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The Long-Term Impact of Head Start on Smoking

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Abstract

Head Start is a comprehensive, early childhood development program designed to augment the human capital and health capital levels of disadvantaged children. Evaluations of Head Start have tended to focus on cognitive outcomes; however, there is increasing recognition that other important outcomes can be influenced by participation. This paper evaluates the long-term impact of Head Start participation on smoking behavior in young adulthood by comparing the behavior of adults who attended Head Start with those of siblings who did not. We find that participation in Head Start reduces the probability that an individual smokes cigarettes as a young adult.

JEL Classification: I12, I38, I28

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I. INTRODUCTION

There is strong evidence that early childhood socioeconomic conditions have long-term economic consequences, reinforcing and sustaining disparities over the lifecourse.[1] This observation provides a compelling rationale for public investments targeted towards disadvantaged children to expand opportunities and break the cycle of poverty. Head Start is the principal federally-funded program through which the United States invests directly in the human capital of disadvantaged preschool children. Since its inception in 1965 as part of President Lyndon Johnson's "War on Poverty," Head Start has provided services to more than 23 million preschool children; in 2005 there were over 900,000 children enrolled in the program at a total cost of $6.8 billion (Office of Head Start, 2006a). To achieve its overall goal of increasing the school readiness of participants, Head Start provides a comprehensive set of services including education, health, nutritional, and social services to participants and their families. Research has shown that Head Start has positive impacts on participants' human capital, both in childhood and adulthood.[2]

In recent years, questions have arisen about the relative effectiveness of Head Start and whether it should be continued in its present form (U.S. Department of Health and Human Services, 2003). Much of the debate has centered on the magnitude and persistence of the cognitive achievements of Head Start participants. However, given the link between education and health,[3] and the comprehensive nature of Head Start (with substantial health components), one could reasonably expect it to have a favorable impact on participants' health as well as education. If significant health effects were found to persist into adulthood, this in itself could

[1] See, for example, Haveman and Wolfe (1995) and Hayward and Gorman (2004).
[2] See Currie and Thomas (1995), Garces, Thomas, and Currie (2002), and the references provided in the next section.
[3] See, for example, Grossman and Kaestner (1997) and Cutler and Lleras-Muney (2006).

alter the evaluation of Head Start and have important implications for the associated policy debate.

Smoking is the leading preventable cause of mortality in the United States (Mokdad et al., 2004). It is linked to an extensive list of diseases (Chaloupka and Warner, 2000) and imposes large economic costs on society (Center for Disease Control and Prevention, 2002). Tobacco use generally begins before individuals graduate high school and, as an addictive behavior, youth smoking is linked to adult smoking (U.S. Department of Health and Human Services, 1994). Adolescents from low socioeconomic status households with low academic achievement are more likely to use tobacco products (U.S. Department of Health and Human Services, 1994). Thus, comprehensive development programs targeted towards disadvantaged youths that are designed to improve child outcomes have the potential to influence smoking, improve health over the lifecourse, and reduce the social costs from smoking. Suggestive evidence that Head Start might influence the smoking behavior of participants comes from evaluations of other preschool programs that targeted low-income children. Participants in both the Carolina Abecedarian preschool program and the High/Scope Perry Preschool Program were much less likely to smoke as adults (Barnett and Masse, 2007; Belfield et al., 2006).

In this paper, we assess the impact of Head Start participation on adult smoking behavior using data from the Panel Study of Income Dynamics and its supplements on early childhood education and health. We examine the cohort of adults (above age 21 in 1999) whose age is low enough to have potentially participated in a Head Start program. Following Currie and Thomas (1995) and Garces, Thomas, and Currie (2002), we employ a sibling-based model to control for unobservable family characteristics that may affect smoking or the decision to participate in Head Start.

Our results show that Head Start participation significantly influences smoking-related behavior. We estimate that if Head Start participants had not enrolled in the program, these individuals would be approximately 20 percentage points more likely to smoke cigarettes beyond age 25. The magnitude of the impact of Head Start participation is considerable and similar to the impact from the randomized evaluations of the Perry Preschool and Carolina Abecedarian early childhood development programs that target similar populations. Based on these results, Head Start participation may yield significant improvements in health over the lifecourse through its impact on smoking behavior. These results have relevance for the policy debate surrounding Head Start; they suggest that public investment in disadvantaged children can have a lasting impact. We provide the first systematic evidence in the literature that Head Start participation is associated with improvement in adult health outcomes.

II. BACKGROUND

Head Start is a comprehensive, national, federally-funded program that provides early childhood developmental services to disadvantaged children and their families. Federal guidelines state that at least 90 percent of the children enrolled in each of the Head Start centers must be from families whose total annual income before taxes is less than or equal to the poverty line and at least 10 percent of the participants must be children with disabilities (Office of Head Start, 2006b). Of the 906,993 children enrolled in the 19,800 centers throughout the country in 2005, 52 percent were 4 years old and 34 percent were 3 years old (Office of Head Start, 2006a). Thirty five percent of Head Start children in 2005 were white and 31 percent were black. Thirty three percent of children also classified their ethnicity as Hispanic (Office of Head Start, 2006a).

In light of the overall focus of the Head Start program on improving school readiness, most evaluations of the program assessed the impact of Head Start on test scores or other measures of educational success. Head Start participation is generally believed to be associated with short-term cognitive benefits; however, researchers have also found that after a few years, these benefits begin to fade (McKey et al., 1985; Lee, Brooks-Gunn, and Schnur, 1988; Lee et al., 1990; Aughinbaugh, 2001). On the other hand, Head Start participation leads to sizeable increases in educational attainment. White Head Start participants are 40 percentage points less likely to repeat a grade in school (Currie and Thomas, 1995), 22 percentage points more likely to graduate high school (Garces, Thomas, and Currie, 2002), and 19 percentage points more likely to attend college (Garces, Thomas, and Currie, 2002). Additionally, Ludwig and Miller (2007) provide evidence that Head Start participation increases the educational attainment of both white and black participants.

Recent evidence from the randomized evaluation of Head Start demonstrates that Head Start participation increases cognitive abilities in reading, writing, literacy, and vocabulary (U.S. Department of Health and Human Services, 2005). The magnitude of the estimated impacts has led to calls for greater emphasis in the program on literacy and increasing cognitive achievement (Besharov, 2005).[4]

Increasing the cognitive achievement of the disadvantaged children in the Head Start program is clearly an important goal. However, because of the comprehensive services provided in the program, greater cognitive ability is likely to be only one of many outcomes. Considering the importance of early childhood conditions on social and economic outcomes, early childhood

[4] However, Ludwig and Phillips (2007) emphasize that the estimates from the Head Start Impact Study are intent to treat effects, not estimates of the treatment effect on the treated. Additionally, Ludwig and Phillips (2007) suggest that the expected benefits based on the short-term experimental estimates from the Head Start Impact Study are likely to exceed the costs of the program.

investment programs such as Head Start have the potential to substantially improve broader indicators of social welfare. To understand the value of the Head Start program to society, it is necessary to assess the lasting impact of the program on a wide array of outcomes.[5]

Previous research has demonstrated that Head Start participation results in positive short-term health benefits for children in terms of general physical health, motor skills, and nutrition (McKey et al., 1985). Head Start participants are more likely to receive age-appropriate health screenings or dental examinations (Hale, Seitz, and Zigler, 1990) and be immunized for the measles (Currie and Thomas, 1995). Additionally, Head Start participants are less likely to be obese in later childhood (Frisvold, 2007). Head Start participation has also led to a substantial decline in child mortality rates (Ludwig and Miller, 2007).

In this paper, we analyze the impact of Head Start participation on adult smoking. Head Start may influence smoking behavior for a variety of reasons. As discussed by Heckman and Masterov (2007), non-cognitive skills during childhood are important predictors of a variety of adult outcomes, including smoking. Enhancing the non-cognitive skills or social development of participants is a key component of the mission of the Head Start program. Thus, one potential mechanism is that Head Start participation may influence non-cognitive outcomes that are associated with smoking. For example, Head Start participation reduces hyperactive behavior and behavior problems (U.S. Department of Health and Human Services, 2005). Hyperactivity is related to youth smoking (Milberger et al., 1997), and behavior problems are associated with smoking initiation and persistence (Griesler, Kandel, and Davies, 2002). Head Start may influence individual's preferences for the future, self-image, self-esteem, confidence, and impulse control, as well as peer group formation – all of which are related to smoking use (U.S. Department of Health and Human Services, 1994).

[5] For a review of the costs and benefits of Head Start, see Ludwig and Phillips (2007).

Another potential mechanism is that Head Start participation may influence smoking as a result of increases in educational attainment (Garces, Thomas, and Currie, 2002). More educated individuals make better decisions about their health and are less likely to engage in behaviors that reduce their health. In particular, education has a negative influence on the likelihood that an adult smokes (Kenkel, 1991; Sander, 1995; Kabat and Wynder, 1987; Gilleskie and Harrison, 1998).

More directly, Head Start educates children and parents about the health consequences of smoking and increases in health knowledge reduce smoking (Hsieh et al., 1996). Sixty-two percent of Head Start health coordinators report discussing the consequences of tobacco use with children and 78 percent of Head Start parents continue this discussion at home with their children (Keane et al., 1996). The health education in Head Start may directly influence participants' behavior and indirectly influence children by influencing parents' behavior. Not only might parents of Head Start children who smoke quit, but parents are also likely to reinforce positive health behaviors with their children. Parenting behavior towards smoking has a significant influence on youth smoking, and parents' smoking status is strongly related to children's smoking behavior (Powell and Chaloupka, 2005).

III. ESTIMATION STRATEGY

The ideal design for evaluating the effect of Head Start participation on smoking would begin with a random assignment of children to a treatment group that attends Head Start and a control group that does not attend any form of preschool. The behavior of individuals would then be monitored over time, and the observed difference in smoking behavior across the two groups would provide an estimate of the impact of attending Head Start. However, in the

absence of such a randomized experiment, we analyze existing survey data and attempt to account for several important deviations from this ideal.[6]

Observable characteristics of families that are associated with the selection of participants into Head Start could also be associated with smoking behavior. For example, Harrell et al. (1998) find that children in low socioeconomic status families are more likely to begin smoking. To allow for the options that individuals attend Head Start, other forms of preschool, or no preschool, the relationship between Head Start and smoking controlling for individual and family background characteristics during the preschool years can be modeled as:

$$S_i = \beta_0 + \beta_1 HS_i + \beta_2 PS_i + \beta_3 X_i + \eta_i, \quad (1)$$

where S_i represents the current smoking status of individual i, HS and PS are indicator variables for participation in Head Start or other preschool programs, X includes exogenous family background and individual characteristics, and η is random error. The coefficient β_1 is the marginal impact of attending Head Start, β_2 is the impact of attending other preschool programs, and β_3 is the impact of childhood conditions on health behavior.

Unobservable characteristics of families that influence smoking may be correlated with Head Start attendance. Over 890,000 parents volunteer in Head Start (Office of Head Start, 2006a); these parents may choose to make other investments in their child that could positively influence behavior. Failure to account for such unobserved variables could lead to an overestimate of the impact of Head Start participation.

Alternatively, the most disadvantaged of eligible applicants are selected for Head Start by the program administrators. Head Start programs are required by federal guidelines to establish

[6] In the fall of 2002, as part of the congressionally-mandated evaluation of Head Start, Head Start eligible children were randomly assigned into Head Start or a non-Head Start control group (U.S. Department of Health and Human Services, 2005). These children will not be evaluated into adulthood. The Head Start Impact Study will allow for the estimation of the short-term benefits of Head Start participation in a randomized setting, but not the long-term benefits.

a formal selection mechanism to determine which eligible children are admitted, and children with the greatest need for Head Start services are required to be chosen by program administrators (Office of Head Start, 2006b).[7] Thus, children in families with incomes farthest below the poverty line are most likely to be chosen to enroll in the program. Also, children in high risk families are preferentially admitted into the program. Although high risk may be defined differently across programs, this category can include children in families with substance abuse or domestic violence; children in families afflicted by a crisis such as death, separation, terminal illness, or chronic health issues; children referred into Head Start by a community agency; or other special circumstances. Based on the Head Start selection criteria, Head Start participants are disadvantaged according to characteristics that are likely to be unobserved, especially family characteristics. Felitti et al. (1998) demonstrate that children raised in dysfunctional households characterized by abuse are more likely to smoke. The failure to control for unobserved characteristics related to Head Start attendance that are also determinants of smoking will lead to an underestimate of the impact of Head Start participation.

Following established methodology by Currie and Thomas (1995) and Garces, Thomas, and Currie (2002), we compare sibling outcomes to determine the effects of Head Start participation. We restrict the sample to individuals with at least one sibling and include a family-specific fixed effect. The fixed effect controls for fixed unobservable family characteristics that affect individuals' smoking decisions and are correlated with the decision to participate in Head Start. The smoking behavior of an individual is estimated as:

$$S_{if} = \delta_0 + \delta_1 HS_{if} + \delta_2 PS_{if} + \delta_3 X_{if} + \phi_f + \nu_{if}, \quad (2)$$

[7] Programs are also required to obtain more applications than the anticipated number of enrollment opportunities so that program administrators are able to choose those children with the greatest need for Head Start services from the eligible applicants to enroll (Office of Head Start, 2006b).

where S_{if} is now a measure of smoking for individual i in family f, while ϕ is the mother-specific fixed effect and ν is random error. The coefficient δ_1 is the marginal impact of Head Start, δ_2 is the impact of other preschool programs, and δ_3 is the impact of childhood conditions on smoking behavior.

Equation (2) determines the impact of Head Start participation by comparing the smoking status of siblings who attended Head Start to the behavior of siblings who did not attend any form of preschool. The identifying assumption is that the underlying reasons that some siblings attended Head Start and others did not are uncorrelated with smoking. Thus, to assess the validity of this empirical strategy, it is important to consider why siblings differ in their attendance in the Head Start program.

One reason that the early childhood experiences of siblings might differ is that differences in family income or size could mean that some siblings are eligible for Head Start during the preschool years while others are not. Therefore, we control for the family background characteristics that are specific to each child during the ages in which children are eligible for Head Start.

If the unobserved household characteristics that are related to selection into Head Start are constant across siblings, then δ_1 is a consistent estimate of the impact of Head Start participation. However, it is possible that parents decide whether their children will attend Head Start based on characteristics that are related to future outcomes but are unobservable to researchers. For example, if parents choose to invest more in the health or human capital of a sibling with higher ability by sending that child to Head Start but not sending other siblings, then they may also choose to make other investments in that child that positively influence their behavior. As discussed by Currie and Thomas (1995), parental favoritism could result in

differential investments among siblings. The estimate of the impact of Head Start participation would be confounded by the unobserved family characteristics that influence early childhood experience and later adult behavior. Selection on unobservable characteristics is not likely to be restricted to Head Start attendance; similar parental decisions that lead to differences in Head Start participation among siblings are also likely to lead to differences in attendance in other preschools. In fact, Currie and Thomas (1995) suggest that other preschool children are more likely to benefit from favoritism than Head Start children. To assess the potential that differential parental investments lead to differences in Head Start participation, we compare the individual characteristics of siblings who attended Head Start to those who did not and examine differences in characteristics such as birth order that are related to parental investments (Price, 2006). Within our multivariate model, to reduce the bias from unobserved family characteristics that are not constant across siblings, we compare the effects of participation in Head Start to participation in other preschools ($\delta_1 - \delta_2$). The difference in coefficients is a consistent estimator of the effect of Head Start if parents view Head Start and other preschools of comparable quality. If parents think that other preschools are of higher quality than Head Start (U.S. Department of Health and Human Services, 2001) and send their preferred children to the other preschools, the difference estimate ($\delta_1 - \delta_2$) is likely to be a lower bound estimate of the impact of Head Start (Currie and Thomas, 1995).

Our estimation strategy is subject to additional limitations. First, although the fixed effects strategy is implemented to reduce the endogenous variation in Head Start participation, it also reduces the exogenous variation in participation (Griliches, 1979; Bound and Solon, 1999). Second, the fixed effects strategy exaggerates measurement error, which biases the estimates towards zero and contributes to the underestimation of the effect of Head Start participation.

Third, spillover benefits from Head Start participants to siblings could result in an underestimate of the effect of Head Start participation (Garces, Thomas, and Currie, 2002; Barnett and Hustedt, 2005). To explore the possibility of sibling spillovers from Head Start participation, we follow Garces, Thomas, and Currie (2002) and modify equation (3) to include an interaction term for Head Start participation and birth order and whether the child is the oldest sibling. We do not find evidence to support the possibility of sibling spillovers for smoking status.

Fourth, the fixed effects strategy might lead to an underestimate of the effect of Head Start participation because of compensating behaviors by parents to equalize outcomes among siblings (Barnett and Hustedt, 2005). Even if the reasons which lead parents to differentially send siblings to Head Start are exogenous, if parents seek to compensate the children who did not attend, then the resulting reduced-form estimates of the effect of Head Start may be less than the actual impact of the program. We do not find evidence to support this possibility; former Head Start participants and their siblings, for example, are equally likely to receive an inheritance from their caregivers. However, we cannot rule out the possibility that there are other unobservable parental investments that are designed to equalize sibling outcomes.

Finally, changes in mothers' smoking status due to Head Start participation are not likely to contribute to the estimated impact of Head Start in the fixed effects specification.[8] To explore the importance of mother's smoking behavior as a mechanism through which Head Start might influence smoking, we examine mothers' smoking status before and after the ages of Head Start eligibility. Mothers' smoking status by children's age is constructed from survey responses to current smoking status, age at initiation, and quitting age in the 1999 wave of the PSID. We find

[8] The mother-specific fixed effect in equation (3) also controls for fathers' characteristics if the siblings have the same father.

that mothers of Head Start children smoke less after their children attended Head Start than before; however the rate of decline is similar to the decline experienced by all mothers.[9] Thus, while children's Head Start attendance could influence mothers' smoking behavior, it does not appear that estimates based on sibling comparisons that ignore this potential mechanism underestimate the impact of Head Start participation.[10]

In summary, because of possible sibling spillovers, compensating behaviors by parents, measurement error, and negative selection into Head Start within families, we emphasize that our estimates of the impact of Head Start participation are potentially lower bound estimates of the treatment effect on the treated.

IV. DATA

Our research evaluates the impact of Head Start on smoking using data from the Panel Study of Income Dynamics (PSID). The PSID is a longitudinal study of U.S. households and individuals that began in 1968 with a national sample of approximately 4,800 households. Members of these households, their offspring, and current co-residents have been interviewed on an annual or biennial basis since the inception of the PSID.

Supplements to the PSID occasionally expand the information collected. In 1995, additional questions were asked of interviewees that related to early childhood education.[11] This included whether or not an individual attended Head Start or a preschool, nursery school, or day

[9] These results are shown in Appendix Table 1.
[10] Additionally, including whether mothers smoked prior to age 3 and whether mothers quit smoking during the preschool ages in equation (1) does not influence the results of the baseline specification shown in Table 2.
[11] Collecting information retrospectively about early childhood education experiences can lead to recall error. After comparing reported enrollment rates, racial composition, and family income from the PSID to the national Head Start data, Garces, Thomas, and Currie (2002) validate the quality of the data from the 1966 birth cohort onward. Data from the 1964-1965 birth cohorts are not as reliable because participation rates in the PSID are significantly lower than the national rates. However, their results (based on data from the 1966-1977 birth cohorts) are robust to the inclusion of the 1964-1965 birth cohorts (personal communication with Eliana Garces).

care center other than Head Start. In 1999, health-related questions were asked of adult members of the household, including whether or not the individual currently smokes cigarettes.[12] This question was repeated in 2003. The advantage of using the PSID for this analysis is that it brings together information on early childhood education and on adult smoking, along with other important socio-economic variables. One of the key questions arising in studies of this type is whether impacts found for a group of people at a given date might dissipate or disappear over time (Currie and Thomas, 1995). To address this concern we selected a cohort from the PSID whose birth years are late enough to be consistent with participation in Head Start (which occurs mainly during ages 3 and 4) and early enough to be an adult (which in the present study is taken to be over age 21) at the two dates the data on smoking behavior were gathered. We analyze the impact of Head Start on smoking for this cohort using the 1999 smoking data, and then follow up four years later to see whether the original findings are sustained.

The family background variables available in the PSID include the average total family income between ages 3 through 6[13], the mother's average years of formal schooling completed between ages 3 through 6, the average family size between ages 3 through 6, whether the father was present between ages 3 through 6, and disability status[14] during childhood. Controlling for family background throughout the period of early childhood education (ages 3 through 6), as opposed to capturing a snapshot of the family environment at the most common age of preschool attendance (age 4), minimizes measurement error, reduces missing data, and provides a more

[12] In their assessment of the quality of the smoking data in the PSID, Andreski et al. (2005) document that for both 1999 and 2003 the smoking rates in the PSID are comparable to those in the National Health Interview Survey.
[13] Total family income includes the taxable income and transfer income, which includes public assistance, of all household members. Taxable income includes labor, asset, rental, interest, and dividend income. Income is converted into 1999 or 2003 prices using the Consumer Price Index.
[14] Whether an individual is disabled or requires extra care is only assessed from 1969 to 1972 and 1976 to 1978 in the PSID. Additionally, in 1999 and 2003, individuals were asked to provide a self-assessment of their health during childhood. An individual is considered disabled during childhood if they report a disability or requiring extra care during the ages of 3 through 6 or if they report their health status as poor during childhood.

accurate description of the family environment during the early childhood years. Variables that measure individual characteristics include age, gender, race (black, white, and other race), marital status, birth order, and whether the individual is the oldest child. We also include two dummy variables that are interactions between birth prior to 1966 and participation in Head Start or other preschool.[15]

Individuals with missing values for any variable in the 1999 sample are excluded from the analysis using the 1999 smoking data.[16] A similar restriction is imposed on the 2003 sample. Because the PSID began in 1968, individuals who were older than 5 years in 1968 are excluded from both samples. This restriction ensures that family background characteristics are available during the ages of Head Start eligibility. Thus the oldest individuals included are 36 years old in 1999. Individuals in the 1999 sample attended Head Start between the years of 1968 and 1982. The descriptive statistics for the 1999 sample are provided in Table 1, and include the means and standard errors for the early childhood education variables, smoking behavior, and individual and family background characteristics of PSID respondents.[17] The descriptive statistics for the 2003 sample are included in Appendix Table 2.

Because a drawback of the fixed effects methodology is the sample restriction to individuals with at least one sibling, Table 1 includes the descriptive statistics for all individuals

[15] These two variables are included to allow for the possibility that recall error influenced the responses of individuals born prior to 1966 as suggested by Garces, Thomas, and Currie (2002). The estimated influence of early childhood experiences on smoking does not vary according to whether an individual was born before or after 1966.
[16] Keeping individuals with missing values in the sample and imputing the mean value of the sample and adding an indicator variable to reflect that the values were imputed does not impact the results reported below. After imposing the age restrictions, 158 individuals are removed from the sample because of a missing value for at least one variable, which includes 17 individuals with missing values for race, 111 individuals for birth order, 76 for oldest child, two for marital status, 18 for family income, eight for family size, ten for father not present, and 24 for mother's education.
[17] The means and standard errors are weighted by the PSID sample weights to be representative of the national population. These weights account for the initial oversampling of low-income households, changes in family composition, and differential attrition. These weights also reflect the addition of a nationally representative sample of post-1968 immigrant households in the PSID and the poststratification adjustments of the weights to the Current Population Survey by race, metropolitan status, and Census region (Heeringa and Connor, 1999).

and the subset of individuals who have at least one sibling in the sample. The descriptive statistics reveal that, while the sample size is dramatically reduced, restricting the analysis to individuals with at least one sibling does not change the overall characteristics of the sample.

The Head Start, Preschool, and Neither samples are subsets of individuals within the sibling sample who participated in: Head Start; a preschool program, nursery school, or day care center besides Head Start; or none of the above, respectively. These descriptive statistics highlight the disadvantaged background of Head Start participants and the importance of controlling for the home environment in estimating the impact of Head Start participation. Former Head Start participants are more likely to be from larger families with less income and to be the younger children in the family. These families are also less likely to have had a father present in the home, and mothers had less education on average. Additionally, Head Start participants are more likely to be black and less likely to be currently married.

While the fixed effects model in equation (2) restricts the sample to individuals with at least one sibling, the Head Start coefficient in the equation (δ_1) is estimated from the sample of sibling pairs where one sibling attended Head Start and the other siblings did not. The columns under the heading "Effective Sample for Head Start" summarize the sample of individuals who contribute to the estimation of the Head Start coefficient. The sample of all Head Start participants is similar to the sample of Head Start participants who contribute to the estimation of the Head Start coefficient with two exceptions – the effective sample has a larger percent of individuals who are female and a smaller percent who are black. The number of individuals who contribute to the estimation of δ_1 is 136 (in 52 families), and 62 of these individuals attended Head Start.[18] While this sample is small, the sample size is comparable to many of the model

[18] For the 2003 sample, 144 individuals in 55 families contribute to the estimation of the Head Start coefficient.

early childhood program evaluations described in Barnett (1995). This sample size is smaller than the effective sample size in Garces, Thomas, and Currie (2002) of 255 individuals in 100 families because smoking behavior is not asked of all individuals within households in the PSID. The sample size influences the precision but not the magnitude of the estimated impact of Head Start.

Comparisons of means between Head Start participants and their siblings yield no statistically significant differences in individual characteristics, with the exception of age. Head Start participants are younger than their siblings who did not attend Head Start and are of higher birth order. Siblings of a higher birth order generally have worse education and labor market outcomes (Black, Devereux, and Salvanes, 2005); one explanation for this is that parents spend less time with later-born children (Price, 2006). Based on this descriptive comparison, it does not seem likely that parents choose which child to send to Head Start based on observed, individual characteristics associated with adult success or greater parental investment. Additionally, a fixed-effects regression, similar to equation (2), of individual and family characteristics on Head Start participation suggests that a decrease in family income influences the likelihood that a sibling will attend Head Start.[19] On the other hand, child-specific characteristics such as age, gender, birth order, and disability status do not influence which sibling will attend Head Start.

V. RESULTS

Table 2 displays the estimation results, based on linear probability models, of the relationship between Head Start participation and whether an individual currently smokes

[19] These results are shown in Appendix Table 3. Whether the father is present is also related to Head Start attendance. Because the most disadvantaged children from the eligible applicants are admitted to Head Start by program administrators, children with one parent are more likely to be accepted than children with two parents.

cigarettes.[20] The first two columns display the results for the 1999 sample of individuals.[21] The first column displays the results of the estimates of equation (1), which controls for individual and family background characteristics to account for observable selection into Head Start. The coefficient for Head Start demonstrates that Head Start participants are 9.7 percentage points less likely to smoke than their siblings who did not attend Head Start, and this estimate is statistically significant at the 10 percent level. The coefficient for other preschools is negative, but small in magnitude and statistically insignificant. The difference estimate suggests that Head Start participants are 8.4 percentage points less likely to smoke, although this estimate is not measured precisely.

The estimates of the mother-specific fixed effects model, equation (2), are displayed in the next column. After accounting for unobservable selection into the program, the Head Start coefficient becomes even more negative and is statistically significant at the 5 percent level. This change suggests that Head Start participants are significantly disadvantaged across unobserved characteristics and is consist with previous research on the impact of Head Start participation (Garces, Thomas, and Currie, 2002; Frisvold, 2007). The coefficient for other preschools becomes positive but is not statistically significant after accounting for unobservable selection into other preschools, which suggests that children sent to other preschools are relatively advantaged in unobserved characteristics. Because the unobservable household

[20] Results from conditional logit models are qualitatively similar.

[21] These columns correspond to columns (3) and (4) of Table 2 in Garces, Thomas, and Currie (2002). In unreported results, we find a similar pattern of results to the findings from the specifications in Table 2 in Garces, Thomas, and Currie (2002). The baseline results are similar for all PSID respondents and the sibling sample. The estimates are also influenced by the inclusion of family background characteristics. For example, the difference estimate for the 1999 sample changes from -0.018 to -0.084 when we include family background characteristics. When we estimate the fixed effects specification by race, similar to columns (5) and (6) of Table 2 in Garces, Thomas, and Currie (2002), we find large, negative results for both whites and blacks but only the estimate for whites is statistically significant. However, the sample size is greatly reduced when we divide the sample by race. Including the interaction of black and Head Start in the fixed effects specification suggests that the impact of Head Start participation does not vary by race.

characteristics that determine the selection decisions associated with early childhood education may not be fixed across siblings, the difference in smoking between Head Start participants and their siblings is compared to the difference in smoking between other preschool participants and their siblings. This reveals a negative and statistically significant effect of Head Start participation on smoking. Head Start participation reduces the probability that an adult will smoke cigarettes by 0.248.

The last two columns in Table 2 contain the results for the 2003 sample. Comparing the estimates from the last two columns to those in the first two columns provides evidence on the persistence of the impact of Head Start participation. After controlling for observed and unobserved selection with mother-specific fixed effects and the difference in the Head Start and other preschool coefficients, Head Start participation now reduces the likelihood that an adult will smoke by 19.4 percentage points. While the impact of Head Start participation is smaller for the 2003 sample, this estimated impact remains substantial and statistically significant.

VI. DISCUSSION

We estimated the impact of Head Start participation on the smoking behavior of adults using data from the Panel Study of Income Dynamics and found, for this cohort, that adults who attended Head Start were less likely to smoke as adults than adults who attended other preschools or did not attend preschool.[22] For this cohort, the smoking benefit from attending Head Start diminished but persisted at least over the next four years.

[22] Although we focus on smoking, which is the leading preventable cause of mortality (Mokdad et al., 2004), Head Start participation may influence other health behaviors as well. Poor diet and physical inactivity form the second leading preventable cause of mortality (Mokdad et al., 2004); we find evidence that Head Start participation does not influence physical activity but potentially influences diet. There is no statistically significant impact on engaging in heavy or light exercise. We find that Head Start participation increases height by nearly one inch, which can be influenced through nutrition, but do not find any impact on weight or body mass index. For more on the impact of Head Start participation on obesity for more recent cohorts of participants, see Frisvold (2007) and Frisvold and

Given the sizeable impact of Head Start participation on educational outcomes, the large estimated impact on smoking is consistent with our expectations. The magnitude of the persistent impact of Head Start participation on smoking is comparable to the impact of other early childhood education programs on adult smoking (Barnett and Masse, 2007) and the quit rates obtained through traditional intensive smoking cessation programs (Anthonisen et al., 2005; Cutler, 2002). The estimated 0.194 reduction in the probability of smoking implies that the probability that a Head Start participant would smoke had they not participated in Head Start would be 0.418 in 2003.[23] Table 3 compares this estimated counterfactual probability to various comparison groups that are similar to Head Start participants. The estimated counterfactual for Head Start participants is higher than the prevalence of smoking of 30.5 percent among adults below the poverty line in 2003 (Center for Disease Control and Prevention, 2005). However, individuals who attend Head Start are likely to be more disadvantaged than the average individual with income below the poverty line because Head Start program administrators select the most disadvantaged of the eligible applicants. More relevant comparison groups are the control groups in the randomized evaluations of the Carolina Abecedarian preschool program and the High/Scope Perry Preschool Program because both of these programs targeted populations similar to Head Start participants. The prevalence of smoking in the control groups for both of these evaluations was 55 percent (Barnett and Masse, 2007), well above the estimated counterfactual of Head Start participants. The most relevant comparison group, however, is

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Lumeng (2008). Alcohol is the third leading preventable cause of mortality (Mokdad et al., 2004); we do not find an influence of Head Start on excessive drinking. However, only three percent of adults in the sibling sample report excessive consumption of alcohol. Information about illicit drug use is not available in the PSID main files.

[23] The average treatment effect on the treated is the difference between the probability that an individual who attended Head Start smokes and the probability that that individual would have smoked had they not attended Head Start. The estimated treatment effect on the treated is -0.194, and the sample average smoking rate for Head Start participants in the effective sample for 2003 of 0.224 (in Appendix Table 2) is an estimate of the probability that an individual who attended Head Start smokes. Thus, the counterfactual estimate of the probability that an individual would have smoked had they not attended Head Start is (0.224 + 0.194) or 0.418.

likely to be Head Start participants' own siblings. In the PSID sample used in this analysis, thirty nine percent of Head Start siblings smoked in 1999 and 37 percent of Head Start siblings smoked in 2003. These comparisons suggest that the large estimated magnitude of the impact of Head Start participation is plausible.

Head Start participation can influence adult smoking for a variety of reasons.[24] We explore two potential mechanisms: (1) Head Start increases educational attainment and thus decreases smoking; and (2) Head Start improves non-cognitive skills and thus decreases smoking. For the first path, we are able to use data from the PSID to explore its importance. For the second path, measures of non-cognitive skills are not available; we rely on existing research to understand its importance.

To examine the influence of educational attainment on the relationship between Head Start participation and smoking, we estimate equation (2) including the years of completed schooling as an additional explanatory variable.[25] The results are displayed in Table 4. Comparing the results from Table 4 to the results in Table 2 demonstrates the importance of completed schooling as a pathway through which Head Start can influence smoking. Introducing educational attainment as an additional regressor has little influence on the estimated impact of Head Start participation on smoking using the 1999 sample. This lack of influence may result because not all individuals had completed schooling in the sample. For the 2003 sample, including completed education in the model decreases the estimated impact of Head Start participation to -0.146, and this estimate is no longer statistically significant at conventional

[24] As discussed previously, changes in parental smoking are a potential mechanism through which Head Start participation may influence smoking, but this mechanism does not contributed to the estimates in our fixed effects specification.

[25] An additional possibility is that increased income can explain the relationship between Head Start participation and smoking. Estimating equation (2) with current total family income included and with years of schooling completed and current total family income included as additional explanatory variables demonstrates that there is no influence of income on the relationship between Head Start participation and smoking.

levels. Thus, there is some evidence that Head Start influences the smoking behavior of participants through increased educational attainment. However, education does not completely explain the relationship between Head Start participation and smoking.

An additional mechanism through which Head Start may be influencing adult smoking is through increases in non-cognitive skills, such as sense of control, discipline, motivation, self-esteem, and social skills. Non-cognitive skills are important determinants of a variety of behavioral outcomes and are as important as cognitive skills in predicting smoking behavior (Heckman, Stixrud, and Urzua, 2006; Heckman and Masterov, 2007). An increase from the 25th percentile to the 75th percentile of the distribution of non-cognitive skills, measured by locus of control, leads to approximately a 15 percentage point decrease in the probability of smoking (Heckman, Stixrud, and Urzua, 2006). Longitudinal studies in the medical literature show that hyperactivity in adolescence leads to greater smoking initiation (Hartsough and Lambert, 1987; Milberger et al, 1997) and smoking initiation at earlier ages (Milberger et al, 1997). Problem behaviors in adolescence also predict smoking initiation (Griesler, Kandel, and Davies, 2002) and becoming a daily smoker (Kandel, Kiros, Schaffran, and Hu, 2004).

Evidence from experimental evaluations demonstrates that Head Start participation improves non-cognitive skills. The Head Start Impact Study found that program participation reduced hyperactive behavior by 0.20 standard deviations and reduced total problem behavior by 0.16 standard deviations (U.S. Department of Health and Human Services, 2005).[26,27] Alternatively, participation in other preschools does not lead to similar increases in non-cognitive skills. Magnuson, Ruhm, and Waldfogel (2007) demonstrate that prekindergarten

[26] These figures are the average treatment on the treated results for 3 year olds shown in the appendix of the study, as opposed to the intent to treat effects shown in the main body of the report.
[27] Garces, Thomas, and Currie (2002) provide evidence consistent with a long-term impact of Head Start participation on non-cognitive skills; these authors show that Head Start participation reduces criminal activity in young adults.

attendance improves cognitive skills, but also increases behavioral problems. Child care attendance is associated with behavioral problems (NICHD ECCRN, 2003) and hyperactivity and aggressiveness (Baker, Gruber, and Milligan, 2005).[28] Based on the body of evidence from this existing literature, the increase in non-cognitive skills from Head Start participation likely contributes to the measured impact on smoking in our analysis. In summary, multiple pathways, including educational attainment and the development of non-cognitive skills, generate the impact of Head Start participation on smoking.

VII. CONCLUSION

Most evaluations of Head Start have emphasized the cognitive and educational benefits to participants. In this paper we argue that Head Start also impacts participants' health by altering their likelihood of smoking. We estimated a fixed effects model for a cohort of young adults using data from the Panel Study of Income Dynamics and found a substantial and sustained reduction in smoking associated with Head Start participation.

One traditional way of interpreting our result is to convert the estimate into dollar terms. Between 1995 and 1999, the estimated annual cost of smoking was $3,391 per smoker, which included excess medical expenditures and lost productivity (Center for Disease Control and Prevention, 2002). The present value of a 19.4 percent reduction in smoking, assuming a 3 percent real discount rate, is $9,967 per each Head Start participant entering the program at four

[28] One potential reason for the difference in the impact on non-cognitive skills between Head Start and other care arrangements is that Head Start classrooms are of higher quality on average than other preschool programs and child care centers (Currie, 2001), and higher quality child care attendance is associated with less aggressive behavior (Love et al, 2003). An additional possibility is that the Head Start curriculum offers a wider array of services to participants and their families than other child care arrangements.

years of age in 2003.[29] Alternatively, using a 7 percent real discount rate, the present value becomes $2,563. For comparison purposes, the average cost of each Head Start participant in 2003 was $7,092. The value of the reduction in smoking associated with Head Start, then, represents 36 to 141 percent of the program costs for an average Head Start participant.[30] Since this is only one of the many outcomes from participating in Head Start, these results suggest that there are significant personal and social benefits associated with the Head Start program.

[29] The economic costs are converted into 2003 dollars using the Consumer Price Index of all items for all urban consumers (current series). This calculation assumes that the reduction in smoking begins at age 25 and lasts until death at age 70.

[30] Of course, these estimates are meant to be merely indicative of the economic benefits predicted by our results. The estimated cost per smoker may vary across socioeconomic groups or over time, and different cohorts may have different impacts from Head Start. Preliminary analysis of younger Head Start participants who grew up during the peak of youth smoking in the late 1990s suggests that their smoking behavior may not have been significantly altered by Head Start. However, an updated analysis of younger cohorts will require additional data.

REFERENCES

Andreski, P., E. Gouskova, K. McGonagle, and B. Schoeni. "An Analysis of the Quality of the Health Data in the Panel Study of Income Dynamics: 1999-2003." Manuscript, University of Michigan, 2005.

Anthonisen, N.R., M.A. Skeans, R.A. Wise, and J. Manfreda. "The Effects of a Smoking Cessation Intervention on 14.5-Year Mortality: A Randomized Clinical Trial." *Annals of Internal Medicine*, 142, 2005, 233-39.

Aughinbaugh, A. "Does Head Start Yield Long-Term Benefits?" *Journal of Human Resources*, 36(4), 2001, 641-65.

Baker, M., J. Gruber, and K. Milligan. "Universal Childcare, Maternal Labor Supply and Family Well-Being." National Bureau of Economic Research Working Paper 11832, 2005.

Barnett, W.S. "Long-Term Effects of Early Childhood Programs on Cognitive and School Outcomes." *The Future of Children*, 5(3), 1995, 25-50.

Barnett, W.S. and J.T. Hustedt. "Head Start's Lasting Benefits." *Infants and Young Children*, 18(1), 2005, 16-24.

Barnett, W.S. and L.N. Masse. "Comparative Benefit-Cost Analysis of the Abecedarian Program and its Policy Implications." *Economics of Education Review*, 26(1), 2007, 113-125.

Belfield, C.R., M. Nores, S. Barnett, and L. Schweinhart. "The High/Scope Perry Preschool Program: Cost-Benefit Analysis Using Data from the Age-40 Followup." *Journal of Human Resources*, 41(1), 2006, 162-90.

Besharov, D.J. "Head Start's Broken Promise." *American Enterprise Institute for Public Policy Research: On the Issues*, October 2005.

Black, S.E., P.J. Devereux, and K.G. Salvanes. "The More the Merrier? The Effect of Family Size and Birth Order on Children's Education." *Quarterly Journal of Economics*, 120(2), 2005, 669-700.

Bound, J. & Solon, G. (1999). Double trouble: on the value of twins-based estimation of the return to schooling. Economics of Education Review, 18, 169-182.

Center for Disease Control and Prevention. (2002). Annual Smoking-Attributable Mortality, Years of Potential Life Lost, and Economic Costs – United States, 1995-1999. Morbidity and Mortality Weekly Report, 51, 300-303.

Center for Disease Control and Prevention. (2005). Cigarette Smoking Among Adults – United States, 2003. Morbidity and Mortality Weekly Report, 54(20), 509-513.

Chaloupka, F.J. & Warner, K.E. (2000). The Economics of Smoking. In: A.J. Culyer & J.P. Newhouse (Eds.), Handbook of Health Economics, Vol. 1B (pp.1539-1627). Amsterdam: North-Holland.

Currie, J. (2001). Early Childhood Education Programs. Journal of Economic Perspectives, 15(2), 213-238.

Currie, J. & Thomas, D. (1995). Does Head Start Make a Difference? American Economic Review, 85(3), 341-364.

Cutler, D.M. (2002). Behavioral Health Interventions: What Works and Why? Available at: http://post.economics.harvard.edu/faculty/dcutler/papers/interventions_6-02.pdf.

Cutler, D. and A. Lleras-Muney. "Education and Health: Evaluating Theories and Evidence." National Bureau of Economic Research Working Paper No. 12352, 2006.

Frisvold, D. (2007). Head Start Participation and Childhood Obesity. Early Childhood Research Collaborative Discussion Paper 108.

Frisvold, D. and J. Lumeng (2008). "Expanding Exposure: Can Increasing the Daily Duration of Head Start Reduce Childhood Obesity?" Working Paper, University of Michigan, 2008.
Garces, E., Thomas, D., & Currie, J. (2002). Longer-Term Effects of Head Start. American Economic Review, 9(4), 999-1012.
Gilleskie, D. & Harrison, A. (1998). The Effect of Endogenous Health Inputs on the Relationship between Health and Education. Economics of Education Review, 17(3), 279-297.
Griesler, P.C., Kandel, D.B., & Davies, M. (2002) Ethnic differences in predictors of initiation and persistence of adolescent cigarette smoking in the National Longitudinal Survey of Youth. Nicotine & Tobacco Research, 4, 79-93.
Griliches, Z. (1979). Sibling Models and Data in Economics: Beginnings of a Survey. Journal of Political Economy, 87(5), S37-S64.
Grossman, M., and R. Kaestner. "Effects of Education on Health," in *The Social Benefits of Education*, edited by J. Behrman and N. Stacey. Ann Arbor: The University of Michigan Press, 1997, 69-123.
Hale, B., Seitz, V., & Zigler, E. (1990). Health Services and Head Start: A Forgotten Formula. Journal of Applied Developmental Psychology, 11, 447-458.
Harrell, J.S., Bandgiwala, S.I., Deng, S., Webb, J.P. & Bradley, C. (1998). Smoking Initiation in Youth: The Roles of Gender, Race, Socioeconomics, and Developmental Status. Journal of Adolescent Health, 23, 271-279.
Hartsough, C.S., & Lambert, N.M. (1987). Pattern and Progression of Drug Use among Hyperactives and Controls: A Prospective Short-Term Longitudinal Study. Journal of Child Psychology and Psychiatry and Allied Disciplines, 28, 543-553.
Haveman, R. & Wolfe, B. (1995). The Determinants of Children's Attainments: A Review of Methods and Findings. Journal of Economic Literature, 33, 1829-1878.
Hayward, M.D. & Gorman, B.K. (2004). The Long Arm of Childhood: The Influence of Early-Life Social Conditions on Men's Mortality. Demography, 41(1), 87-107.
Heckman, J.J. & Masterov, D.V. (2007). The Productivity Argument for Investing in Children. National Bureau of Economic Research Working Paper 13016.
Heckman, J.J., Stixrud, J., & Urzua, S. (2006). The Effects of Cognitive and Noncognitive Abilities on Labor Market Outcomes and Social Behavior. Journal of Labor Economics, 24(3), 411-482.
Heeringa, S.G. & Connor, J.H. (1999). 1997 Panel Study of Income Dynamics Analysis Weights for Sample Families and Individuals. Available at: http://psidonline.isr.umich.edu/data/Documentation/wts97.pdf.
Hsieh, C., Yen, L., Liu, J., & Lin, C.J. (1996). Smoking, health knowledge, and anti-smoking campaigns: An empirical study in Taiwan. Journal of Health Economics, 15, 87-104.
Kabat, G.C. & Wynder, E.L. (1987). Determinants of Quitting Smoking. American Journal of Public Health, 77, 1301-1305.
Kandel, D.B., Kiros, G.E., Schaffran, C., Hu, M.C. (2004). Racial/Ethnic Differences in Cigarette Smoking Initiation and Progression to Daily Smoking: A Multilevel Analysis. American Journal of Public Health, 94, 128-135.
Keane, M.J., O'Brien, R.W., Connell, D.C., & Close, N.C. (1996). A Descriptive Study of the Head Start Health Component. Washington, DC: U.S. Department of Health and Human Services.
Kenkel, D.S. (1991). Health Behavior, Health Knowledge, and Schooling. Journal of Political Economy, 99(2), 287-305.

Lee, V., Brooks-Gunn, J., & Schnur, E. (1988). Does Head Start Work? A 1-Year Follow-Up Comparison of Disadvantaged Children Attending Head Start, No Preschool, and Other Preschool Programs. Developmental Psychology, 24(2), 210-222.

Love, J.M., Harrison, L., Sagi-Schwartz, A., van Ijzendoorn, M.H., Ross, C., Ungerer, J.A., Raikes, H., Brady-Smith, C., Boller, K., Brooks-Gunn, J., Constantine, J., Kisker, E.E., Paulsell, D., & Chazan-Cohen, R., (2003). Child Care Quality Matters: How Conclusions May Vary with Context. Child Development, 74(4), 1021-1033.

Lee, V., Brooks-Gunn, J., Schnur, E., & Liaw, F. (1990). Are Head Start Effects Sustained? A Longitudinal Follow-up Comparison of Disadvantaged Children Attending Head Start, No Preschool, and Other Preschool Programs. Child Development, 61, 495-507.

Ludwig, J., & Miller, D.L. (2007) Does Head Start Improve Children's Life Chances? Evidence from a Regression Discontinuity Design. Quarterly Journal of Economics, 122(1), 159-208.

Ludwig, J., & Phillips, D. (2007) The Benefits and Costs of Head Start. National Bureau of Economic Research Working Paper 12973.

Magnuson, K.A, Ruhm, C., & Waldfogel, J. (2007) Does Prekindergarten Improve School Preparation and Performance? Economics of Education Review, 26(1), 33-51.

McKey, R.H., Condelli, L., Ganson, H., Barrett, B.J., McConkey, C., & Plantz, M.C. (1985). The Impact of Head Start on Children, Families and Communities: Final Report of the Head Start Evaluation Synthesis and Utilization Project. Washington, DC: CSR, Incorporated.

Milberger, S. Biederman, J., Faraone, S.V., Chen, L., & Jones, J. (1997) ADHD is Associated with Early Initiation of Cigarette Smoking in Children and Adolescents. Journal of the American Academy of Child & Adolescent Psychiatry, 36(1), 37-44.

Mokdad, A.H., Marks, J.S., Stroup, D.F., & Gerberding, J.L. (2004). Actual Causes of Death in the United States, 2000. Journal of the American Medical Association, 291(10), 1238-1245.

National Institute of Child Health and Human Development Early Child Care Research Network (2003). Does Amount of Time Spent in Child Care Predict Socioemotional Adjustment During the Transition to Kindergarten? Child Development, 74(4), 976-1005.

Office of Head Start, (2006a). Head Start Program Fact Sheet. Washington, DC: U.S. Department of Health and Human Services. Available at: http://www.acf.hhs.gov/programs/hsb/research/2006.htm.

Office of Head Start, (2006b). Head Start Program Performance Standards and Other Regulations. Available at: http://www.acf.hhs.gov/programs/hsb/performance/index.htm.

Powell, L.M. & Chaloupka, F.J. (2005). Parents, Public Policy, and Youth Smoking. Journal of Policy Analysis and Management, 24(1), 93-112.

Price, J. (2006). Parent-Child Quality Time: Does Birth Order Matter? Available at SSRN: http://www.ssrn.com/abstract=767444.

Sander, W. (1995). Schooling and Smoking. Economics of Education Review, 14, 23-33.

U.S. Department of Health and Human Services. (1994). Preventing Tobacco Use Among Young People: A Report of the Surgeon General. Atlanta, Georgia: U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health.

U.S. Department of Health and Human Services. (2001). Reaching Out to Families: Head Start Recruitment and Enrollment Practices. Available at: http://www.acf.hhs.gov/programs/opre/hs/faces/reports/reaching_out_families/reaching_title.html.

U.S. Department of Health and Human Services. (2003). Strengthening Head Start: What the Evidence Shows. Available at: http://aspe.hhs.gov/hsp/StrengthenHeadStart03/index.htm.
U.S. Department of Health and Human Services. (2005). Head Start Impact Study: First Year Findings. Washington, DC: U.S. Department of Health and Human Services, Administration for Children and Families.
Zigler, E. & Valentine, J. (Eds.) (1979). Project Head Start: A Legacy of the War on Poverty. New York: The Free Press.

Table 1: Descriptive Statistics for the 1999 Sample

	Entire Sample			Sibling Sample				Effective Sample for Head Start		
	All	Head Start	Preschool	All	Head Start	Preschool	Neither	All	Head Start Participants	Head Start Siblings
Smoke	0.245	0.228	0.207	0.232	0.192	0.211	0.257	0.309	0.205	0.392
	(0.013)	(0.040)	(0.024)	(0.016)	(0.046)	(0.031)	(0.020)	(0.059)	(0.071)	(0.084)
Head Start	0.064	1.000	0.027	0.072	1.000	0.029	0.000	0.445	1.000	0.000
	(0.007)	(0.000)	(0.008)	(0.010)	(0.000)	(0.012)	(0.000)	(0.065)	(0.000)	(0.000)
Preschool	0.278	0.118	1.000	0.268	0.110	1.000	0.000	0.152	0.092	0.201
	(0.014)	(0.034)	(0.000)	(0.018)	(0.044)	(0.000)	(0.000)	(0.041)	(0.042)	(0.064)
Age	29.804	29.732	28.505	29.826	29.527	28.745	30.129	30.329	29.151	31.272
	(0.120)	(0.450)	(0.221)	(0.146)	(0.585)	(0.267)	(0.175)	(0.550)	(0.878)	(0.587)
Female	0.525	0.597	0.551	0.522	0.589	0.527	0.507	0.682	0.747	0.630
	(0.015)	(0.055)	(0.030)	(0.020)	(0.069)	(0.038)	(0.024)	(0.056)	(0.073)	(0.079)
Black	0.112	0.632	0.101	0.099	0.576	0.088	0.060	0.461	0.422	0.492
	(0.008)	(0.054)	(0.016)	(0.011)	(0.069)	(0.020)	(0.009)	(0.064)	(0.097)	(0.085)
Other Race	0.046	0.050	0.060	0.055	0.062	0.062	0.050	0.047	0.074	0.025
	(0.007)	(0.026)	(0.016)	(0.010)	(0.036)	(0.022)	(0.011)	(0.027)	(0.051)	(0.025)
Birth Order	2.531	4.340	2.042	2.659	4.997	2.214	2.572	3.715	4.216	3.314
	(0.060)	(0.447)	(0.089)	(0.081)	(0.560)	(0.123)	(0.081)	(0.327)	(0.537)	(0.364)
Oldest	0.313	0.186	0.394	0.267	0.151	0.312	0.276	0.164	0.103	0.212
	(0.014)	(0.038)	(0.029)	(0.017)	(0.043)	(0.035)	(0.021)	(0.043)	(0.045)	(0.066)
Married	0.579	0.381	0.498	0.592	0.422	0.489	0.632	0.585	0.504	0.650
	(0.015)	(0.053)	(0.030)	(0.020)	(0.068)	(0.038)	(0.023)	(0.063)	(0.099)	(0.079)
Disabled	0.042	0.064	0.036	0.041	0.040	0.039	0.043	0.048	0.026	0.066
	(0.006)	(0.025)	(0.011)	(0.008)	(0.028)	(0.015)	(0.010)	(0.023)	(0.017)	(0.038)
Family Size	4.910	6.558	4.387	5.154	7.193	4.592	5.167	5.937	6.068	5.832
	(0.053)	(0.415)	(0.082)	(0.071)	(0.534)	(0.112)	(0.067)	(0.216)	(0.329)	(0.282)
Father Not Present	0.137	0.358	0.143	0.122	0.336	0.131	0.104	0.338	0.374	0.309
	(0.010)	(0.051)	(0.021)	(0.013)	(0.061)	(0.025)	(0.014)	(0.062)	(0.094)	(0.083)
Mother's Education	12.141	10.680	13.185	12.226	10.668	13.337	11.889	11.101	11.273	10.963
	(0.067)	(0.246)	(0.126)	(0.089)	(0.308)	(0.167)	(0.097)	(0.252)	(0.390)	(0.324)
Family Income	51.500	30.849	60.702	51.895	31.607	64.101	48.095	32.893	32.679	33.064
	(0.935)	(1.620)	(2.220)	(1.266)	(1.707)	(3.307)	(1.129)	(1.893)	(2.932)	(2.472)
Sample Size	1638	227	405	922	130	214	593	136	62	74

Notes: The means and standard errors (in parentheses) are weighted by the PSID sample weights to be representative of the national population. The entire sample is the sample of all individuals in the PSID older than 21 years in 1999 with complete information on individual and family characteristics. The sibling sample is the subset of individuals who have at least one sibling in the sample. The Head Start, preschool, and neither samples are subsets of individuals who participated in Head Start; a preschool program, nursery school, or day care center besides Head Start; or none of the above, respectively. The effective sample for Head Start is the sample of individuals who contribute to the identification of the Head Start coefficient in the fixed effects estimation. Family income, family size, and mother's education are averaged over the ages 3 through 6. Father not present measures that the father was not a family member at some point during the ages 3 through 6.
Source: Panel Study of Income Dynamics

Table 2: The Relationship between Head Start Participation and Smoking

	1999 Sample		2003 Sample	
Equation:	(1)	(2)	(1)	(2)
Head Start (HS)	-0.097*	-0.173**	-0.078*	-0.116
	(0.053)	(0.082)	(0.047)	(0.082)
Other Preschool (PS)	-0.013	0.075	-0.005	0.077
	(0.034)	(0.053)	(0.033)	(0.053)
Difference (HS-PS)	-0.084	-0.248***	-0.073	-0.194**
	(0.060)	(0.095)	(0.054)	(0.094)
Sample Size	922	922	1005	1005
Mother Fixed Effects		X		X

Notes: Standard errors (in parentheses) allow for household clustering and heteroskedasticity in ordinary least squares regressions. Individual characteristics include age, female, black, other race, birth order, whether the individual is the oldest child, marital status, and disability status. Family background characteristics include average total family income between ages 3 through 6, the mother's average years of formal schooling completed between ages 3 through 6, the average family size between ages 3 through 6, and whether the father was present between ages 3 through 6. Additional variables include whether a Head Start participant was born prior to 1966 and whether a participant of other preschool was born prior to 1966.
Source: Panel Study of Income Dynamics
*** Significant at the 1% level.
** Significant at the 5% level.
* Significant at the 10% level.

Table 3: The Prevalence of Smoking in Various Comparison Groups

Estimated Counterfactual for Head Start Participants in 2003	42 %
Siblings of Head Start Participants	39 %
Control Group in the Carolina Abecedarian Program	55 %
Control Group in the Perry Preschool Program	55 %
Poor Adults (National Estimate in 2003)	31 %

Sources: Authors' calculations from the PSID; Barnett and Masse, 2007; Center for Disease Control and Prevention, 2005a

Table 4: Assessing the Role of Completed Education on the Impact of Head Start on Smoking

	1999 Sample	2003 Sample
Head Start (HS)	-0.162**	-0.102
	(0.080)	(0.085)
Other Preschool (PS)	0.089*	0.044
	(0.054)	(0.059)
Difference (HS-PS)	-0.250***	-0.146
	(0.094)	(0.099)
Sample Size	883	903

Notes: This table repeats the analysis in Table 2 with the mother-specific fixed effects with the addition of years of completed education included as an additional explanatory variable.
Source: Panel Study of Income Dynamics
*** Significant at the 1% level.
** Significant at the 5% level.
* Significant at the 10% level.

Appendix

Appendix Table 1: Means of Mothers' Smoking Behavior by Child's Preschool Attendance

	Child Attended Head Start	Child Attended Other Preschool	Child Attended No Preschool
Mother Smoked After Age 6 (a)	0.363	0.314	0.376
	(0.055)	(0.030)	(0.020)
Mother Smoked Prior to Age 3 (b)	0.447	0.424	0.447
	(0.056)	(0.032)	(0.020)
Difference (a – b)	-0.084	-0.110	-0.072
	(0.029)	(0.020)	(0.011)
Sample Size	163	357	883

Notes: The means and standard errors (in parentheses) are weighted by the 1999 PSID individual weights.
Source: Panel Study of Income Dynamics

Appendix Table 2: Descriptive Statistics for the 2003 Sample

	Entire Sample			Sibling Sample				Effective Sample for Head Start		
	All	Head Start	Preschool	All	Head Start	Preschool	Neither	All	Head Start Participants	Head Start Siblings
Smoke	0.231	0.191	0.188	0.233	0.194	0.200	0.259	0.305	0.224	0.370
	(0.013)	(0.035)	(0.022)	(0.016)	(0.043)	(0.028)	(0.020)	(0.055)	(0.068)	(0.078)
Head Start	0.065	1.000	0.027	0.069	1.000	0.024	0.000	0.444	1.000	0.000
	(0.007)	(0.000)	(0.008)	(0.009)	(0.000)	(0.009)	(0.000)	(0.061)	(0.000)	(0.000)
Preschool	0.308	0.129	1.000	0.303	0.110	1.000	0.000	0.150	0.091	0.197
	(0.014)	(0.033)	(0.000)	(0.018)	(0.041)	(0.000)	(0.000)	(0.040)	(0.041)	(0.062)
Age	33.357	33.595	31.926	33.333	33.539	31.803	33.544	34.314	33.232	35.179
	(0.125)	(0.414)	(0.222)	(0.154)	(0.548)	(0.271)	(0.182)	(0.528)	(0.833)	(0.599)
Female	0.511	0.561	0.527	0.499	0.530	0.499	0.488	0.649	0.687	0.619
	(0.015)	(0.052)	(0.028)	(0.019)	(0.065)	(0.034)	(0.023)	(0.055)	(0.078)	(0.077)
Black	0.116	0.704	0.096	0.101	0.670	0.078	0.064	0.494	0.458	0.523
	(0.008)	(0.048)	(0.014)	(0.010)	(0.062)	(0.017)	(0.008)	(0.061)	(0.093)	(0.081)
Other Race	0.043	0.036	0.056	0.047	0.042	0.060	0.039	0.032	0.037	0.028
	(0.007)	(0.021)	(0.015)	(0.009)	(0.030)	(0.019)	(0.010)	(0.022)	(0.036)	(0.028)
Birth Order	2.478	4.079	1.978	2.593	4.838	2.049	2.509	3.908	4.228	3.652
	(0.057)	(0.419)	(0.079)	(0.076)	(0.536)	(0.096)	(0.078)	(0.323)	(0.524)	(0.382)
Oldest	0.317	0.216	0.398	0.274	0.170	0.347	0.302	0.167	0.100	0.221
	(0.014)	(0.037)	(0.027)	(0.017)	(0.042)	(0.032)	(0.020)	(0.042)	(0.044)	(0.065)
Married	0.633	0.385	0.634	0.650	0.401	0.665	0.647	0.541	0.475	0.593
	(0.014)	(0.051)	(0.027)	(0.018)	(0.064)	(0.032)	(0.022)	(0.061)	(0.094)	(0.077)
Disabled	0.039	0.064	0.030	0.034	0.038	0.033	0.030	0.033	0.028	0.036
	(0.006)	(0.024)	(0.010)	(0.007)	(0.026)	(0.013)	(0.008)	(0.016)	(0.018)	(0.026)
Family Size	4.846	6.354	4.329	5.080	7.065	4.506	5.082	6.081	6.090	6.074
	(0.051)	(0.397)	(0.071)	(0.067)	(0.512)	(0.089)	(0.066)	(0.218)	(0.328)	(0.292)
Father Not Present	0.132	0.361	0.135	0.111	0.333	0.110	0.097	0.316	0.350	0.289
	(0.010)	(0.048)	(0.019)	(0.012)	(0.057)	(0.021)	(0.013)	(0.058)	(0.089)	(0.077)
Mother's Education	12.248	10.770	13.244	12.370	10.737	13.377	11.984	11.067	11.291	10.888
	(0.067)	(0.229)	(0.119)	(0.088)	(0.285)	(0.149)	(0.096)	(0.247)	(0.358)	(0.336)
Family Income	55.048	33.109	64.275	55.383	33.904	66.069	50.879	36.752	37.436	36.205
	(0.946)	(1.698)	(2.144)	(1.217)	(1.927)	(2.873)	(1.011)	(2.060)	(3.286)	(2.615)
Sample Size	1757	258	465	1005	156	297	699	144	65	79

Notes: The means and standard errors (in parentheses) are weighted by the PSID sample weights to be representative of the national population. The entire sample is the sample of all individuals in the PSID older than 21 years in 1999 with complete information on individual and family characteristics. The sibling sample is the subset of individuals who have at least one sibling in the sample. The Head Start, preschool, and neither samples are subsets of individuals who participated in Head Start; a preschool program, nursery school, or day care center besides Head Start; or none of the above, respectively. The effective sample for Head Start is the sample of individuals who contribute to the identification of the Head Start coefficient in the fixed effects estimation. Family income, family size, and mother's education are averaged over the ages 3 through 6. Father not present measures that the father was not a family member at some point during the ages 3 through 6.
Source: Panel Study of Income Dynamics

Appendix Table 3: Determinants of Head Start Participation Among Siblings

Outcome:	Head Start Participation
Age	0.002
	(0.009)
Female	0.012
	(0.022)
Birth Order	0.029
	(0.023)
Oldest	0.011
	(0.027)
Disabled	0.038
	(0.057)
Family Income (ln)	-0.118 **
	(0.053)
Family Size	0.017
	(0.024)
Father Not Present	0.106 **
	(0.052)
Mother's Education	0.039
	(0.022)
Constant	-0.139
	(0.510)
Sample Size	922
Number of Families	401

Notes: Estimates and standard errors (in parentheses) are based on a mother-specific fixed effects specification from the 1999 sample.
Source: Panel Study of Income Dynamics
*** Significant at the 1% level.
** Significant at the 5% level.
* Significant at the 10% level.