Start costs about three times more per child than the version available in 1992 (see column for FY2003). Assuming that the pattern of benefits does not vary across the 1992 and the 2003 cohorts, the net benefits associated with Head Start through expanded eligibility add up to $2832 under the broader definition of benefits (Panel "Alternative 1"). Under the more strict definition included in Panel "Alternative 2" the net

[6]This is a national level data set from which we obtain disaggregated expenditures according to different activities, thus we assume uniform costs across all types of criminal activities and locations. We choose to measure expenses associated with criminal activity in 2007 because we are interested in the analysis for the cohort of children born in 1988, who are 20 years old in 2008, and there is no data available for 2008.

[7]Our figures number ignore victims costs, which are accounted in the cost-benefit analysis of Perry Preschool Program performed in Heckman et al. (2009).

benefits are negative and add up to $433.

References

[1] Cawley J and Meyerhoefer C., 2012, "The medical care costs of obesity: an instrumental variables approach", Journal of Health Economics, 2012, 31:219-30.

Table E.1: Cost-benefit analysis.

	FY 1992	FY 2003
COSTS		
Total appropriation	1,439,903,924	5,718,484,287
Nb children	621,078	909,608
Cost per child	2,318	6,287
Annual cost of attendance at age 4 (discounted for age 0, interest rate = 4%)	1981.77	5373.95
BENEFITS - Alternative 1		
1) CRIME		
Total cost of corrections in 2007 (see JEEE, 2007)	219,930,610,736	
Adults under correctional supervision 2007 (see BJS, 2010)	7,267,500	
Cost/correction	30,262	
Cost at age 20 discounted for age 0 (interest rate = 4%)	14,364	
2) OBESITY		
Per Capita Cost (Cawley and Meyerhoeferd, 2012)	3,011	
Direct costs of obesity between ages 13-30 (discounted for age 0)	23,808	
NET SAVINGS		
11% less likely to be sentenced at age 20-21	1580.01	
10% less likely to be obese at 13-30	2380.79	
21% more likely to participate in HS	416.17	1128.53
Total savings (benefits - cost)	3544.62	2832.27
BENEFITS - Alternative 2		
1) CRIME		
Total cost of corrections in 2007 (see JEEE, 2007)	71,709,452,250	
Adults under correctional supervision 2007 (see BJS, 2010)	7,267,500	
Cost/correction	9867.14	
Cost at age 20 discounted for age 0 (interest rate = 4%)	4683.36	
2) OBESITY		
Per Capita Cost (Cawley and Meyerhoeferd, 2012)	3,011	
Cost at age 13 discounted for age 0 (interest rate = 4%)	1,808	
NET SAVINGS		
11% less likely to be sentenced at age 20-21	515.17	
10% less likely to be obese at 12-13	180.83	
21% more likely to participate in HS	416.17	1128.53
Total savings (benefits - cost)	279.83	-432.53

Note: All monetary values are in 2009 dollars. Values discounted to age 0 are calculated using an interest rate of 4%. Costs related to criminal activity are obtained from the Justice Expenditure and Employment Extracts for 2007. The figures for "total justice system" include the costs with police protection, judicial and legal expenses and corrections. The number of adults under correctional supervision is obtained from U.S. Department of Justice, 2010.

F Eligibility to Head Start

According to the Head Start Act, Sec. 645(a)(2)(A) "children from low-income families shall be eligible for participation in programs assisted under this subchapter (*Head Start*) if their families' incomes are below the poverty line, or if their families are eligible or, in the absence of child care, would potentially be eligible for public assistance"[8]. Alternatively, grantees may enroll up to 10% of children from "over-income" families.[9] See table B.1 in Appendix B for a summary of Head Start's legislation since the program was launched in 1965. The eligibility criteria have been unchanged throughout the period of analysis (See www.eric.ed.gov and Zigler and Valentine, 1979.)

A low-income family is a family whose income before taxes is below the poverty line or a family that is receiving public assistance, even if the family's income exceeds the poverty line. The U.S. Department of Health and Human Services considers public assistance as AFDC/TANF and SSI (see 45 CFR Part 1305.2). In section II of the main text we explain why we did not impute SSI eligibility.

The income period of time to be considered for eligibility is the 12 months immediately preceding the month in which application or reapplication for enrollment of a child in a Head Start program is made, or the calendar year immediately preceding the calendar year in which the application or reapplication is made. We use income from the last calendar year since it is the income measure available in NLSY79.

The relevant income measure includes (1) money wages or salary before deductions; (2) net income from self-employment; (3) payments from Social Security or railroad retirement; (4) unemployment compensation, strike benefits, workers' compensation, veterans benefits, public assistance (AFDC/TANF, SSI, Emergency Assistance money payments, and non-Federally funded General Assistance or General Relief money payments); (5) training stipends; (6) alimony, child support, and military family allotments or other regular support from an absent family member or someone not living in the household; (7) private pensions, government employee pensions, and regular insurance or annuity payments; (8) college or university scholarships, grants, fellowships, and assistantships; (9) dividends, interest, net rental income, net royalties, and periodic receipts from estates or trusts; (10) net gambling or lottery winnings. Relatively to this definition, the main measure of income used throughout the paper includes Food Stamps.

Income does not include capital gains; any assets drawn down as withdrawals from a bank, the sale of property, a house or a car; or tax refunds, gifts, loans, lump-sum inheritances, one-time insurance payments, or compensation for injury. Also excluded are non-cash benefits, such as the employer-paid or union-paid portion of health insurance or other employee fringe benefits; food or housing received in lieu of wages; the value of food and fuel produced and consumed on farms; the imputed value of rent from owner-occupied non-

[8]See Title VI, Subtitle A, Chapter 8, Subchapter B, of the Omnibus Budget Reconciliation Act of 1981, Public Law 97-35 (42 USC 9840) and its amends (http://www.law.cornell.edu/uscode/html/uscode42/usc_sec_42_00009840—-000-.html).

[9]Indian Tribes meeting the conditions specified in 45 CFR 1305.4(b)(3) are excepted from this limitation (see 45 CRF Part 1305 - source 57 FR 46725, Oct. 9, 1992, as amended at 61 FR 57226, Nov. 5, 1996).

farm or farm housing; and such Federal non-cash benefit programs as Medicare, Medicaid, food stamps, school lunches, and housing assistance, and certain disability payments made to disabled children of Vietnam veterans as prescribed by the Secretary of Veterans Affairs.[10]

The Department of Health and Human Services considers that the income period of time to be considered for eligibility is the 12 months immediately preceding the month in which application or reapplication for enrollment of a child in a Head Start program is made, or the calendar year immediately preceding the calendar year in which the application or reapplication is made, whichever more accurately reflects the family's current needs. We use income from last calendar year because it is the income measure available in NLSY79. As of our knowledge D.H.H.S. does not issue any specific definition of "family unity" and therefore we use NLSY79's definition.

To check the veracity of declared income, centers are required to verify the following proofs: Individual Income Tax Form 1040, W-2 forms, pay stubs, pay envelopes, written statements from employers, or documentation showing current status as recipients of public assistance, and should keep a signed statement by an employee identifying which of these documents was examined and stating that the child is eligible to participate in the program. Some centers do not keep an accurate register.

Given that there are two routes of eligibility to Head Start for each child we perform two separate comparisons (the child is eligible if she is in a poor family or if she is in an AFDC/TANF eligible family):

1. Impute child's poverty status: the child is in a poor family if the annual family gross income is below or equal to the Federal Poverty Guideline for each year of data available.

2. Impute child's family AFDC/TANF eligibility. See "AFDC Eligibility Requirements" below for a detailed description.

To obtain the maximum level of income that would allow Head Start eligibility we perform several comparisons:

1. If the child's family does not verify the categorical requirements to be entitled to AFDC/TANF, the maximum gross income that would have allowed Head Start eligibility is the Federal Poverty Guideline.

2. If the child's family is categorically eligible to AFDC/TANF, several scenarios may emerge:

   (a) if the family is not receiving income from AFDC, or if this information is missing, then two income tests must be verified in order to become AFDC income eligible:

[10] See http://eclkc.ohs.acf.hhs.gov/hslc for the Head Start Program Definition of income and Federal Poverty Guidelines.

i. if the *gross income test* is not valid, the maximum level of income that would allow Head Start eligibility is

$$MAX(m \times 12 \times Need\ Standard, Federal\ Poverty\ Guideline)$$

where m is 1.5 for the years of 1982, 1983 and 1984, and 1.85 from then onwards. We use the Need Standard in the state of residence and year at age four and the Federal Poverty Guideline of the year in which the child turned four years old.

ii. if *the gross income test* is verified, then the relevant cutoff point will be given by

$$MAX(MIN(m \times 12 \times NS, 12 \times NS + Annual\ Deductions), Federal\ Poverty\ Guideline)$$

where NS is the Need Standard in the state of residence at age four.

(b) since 1982, if the family is currently receiving income from AFDC/TANF only *the gross income test* is performed and the maximum level of income above which the family no longer is income eligible is given by

$$MAX(m \times 12 \times Need\ Standard, Federal\ Poverty\ Guideline)$$

(c) the gross income test had not been implemented as of 1979, 1980 and 1981, and the cutoff is given by

$$MAX(12 \times NS + Annual\ Deductions, Federal\ Poverty\ Guideline).$$

AFDC Eligibility Requirements[11]

Eligibility for AFDC requires that household contains at least one child less than eighteen years old, and has sufficiently low income and assets levels. Additionally, children in two-parents families may be eligible to AFDC-UP (Unemployed Parent), which requires that parents satisfy a work history requirement and work less than 100 hours per month while on welfare (the Family Support Act of 1988 mandates that states set up AFDC-UP programs, but it allows states to limit benefits to six months per year). There are two income tests that an applicant family must pass in order to become AFDC income eligible (U.S. Congress, 1994):

- the gross income test: a gross income limit for AFDC eligibility of 150 percent of the state's standard was imposed by The Omnibus Reconciliation Act (OBRA) of 1981, and raised to 185 percent by The Deficit Reduction Act of 1984;

[11] See Hoynes, 1996, for a description of AFDC eligibility rules.

- the countable income test: it requires that family income after some disregards must be less than the state's need standard. The countable income is the gross income subtracted of work related expenses, child care expenses, child support disregards up to a maximum.[12]

Eligibility is re-assessed annually, and for those who are already recipients of AFDC/TANF only the first income test is required. To impute the threshold for AFDC/TANF income eligibility for each child we merge the need standard, child support disregards, child care expenses and work related expenses information with the child-level data from the CNLSY by state of residence and family size for each year.

Federal AFDC law requires that all income received by an AFDC recipient or applicant must be counted against the AFDC grant except that income explicitly excluded by definition or deduction. The disregards can be computed as follows. Prior to 1981 there was no allowance for work related expenses and child care expenses were capped at 160 dollars per month. The OBRA of 1981 continued to cap the deduction for child care costs at 160 dollars per month and set the work incentive disregard for work expenses at 75 dollars per month. These allowances were increased by the Family Support Act of 1988 that raised work expenses disregards to 90 dollars per month and the child care expenses to 200 dollars per each child under two years old and 175 dollars for month per each child two years or older. This was effective from October 1, 1989, but as our income values are annual we used it from 1990 onwards. In 1996, work related expenses were subsequently raised to 100 dollars, 200 dollars in 1997 and 250 dollars per month since 1998. Between 1997 and 1999, child care expenses were set at 200 dollars per each child either she was under or older than two years old. Additionally, the Deficit Reduction Act of 1984 established a monthly disregard of 50 dollars of child support received by family, that is valid from 1985 (inclusive) onwards. As the last age in which we impute program eligibility is 7 years old and the youngest child in our sample was born in 1996, 2003 is the last year in which eligibility status should be imputed.[13]

Since NLSY79 does not contain systematic collection of child care and work related expenses we assume that families fully deduct the full disregard of child care expenses for all children under 6 years old and no disregard for older children (as is imposed by AFDC requirements), and deduct the full amount of work related expenses if the mother or her spouse is working.

Need standard, work related expenses, child care expenses and child support disregards are defined in monthly levels but we convert them into annual values to be comparable with the annual gross income measure available in the NLSY79.

Treatment of Earned Income Tax Credit (EITC) has changed over time. Prior to 1981, EITC was counted only when received, however the OBRA of 1981 requires to assume that working AFDC recipients received a monthly EITC if they appeared eligible for it and

[12]Details on all state-specific values can be found in the Welfare Rules Database of the Urban Institute.

[13]NLSY79 and CNLSY surveys were not conducted in odd years after 1994, and income, family size, child's mother cohabiting status and state of residence were not imputed for these years.

regardless of when or if the credit was actually available. The 1984 legislation returned to prior law policy with respect to the EITC: it was to be counted only when actually received. The Family Support Act of 1988 required to disregard the EITC in determining eligibility for and benefits under the AFDC program. As EITC information in NLSY79 started to be recovered with the 2000 wave we ignore the EITC in our analysis.

Our treatment of the data regarding stepparent's or mother's partner income was as follows. The OBRA of 1981 required that a portion of the stepparent income to count as part of the income, however, as NLSY79 total income does not include mother's partner income, we do not include it in the definition of income, but as long as child's mother is married, her husband's income is included in the definition of family income (regardless of whether she is married or not with the child's natural father). Also, if mother is cohabiting, her partner will not be included in the family size variable.

When determining AFDC/TANF eligibility we took into account the program categorical requirements with respect to the family structure. Eligibility under the traditional AFDC program requires that a child resides in a female-headed household, which we considered as a family where a father-figure is missing. However, children in two-parents households may still be eligible under the AFDC-Unemployed Parent program in those states in which the program is available[14]. Eligibility for AFDC-UP is limited to those families in which the principal wage earner is unemployed but has a history of work. We consider that the principal wage earner has a "history of work" if the the father (or step-father) worked on average less than 100 hours per month in the previous calendar year. [15] We do not perform the assets test required by AFDC, as information on assets is only available after 1985 in NLSY79.

References

[1] Hoynes, H., 1996, Welfare transfers in two-parents families: labor supply and welfare particcipation under AFDC-UP, *Econometrica*, vol.64(2), March 1996, 295-332.

[2] Zigler, E., and Valentine, J. (Eds.). Project Head Start: A Legacy of the War on Poverty. New York: The Free Press/Macmillan, 1979.

[14] In 1988, the Family Support Act required all States, effective October 1, 1990, to provide AFDC-UP (except American Samoa, Puerto Rico, Guam, and the Virgin Islands until funding ceilings for AFDC benefits in these areas are removed). The two-parent program reverted to optional status for all States after September 30, 1998.

[15] Since 1971, Federal regulations have specified that an AFDC parent must work fewer than 100 hours in a month to be classified as unemployed, unless hours are of a temporary nature for intermittent work and the individual met the 100-hour rule in the two preceding months and is expected to meet it the following month. See U.S. Congress, 1994, for the specific requirements.

G Heterogenous Effects

Figure G.1 displays the range of income cutoffs and family size in our data over which we are able to identify the effects of Head Start. This figure shows that relatively to the standard regression discontinuity, we can exploit additional variation. This "continuum of discontinuities" allows us to go beyond the traditional regression discontinuity design and identify treatment effects for individuals over a wide range of values for income and family size (the two main running variables). Black, Galdo and Smith (2005) also recognize the potential of multiple discontinuities to identify heterogeneous effects of the program. Figure G.1 also includes the number of children per family size and intervals of income cutoffs of $571. This figure shows that β in equation (3) is a weighted average of effects for children around different cutoffs, where the largest weights correspond to children living in families with 2 to 6 members and with cutoffs varying between $US10,000-20,000.

Therefore, we also consider models where β varies explicitly across individuals:

$$Y_i = \alpha + \beta_i HS_i + g(Z_i, X_i) + \varepsilon_i. \tag{1}$$

We implement this estimator as follows. In our case, the income cutoffs vary mainly with family size (besides state, year and mother's marital status), so there is a threshold for $\bar{Z}_f$ for each family size f. Therefore, it is possible to estimate effect of the program around each cutoff $\bar{Z}_f, f = \{2, ..., 15\}$, that is,

$$E\left(\beta_f | HS\left(\bar{Z}_f - \delta\right) - HS\left(\bar{Z}_f + \delta\right) = 1, Z_i = \bar{Z}_f\right).$$

The effect estimated under homogeneous effects is a weighted average of the effect around each threshold

$$\beta = \sum_{f=2}^{15} \frac{\beta_f 1\left[\left|Z_{if} - \bar{Z}_f\right| \leq h\right]}{\sum_{f=2}^{15} 1\left[\left|Z_{if} - \bar{Z}_f\right| \leq h\right]}$$

where h is the bandwidth to trim the sample around each cutoff. Therefore, we recover β_f by estimating the following model:

$$Y_i = \alpha + h^*(Z_i, X_i) \times E_i + g(Z_i, X_i) + \varepsilon_i \tag{2}$$

For simplicity, we model $h^*(Z_i, X_i)$ as:

$$h^*(Z_i, X_i) = \beta_0 + \beta_1 \ln Y_{4i} + \beta_2 (\ln Y_{4i})^2 + \beta_3 (\ln Y_{4i})^3 + \beta_4 FS_{4i} + \beta_5 {FS_{4i}}^2 + \beta_6 {FS_{4i}}^3 + \beta_7 \ln Y_{4i} FS_{4i}$$

where Y_{4i} is child's family income at age 4 and FS_{4i} is the family size. Potentially we would like to estimate $h^*(Z_i, X_i)$ using a more flexible specification, but our sample size forces us to be parsimonious. Even with such parsimonious specification our estimates of this function in the Section IV are quite imprecise, and results should be seen as suggestive and illustrative of the potential of this approach. We report estimates of $\beta_j, j = 0, ..., 7$, as well as estimates of the average partial effect of Head Start. We also display graphical representations of $h^*(Z_i, X_i)$.

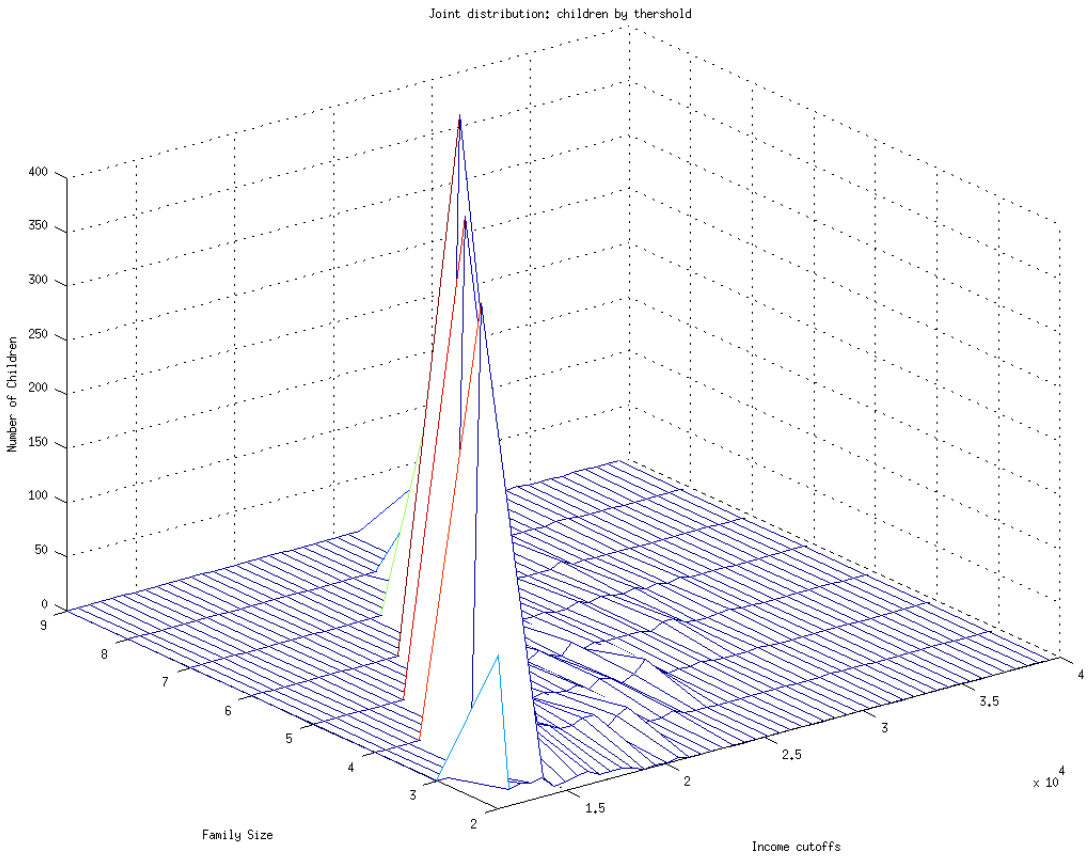


Figure G.1: Density of children around each threshold.

Note: Only children whose family income is at most twice the relevant threshold at age four are included. The sample used is further restricted to children living in families with at most nine members and with a cutoff at most of $40,000.

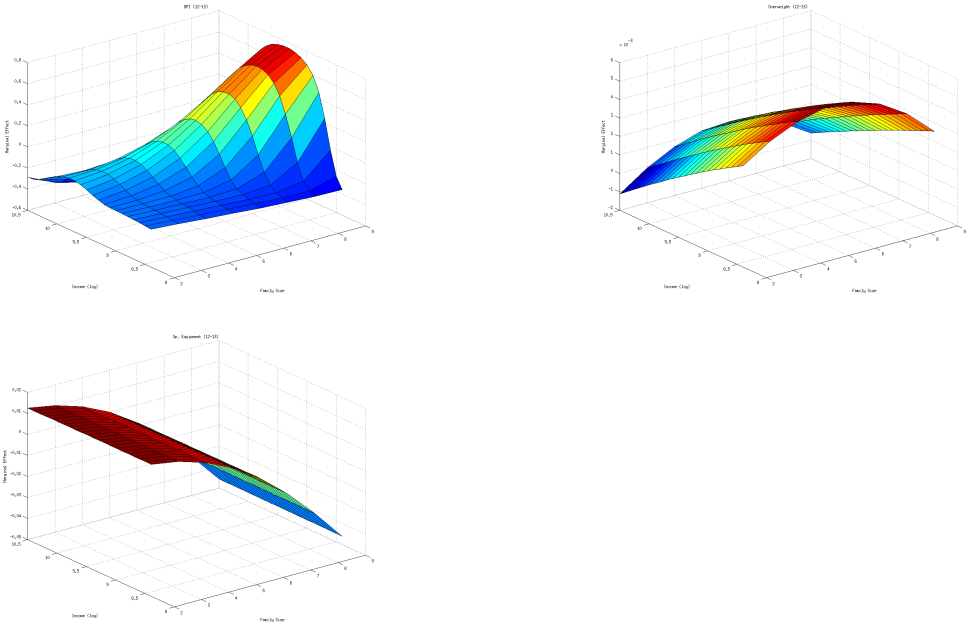


Figure G.2: Ages 12-13.

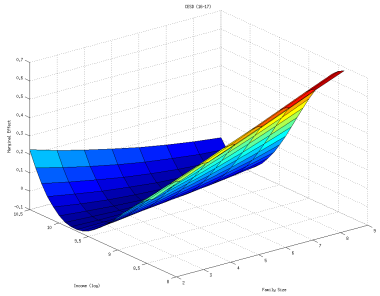


Figure G.3: Ages 16-17