

# A Head Start on Fighting Crime? The Effect of Access to Early Childhood Education

John Anders\*, Andrew C. Barr<sup>†</sup>, Alex Smith<sup>‡</sup>

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## Abstract

We provide the only large-scale evidence that early childhood education reduces later criminal behavior. To do so we leverage the county-level rollout of Head Start and administrative crime data containing the birth county of all individuals convicted of a crime in North Carolina. We find that the availability of a Head Start program reduces the likelihood of a serious criminal conviction by age 35 by 1.3 percentage points (6-9 percent) for children born into higher poverty counties. Given the high social costs of crime, the benefits generated by Head Start's later crime reduction exceeded the costs of the program.

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\*Department of Economics, Texas A&M University

<sup>†</sup>Department of Economics, Texas A&M University

<sup>‡</sup>Department of Economics, United States Military Academy, West Point

# 1 Introduction

Are criminals made or born? Not only does the answer to this fundamental question have important implications for our understanding of criminality, but it is central to efforts aimed at reducing the large costs that crime imposes on society (\$2 trillion annually).<sup>1</sup> Policies that address these costs primarily through the justice system implicitly assume that the development of criminals cannot be prevented cost-effectively and instead focus on incapacitating and rehabilitating those who have already become criminals. However, relatively little is known about the factors that influence an individual’s likelihood of becoming a criminal and their malleability. Furthermore, the concentration of crime among a small number of perpetrators (less than 6 % of the population commit the majority of crime) provides an opportunity for policy interventions to have outsized effects if they can prevent the development of criminals.<sup>2</sup> In fact, some estimates suggest that preventing the development of a single career criminal could result in as many as 600 fewer victims of crime each year.<sup>3</sup>

We explore the role of one popular policy intervention in influencing later criminal behavior: early childhood education. The importance of understanding this relationship is heightened by recent expansions in the share of children attending public preschools, driven in large part by a belief among policymakers that early childhood education interventions have large impacts later in life. We bring new evidence to this question by investigating the effect of childhood Head Start availability on later criminal behavior.

Recent attention has focused on early childhood as a critical developmental period, but the limited evidence on the effect of early childhood education on later criminal behavior

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<sup>1</sup>For context, \$2 trillion dollars is 17% of annual GDP. (United States. Senate Committee on the Judiciary. Hearing on The Costs of Crime. September 19, 2006 (statement of Jens Ludwig))

<sup>2</sup>Farrington et al. (2006) generate this statistic by tracking the criminal behavior of a set of boys in London. Given the higher propensity to commit crime among males, this 6 % is likely a substantial overestimate of the share of the population that commits the majority of crime.

<sup>3</sup>Across major crime categories, estimates suggest that a relatively small proportion of individuals (consistently less than 10%) account for the majority of crime. These “career criminals” commit hundreds of crimes each year (authors’ calculations from Chaiken and Chaiken (1982)).

is mixed and inconclusive. The most compelling evidence comes from a single evaluation of a small-scale high-intensity intervention, Perry Preschool, where effects on crime account for 40-65% of the estimated benefits of the program (Heckman et al. 2010). However, a randomized evaluation of a similar program, the Abecedarian Project, indicates no effect of the program on crime (Campbell et al. 2012). Furthermore, while these studies provide rigorous evidence driven by random assignment, both rely on very small and attrition-plagued samples to support their conclusions.<sup>4</sup> Evidence on the effects of Head Start on criminal behavior is also mixed and relies on small samples, self-reported crime data, and sibling comparison approaches that raise questions about the validity of the estimates (Deming 2009; Garces et al. 2002).

We make three primary contributions to this literature. First, we provide the only large-scale evidence that early childhood education reduces later criminal behavior. Second, we provide the first estimates that rely on administrative crime data to determine the effects of Head Start availability on later criminal behavior. Third, we estimate that, in high poverty counties, the discounted benefits generated by Head Start's later crime reduction were greater than the costs of the program itself.

To investigate the link between early childhood education and later criminal behavior, we take advantage of the staggered introduction of the Head Start program during the 1960s. The Head Start program, funded and administered through the U.S. Department of Health and Human Services, has been an integral part of U.S. early childhood education for the 50 years of its existence. Easily the largest early childhood education program in the United States, annual Head Start enrollment has grown from 400,000 during the early years of the program to nearly a million participants today. We leverage county-level variation in the

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<sup>4</sup>At adult follow up, the Perry experiment had 123 members and the Abecedarian experiment had 101, both somewhat reduced from initial samples. The Abecedarian follow up relied on self-reported crime data, while the Perry follow up relied on a combination of self-reports and county and state-level arrest data. There were also issues with the Perry randomization protocol; while subsequently carefully addressed by researchers, ex-post correction of compromised randomization is never ideal (Heckman et al. 2011).

timing of the Head Start program rollout to identify the effect of Head Start availability on later criminal behavior in adulthood. Given the focus of the Head Start program on poor children and the resulting concentration of funding among high-poverty counties, we focus much of our analysis on this set of more heavily treated counties.<sup>5</sup>

We estimate the effect of Head Start on criminal behavior using individual-level administrative data for the universe of convicted criminals in North Carolina between 1972 and 2015. These administrative data are particularly well suited to our estimation strategy as they contain each criminal’s county of birth, allowing us to overcome a variety of measurement and endogeneity concerns that likely inhibited earlier attempts to investigate the effects of the early childhood environment on later criminal behavior.<sup>6</sup> We combine these data with counts of births to construct county of birth by birth cohort conviction rates, which we link with information on the availability of Head Start in each county and year.

We find that Head Start availability reduces the likelihood of a serious conviction by age 35 by 1.3 percentage points, but only in high-poverty counties. These estimates imply treatment effects of Head Start participation of roughly 6-9 percentage points; while substantial, these estimates are half to two-thirds of the size of effects reported in an evaluation of the Perry Preschool program (Heckman et al. 2010).<sup>7</sup>

The estimates are robust to the inclusion of time-varying county-level controls for the availability of other War on Poverty Programs as well as birth county trends.<sup>8</sup> The legiti-

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<sup>5</sup>Head Start funding per capita is between three and four times larger in high- versus low-poverty counties.

<sup>6</sup>Most administrative crime datasets do not contain county of birth, forcing researchers interested in the early childhood environment to make relatively strong assumptions about the relationship between location of arrest and earlier residence (for example, Reyes (2007)), or to link multiple datasets together to obtain better measures of both childhood environment (or treatment status) and later criminal behavior. This latter strategy has been used in several small-scale experimental evaluations (for example, Heckman et al. 2010; Campbell et al. 2012). While some survey datasets contain measures of criminal behavior and early childhood environment, small sample sizes, high rates of attrition, and well known issues with underreporting of criminal behavior present their own difficulties (Hindelang et al., 1981).

<sup>7</sup>While our measures are not directly comparable, our point estimates suggest somewhat smaller effects on criminal behavior (than those estimated in evaluations of Perry Preschool) across a range of measures. We discuss this further in Section 4.

<sup>8</sup>Furthermore, Head Start availability is unrelated to other policy changes shown to affect crime (e.g.,

macy of the identification strategy is further bolstered by event study estimates showing no significant “impact” of Head Start in the years prior to its rollout in a given county and a sharp jump immediately following the program’s introduction. While our crime data only cover crimes committed in North Carolina, we find no evidence of differential migration out of one’s state of birth as a result of Head Start availability.<sup>9</sup>

Among high-poverty counties, the effects of Head Start availability on later crime are somewhat larger for cohorts exposed to a Head Start program after its first year in operation, perhaps as a result of a ramp up period for the program. The effects also appear to be larger for serious property crimes than violent crimes, suggesting that the effect of Head Start may operate by changing the opportunity cost of crime rather than improving impulse control. Finally, back of the envelope calculations indicate that, in high poverty counties, the discounted benefits generated by Head Start’s later crime reduction were likely larger than the costs of the program itself.

## 2 Evidence on the Origins of Criminal Behavior

Research on the developmental factors that influence the likelihood that an individual will become a criminal is limited, with many studies focusing on the period of adolescence. A number of evaluations of the Moving to Opportunity project provide mixed evidence on the effect of neighborhood environment on criminal behavior, while studies of assignment to foster care suggest that family environment has an important role in affecting both contemporaneous and later criminal behavior (Sanbonmatsu et al. 2011; Doyle 2007; Doyle

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removal of lead from gasoline, changes to compulsory schooling law ages in North Carolina, or the legalization of abortion), which occurred at the state level and generally affected different cohorts of individuals.

<sup>9</sup>Across a variety of approaches and subsamples our estimates indicate a small and non-significant relationship between childhood Head Start availability and the likelihood of living in one’s state of birth. Assuming similar patterns of criminality among North Carolina leavers and stayers, our upper bound estimate of additional migration can explain at most 5% of our estimated effect. We return to this below.

2008).<sup>10</sup> Several studies have focused on the relationship between secondary education and crime, suggesting that additional years of schooling, increases in school quality, and changes in the composition of school peers can affect the likelihood of criminal behavior several years later (Lochner and Moretti 2004; Deming 2011). Because these adolescent treatments occur at an age when individuals typically first decide to engage in crime, they may directly impact the costs or benefits of crime (e.g. through direct exposure to crime or criminal peers) rather than impacting the individual’s development.<sup>11</sup>

Research focusing on earlier periods of development is somewhat less common, with mixed evidence of effects. Emerging evidence suggests an important role for early childhood health and nutrition. Evaluations of the Nurse-Family Partnership Program, the CDC’s recommended treatment protocol for lead-poisoned children, and the Food Stamp program, all suggest significant effects of early health interventions on adolescent or adult criminal behavior (Olds et al. 1998, 2007; Billings and Schnepel 2017; Barr and Smith 2018).<sup>12</sup>

There are fewer studies that examine the role of early childhood education. Evaluations of somewhat resource intensive early childhood education programs provide mixed evidence. Heckman et al. (2010) suggests that HighScope Perry preschool participation led to large reductions in criminal behavior, but Campbell et al.’s (2012) evaluation of the Abecedarian program indicates limited effects of the program on crime. Furthermore, while these studies provide rigorous evidence driven by random assignment, both rely on small sample sizes from single sites to support their conclusions.<sup>13</sup> Even if one takes these effects as given, it is

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<sup>10</sup>While early evaluations of the program found mixed evidence of effects on involvement with the criminal justice system at different ages (Katz, Kling, and Liebman 2001; Kling, Ludwig, and Katz 2005; Ludwig and Kling 2007), Sanbonmatsu et al. (2011) indicates no clear pattern of significant effects on arrests or delinquent behavior. Any effects that exist appear to be a result of current neighborhood conditions rather than the neighborhood that one grew up in. Doyle (2008) finds that those on the margin of placement are two to three times more likely to enter the criminal justice system as adults if they are placed in foster care.

<sup>11</sup>Deming (2011) suggests peer effects as one explanation for the effect of school quality on criminal behavior. Bayer, Hjalmarsson and Pozen (2009) estimate criminal peer effects more directly, showing that juvenile offenders assigned to the same facility affect each other’s subsequent criminal behavior.

<sup>12</sup> Related to Billings and Schnepel (2017), there is also a growing literature on the effects of lead exposure on criminal behavior (Aizer and Currie 2017; Feigenbaum and Muller 2016).

<sup>13</sup>Recent evidence that adjusts for multiple hypothesis testing suggests that neither program had statis-

unclear whether these types of programs will continue to be effective at a larger scale.

## 2.1 The Evidence on Head Start

The Head Start program was an early piece of President Lyndon B. Johnson’s War on Poverty, commencing as a summer program in 1965, serving 560,000 children (Vinovskis 2005). It quickly expanded to a year-round program in the following year. Head Start’s mission was to “[provide] the children of the poor with an equal opportunity to develop their full potential” (Office of Child Development 1970). To that end, it was designed to focus on the “whole child” by providing a number of wrap-around services alongside education (Ludwig and Miller 2007). These additional services included providing nutritious meals and snacks and access to social workers, mental health and dental treatment, immunizations, and health screenings.

Head Start served a decidedly disadvantaged population in the early years of the program. The median family income of children enrolled in Head Start was less than half that of all families in the U.S. (Office of Child Development 1968). In the early years of the program, between nine and 17 percent of families reported having no running water inside the home and 65 to 70 percent of participants’ mothers did not finish high school. Approximately 25 percent lived in female-headed households and between 65 and 70 percent of participating children’s mothers were unemployed (Office of Child Development 1968).

While there is some debate about the pattern of short-run Head Start effects, prior quasi-experimental studies suggest Head Start has had important long-term effects for cohorts of children who participated from the late 1960s through the 1980s.<sup>14</sup> Leveraging sibling com-

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tically significant effects on crime and suggests there may not have been statistically significant benefits for boy participants in either program (Anderson 2008).

<sup>14</sup>While the Head Start Impact Study (HSIS) found initial positive effects on cognitive skill for participants in the mid-2000s, there were no persistent effects at first and third grade follow-ups (Puma et al. 2005, Puma et al. 2010, Puma et al. 2012). Re-analyses of the HSIS data suggest a more nuanced picture Montialoux (2016). These analyses revealed that there is considerable variation in impact by center Walters (2015), that effects are most pronounced among children who would otherwise be in parental or relative care Kline

parisons and discontinuities in grant-writing assistance and program eligibility, studies have documented increased educational attainment, better health, and higher earnings Carneiro and Ginja (2014); Deming (2009); Garces et al. (2002); Ludwig and Miller (2007), even in the presence of short-term test-score fadeout Deming (2009).

Two prior studies have included criminal behavior in their investigations of the long-run effects of Head Start, providing conflicting evidence. Garces et al. (2002) find that Head Start participation reduces later criminality among blacks, but Deming (2009) finds no effect. While effects on crime are not the focus of either paper, these estimates should be interpreted cautiously given well known issues with underreporting in self-reported measures of criminal behavior (Hindelang et al. 1981). Moreover, as both of these studies use family fixed effects designs, we might worry that even within families certain types of siblings select into treatment, which could lead to biased estimates of effects.

To overcome these measurement and endogeneity concerns, we leverage (1) unique administrative crime data from North Carolina containing offender county of birth, and (2) the plausibly exogenous rollout of the Head Start program over space and time (see Figure 1). The Head Start program was rolled out quickly and grant funds were distributed directly to local grantees as a means to circumvent governors, state legislatures, and agencies that may have prevented the funds from reaching black children (Gibbs et al. 2011; Vinovskis 2005). In the early years of the program, approximately 40 percent of counties in the U.S. received Head Start funding. As a result of the local distribution of funding, programs became available in different counties at different times. We leverage this variation to identify the effects of Head Start availability on adult criminal behavior.

Three concurrent papers use the early introduction of Head Start over geography and time to explore impacts on other outcomes using survey data.<sup>15</sup> Using the NLSY 79, Thompson and Walters (2016), and that Hispanic children and children with low skills at program entry experience the greatest benefit Bitler et al. (2014).

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<sup>15</sup>Ludwig and Miller (2007) also rely on county-level Head Start availability, leveraging a county poverty



(2017) demonstrates that individuals born in counties with greater levels of Head Start funding attain more education and have better health and earnings in adulthood. Using the PSID, Johnson and Jackson (2017) focus on the interaction between Head Start funding levels and subsequent schooling investments, suggesting the presence of dynamic complementarities for these two inputs. Finally, Barr and Gibbs (2017) explore the intergenerational effects of Head Start availability.

### 3 Data

Our primary data source is administrative conviction data from the state of North Carolina. We use these data, combined with information on the number of births within counties over time, to calculate rates of conviction for cohorts across counties. We use Head Start funding by county and year to construct a binary measure of Head Start availability by birth county and cohort. We link this to county by cohort conviction rates to estimate the effect of Head Start availability on crime.

#### 3.1 North Carolina Data

We obtained data containing public information on all individuals convicted of a crime in North Carolina between 1972 and 2015 from the North Carolina Department of Public Safety. The administrative data contain information on the type of crime, including the statute of the offense and whether it was a felony, as well as the name, dates of birth, gender, and race of the perpetrator. An important advantage of the North Carolina data over other state criminal databases is the inclusion of county of birth for each individual. Combining information on criminals' years and counties of birth with birth counts obtained from the North Carolina Department of Health and Human Services allows us to construct conviction rate discontinuity in Head Start grant-writing assistance, to demonstrate effects of the program on mortality.

rates for birth cohorts of individuals born in North Carolina. For example, to generate the cohort conviction rate for children born in county  $c$  in 1961, we divide the number of convicted individuals born in county  $c$  in 1961 by the total number of individuals born in county  $c$  in 1961.

Summary statistics are contained in Table 1. Roughly 5 percent of individuals born between 1955 and 1968 were convicted of a crime by age 35. Looking by type of crime, 2.2 percent were convicted of violent crime and 2.6 percent were convicted of a property crime by age 35.<sup>16</sup> While the data contain the universe of individuals convicted of a crime in North Carolina during this time period and allow us to link these individuals to their counties of birth, they are limited in that they do not allow us to observe convictions for individuals who are born in North Carolina and then leave the state. While most likely criminals remain in their state of birth (and the rate of criminal behavior is actually lower for those who leave), this may be a concern for interpretation of our estimates if Head Start availability generates additional migration of individuals out of the state, but they still commit crime elsewhere.<sup>17</sup> We return to this concern below, providing evidence that program availability does not appear to influence migration rates.<sup>18,19</sup>

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<sup>16</sup>We largely follow the convention of FBI's Uniform Crime Reporting Statistics for Part I offenses. Violent crimes are defined as offenses containing the words "murder", "assault", or "robbery". Property crimes are defined as offenses containing the words "burglary" or "larceny".

<sup>17</sup>Roughly 70% of individuals born in North Carolina during this period reside there between the ages of 18 and 35. This share is even higher (roughly 80%) for those with the highest rates of criminal behavior (between ages 18 and 24, non-white, or with less than a high-school degree).

<sup>18</sup>Specifically, we explore the relationship between measures of childhood Head Start availability (at the state of birth by birth cohort level) and the likelihood of living in one's state of birth. Across a variety of approaches and subsamples our estimates indicate a small and non-significant relationship between childhood Head Start availability and the likelihood of living in one's state of birth. We address this concern further in Section 4.3

<sup>19</sup>We may also be missing individuals with one-time nonviolent convictions (at any age) or one-time drug convictions (under age 22) that hired a lawyer and had the record expunged.

### 3.2 Head Start Data

We follow Barr and Gibb’s (2017) construction of Head Start availability measures, which rely on county-by-year data from the Community Action Programs (CAP) and Federal Outlay System (FOS) files obtained from the National Archives and Records Administration (NARA).<sup>20</sup> We aggregate funding data by county and year and construct an availability measure as an indicator equal to one if a county had Head Start expenditures per four-year old above the tenth percentile.<sup>21</sup>

## 4 Estimation of Program Availability Effects

To estimate the effect of Head Start availability during childhood on adult crime, we leverage within county variation in the availability of Head Start generated by the initial roll-out of the program in the 1960s. For example, we utilize the fact that eligible four-year-olds in 55 out of North Carolina’s 100 counties had access to Head Start in 1968 while no four-year-olds had access to Head Start prior to 1965 (See Figure 1).

The Head Start program targeted children from families at or below the federal poverty line.<sup>22</sup> Therefore, Head Start availability likely had a more dramatic impact in counties with high poverty rates. Indeed, funding per four-year old is three to four times as high in high-poverty counties (Figure 2). Accordingly, we conduct much of our analyses separately for high and low poverty counties, splitting counties at the median poverty level for all counties in North Carolina in 1960. For both poverty groups we estimate a difference-in-differences specification:

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<sup>20</sup>See Barr and Gibb’s (2017) Data Appendix for details.

<sup>21</sup>We use this threshold for consistency with Barr and Gibbs (2017), who find that using this threshold better predicts Head Start take-up, but neither the values of the availability indicator (in North Carolina) nor the main results are sensitive to moving this threshold.

<sup>22</sup>At least 90 percent of Head Start participants at each site had to be from families below the poverty line.

$$C_{ct} = \alpha_c + \alpha_t + \beta HS_{ct} + \gamma(X_{c,60} \times t) + \epsilon_{ct},$$

where  $C_{ct}$  is the conviction rate for those born in county  $c$  in year  $t$ ,  $HS_{ct}$  is indicator for whether a county-cohort was exposed to Head Start,  $\alpha_c$  and  $\alpha_t$  are birth county and birth cohort fixed effects, and  $X_{c,60} \times t$  are controls for birth county characteristics in 1960 interacted with a time trend. Including these trends allows, for example, counties which are more rural or have an older age demographic to trend differently than more urban and younger counties.<sup>23</sup> Standard errors are clustered at the county of birth level.

## 4.1 Main Results

Our primary interest is in the coefficient  $\beta$ , which represents the effect of Head Start availability on adult crime. Given the focus of the Head Start program on poor children and the resulting concentration of funding among high-poverty counties, we present estimates separately for high and low poverty counties. Our main estimates suggest a 1.3 percentage point reduction in high poverty counties, but offer no evidence of effects in low poverty counties (Table 2). The 1.3 percentage point reduction in high poverty counties is 28% off the mean conviction rate of 4.7%. While the point estimates in low poverty counties are small, positive, and insignificantly different from zero, we cannot reject the equivalence of the effects of Head Start *participation* given the substantially higher participation rates in high-poverty counties. In other words, the differences in estimates across the high and low poverty counties can potentially be explained as capturing the differential Head Start “dosage” by poverty level.<sup>24</sup> We have also estimated specifications that interact the continuous poverty rate with

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<sup>23</sup>The county characteristics include the percent of people living in families with less than \$3,000 (1960 dollars), the percent living in urban areas, the percent black, the percent under 5 years old, the percent over 65 years old, the percent of land in farming, and the percent of employment in agriculture.

<sup>24</sup>Figure 3 presents coefficient estimates for the same specification by poverty quintiles. While there is evidence of a Head Start effect in the fourth quintile, the most dramatic effect occurs in counties in the highest poverty quintile.

an indicator for Head Start availability (Appendix Table A1). Using this approach, we estimate that the reduction in crime rate due to Head Start availability is 0.2 percentage points larger for each 10 percentage point increase in the poverty rate. Consistent with our prior estimates these estimates suggest that the effect of Head Start ranged from 0.000 in the county with the lowest poverty rate (23 percent) to roughly 1 percentage point in the county with the highest (74 percent).

The estimates are robust to the inclusion of pretreatment (1960) county characteristics interacted with time trends as well as the inclusion of covariates indicating availability of other War on Poverty programs, such as Food Stamps, Medicaid, Community Health Centers, etc. (Tables A2 and A3). While our baseline inference relies on standard errors clustered at the county of birth level, we have also explored the robustness of our p-values to an even more conservative approach: randomization inference. Under this procedure, we randomly assign the rollout year of Head Start in each county and estimate our baseline specification. The distribution of these estimates over 1,000 iterations is contained in Appendix Figure A1. As can be seen in the figures, the estimates we observe in our baseline results are quite unlikely under random assignment. The two-tailed p-values we obtain from this randomization inference approach are similar to those obtained using our baseline approach.<sup>25</sup>

To understand the dynamics of how the program may have affected adult criminal outcomes and to test for pre-trends that may confound our baseline specification, we also present estimates from an event study specification. We center counties around the first year that Head Start is available, and estimate the following specification separately for counties above and below the median poverty rate:

$$C_{ct} = \sum_{\tau=-6}^{7+} \beta_{\tau} 1(t = T_c + \tau) + \alpha_c + \alpha_t + \gamma(X_{c,60} \times t) + \epsilon_{ct},$$

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<sup>25</sup>P-values presented are the two-tailed statistics calculated as the share of coefficient estimates obtained under random assignment of Head Start timing that are larger in absolute magnitude than the estimate produced using the true timing of assignment.

We are primarily interested in the coefficients on the indicators,  $1(t = T_c + \tau)$ , each of which indicates how many years cohort  $t$  in county  $c$  is removed from the first cohort in county  $c$  exposed to Head Start,  $T_c$ . Our baseline dynamic estimates (Table 3 and Figure 4) indicate a flat trend in cohort conviction rates before Head Start rollout for both high and low poverty counties. This provides evidence that our difference-in-differences estimates are not capturing differential pre-existing trends in the years prior to county’s rollout of Head Start. For cohorts exposed to Head Start, we see significant decreases in the conviction rate for the high poverty counties but continue to see no evidence of changes in the low poverty counties. In the high poverty counties, the estimates of crime reduction appear to grow somewhat as the program persists in a county. In particular, the impact of Head Start availability in the first year of the program is substantially smaller than in subsequent years. This may be due to centers improving (or increasing the size of) their Head Start programs during the first years of operation or as a result of peer effects.<sup>26</sup> Indeed, funding does appear to increase somewhat during the early years of program operation (Figure 2).

## 4.2 Magnitude of Effect on Criminal Behavior

Our estimated effects of the availability of Head Start on criminal behavior are substantial. Our preferred estimates indicate reductions in the likelihood of any serious conviction of 1.3 percentage points (among cohorts in high poverty counties). To put our results in the context of recent literature with similar outcome measures, these estimates imply treatment-on-the-treated (TOT) effects of 6 to 9 percentage points.<sup>27</sup>

While it isn’t straightforward to construct comparable measures of criminal behavior

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<sup>26</sup>If peer effects are an important factor in criminal behavior, we would expect smaller effects of the program in the first year as compared to subsequent years when older peers would have also experienced the program.

<sup>27</sup>These TOT estimates are based on estimated Head Start participation rates in high poverty counties of 15 to 21 percent. The lower bound is based on OEO statistics on state-level North Carolina Head Start enrollment in 1966 and the upper bound is based on author’s calculations assuming the national per participant funding level is fixed across North Carolina counties.

across studies, our implied TOT effects are between half and two-thirds of the size of effects on somewhat similar measures reported in evaluations of the Perry Preschool program (11 to 12 percentage points on any arrest (or any charges) by age 40).<sup>28,29</sup> As in the Perry evaluation, we find larger effects on property crimes; Head Start access reduces the likelihood of a serious property conviction by 0.9 percentage points, a TOT effect of roughly 5 percentage points in high-poverty counties (Table 4). While there is no significant effect on serious violent convictions, the point estimate (0.0046) implies a TOT of approximately 3 percentage points.<sup>30</sup> In comparison, Schweinhart et al. (2005) find a 16 percentage point reduction in violent arrests by age 40 (32 versus 48 percent) and a 22 percentage point reduction in property arrests by age 40 (36 versus 58 percent) in their evaluation of Perry preschool, four to five times the size of our effects.<sup>31</sup> Perry Preschool enrolled a very particular type of student: extremely disadvantaged, black children in Ypsilanti, Michigan. If we split our property crime estimates by race, we find similar effects for whites and non-whites (Table 5).<sup>32</sup>

Of course it may not be reasonable to convert our estimates to TOT effects as there may be important spillover effects of program availability; indeed, it is not difficult to imagine that

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<sup>28</sup>The treatment effect of Perry Preschool on any felony arrest, the definition of which overlaps substantially with Part 1 crimes, is even larger (15 percentage points), but is reported only for males (Heckman et al. 2009).

<sup>29</sup>Our TOT estimates are less than half of the effects estimated for the Nurse-Family Partnership by age 19 (16 percentage points on likelihood of conviction or arrest) and the effects estimated for the full set of services provided by a more recent intervention targeted at children with high blood lead levels (17 percentage points on likelihood of arrest). The less intensive set of services, primarily information on how to reduce lead exposure and eat better, produced effects of a similar size to our implied TOT estimates (Olds et al. 1998, 2007; and Billings and Schnepel 2017). Our effect sizes are similar to recent estimates of the effects of early childhood Food Stamp access (Barr and Smith 2018). In contrast to all three of these health interventions, which found strong effects on violent criminal behavior, the effects of Head Start access are stronger on property crimes.

<sup>30</sup>The event studies indicate that Head Start availability likely reduced both types of crime (Figures 5 and 6). These p-values are also robust to randomization inference (Appendix Figures A2 and A3).

<sup>31</sup>Although we note that these are effects on *any* arrest and thus may not be directly comparable to convictions for a serious violent or property crime. Treatment estimates of Perry Preschool on the *number* of felony arrests indicates no significant difference in the number of serious violent crimes and a 90 % reduction in the number of felony property arrests (0.31 versus 2.91 per individual).

<sup>32</sup>The estimates for violent crime are in Appendix Table A4. During this period in North Carolina, blacks comprised more than 95% percent of the non-white population (1970 Census).

improving the behavioral trajectories of a significant share of a group results in improvements for the group as a whole that are substantially larger than what we might expect to see if an individual was treated in isolation. Unlike the Perry evaluation, in which fewer than 50 children were offered a spot in the treatment group, Head Start was attended by a substantial fraction of children, particularly in poor areas. As participants interacted with others in their cohort, effects of the program might have spilled over to the children of non-participants in a way that would have been unlikely with the smaller treatment and control groups in the Perry evaluation. It is easy to see how these spillovers might operate through peer effects. Given the potential for large spillovers, we focus our discussion on the estimated effects of Head Start availability rather than participation.

### **4.3 Threats to Internal Validity**

To interpret these estimates as the causal effect of Head Start availability, it must be the case that the availability of a Head Start program is, conditional on county and year of birth fixed effects, unrelated to other factors that would affect the outcomes of children born to women who did and did not have the program available. While the evidence indicates large negative effects of Head Start availability on crime, here we address concerns related to the endogeneity of Head Start program adoption as well potential concerns related to the effect of Head Start availability on migration out of North Carolina.

#### **4.3.1 Endogeneity of Head Start Availability**

Whereas the initial policy implementation occurred at the federal level, variation in the rollout of the policy occurred at the county level. Because we are controlling for variation over time (with birth cohort fixed effects) and fixed differences between counties (with county fixed effects), the concern is that counties adopted the Head Start program when four year olds in those counties happened to be less likely to commit crimes as adults for some other



reason. For example, counties that chose to adopt the Head Start program earlier may be those who were proactively improving medical or childcare for four year olds at the same time. If this were the case, we might observe reduced criminal behavior for these cohorts due to a comprehensive effort to help them, and not because of Head Start availability.

If this type of endogenous policy implementation were occurring, we would expect to see some strong association between county characteristics and the timing of adoption. In Tables A5 and A6 we explore the endogeneity of Head Start adoption within North Carolina, regressing county characteristics on Head Start timing. We find no statistically significant relationship between county characteristics in 1960 and the timing of Head Start availability, whereas more populous counties were more likely to get the program at all during this time period.<sup>33</sup> Consistent with this, the inclusion of 1960 county characteristics interacted with a trend in birth year has little impact on our estimates. A related concern is that there are pre-existing trends in the likelihood of criminal behavior in counties that are related to the timing of Head Start adoption. Allowing for birth-county specific trends also has no effect on our point estimates (Table A7).

The event-study estimation depicted in Figure 4 further addresses concerns related to endogenous program adoption by demonstrating no “effect” of Head Start availability in the years prior to the program’s initial rollout in a county and a sharp jump immediately following the program’s introduction. This figure also addresses concerns that there were subsequent changes in a county that affected crime rates, such as changes to its criminal justice system, that are correlated with but not caused by the timing of a county’s Head Start adoption. For such a correlation to produce our event study results, the policy change would have to precisely target only cohorts exposed to Head Start availability and have no effect on cohorts born just a couple years earlier.

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<sup>33</sup>We present these relationships between county characteristics and the timing of Head Start adoption graphically in Appendix Figure A6. As with our regression estimates, there is little relationship between county characteristics and the timing of adoption, supporting the validity of our identification strategy.

If changes in availability of other War on Poverty programs occurred in a county at the same time as the rollout of Head Start, then our estimates could be capturing the effects of those programs rather than the effect Head Start. We address this concern by including controls for the availability of various War on Poverty Programs in Tables A2 and A3.<sup>34</sup> We find that our baseline estimates are robust to the inclusion of these controls.

#### **4.3.2 Effects of Head Start Availability on Migration out of North Carolina**

Another potential threat to the validity of our estimates relates to our data. While the data contain the universe of individuals convicted of a crime in North Carolina during this time period and allow us to link these individuals to their counties of birth, they are limited in that they do not allow us to observe convictions for individuals who are born in North Carolina and then leave the state. Fortunately, most individuals born in North Carolina remain there during adulthood; roughly 70% born in North Carolina during this period reside there between the ages of 18 and 35. This share is even higher (roughly 80%) for those with the highest rates of criminal behavior (between ages 18 and 24, non-white, or with less than a high-school degree).

And yet we might still be concerned if Head Start availability has differential effects on migration out of the state. While this will not affect our estimates of convictions in North Carolina, it is a potential concern for interpreting the estimates as representing an overall reduction in criminal behavior. Specifically, we would be concerned if Head Start availability led individuals to be more likely to leave the state but no less likely to commit a crime, as we could confuse this for a reduction in crime. In Appendix Table A8, we explore the relationship between measures of childhood Head Start availability (at the state of birth by birth cohort level) and the likelihood of living in one's state of birth. Across a variety of approaches and

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<sup>34</sup>Following Bailey and Goodman-Bacon (2015), we consider controls for the Food Stamp Program as well as per capita expenditures on Public Assistance Transfers, Medicaid expenditures, Community Health Centers and Community Action Agencies.

subsamples our estimates indicate a small and non-significant relationship between childhood Head Start availability and the likelihood of living in one’s state of birth. Assuming similar patterns of criminality among North Carolina leavers and stayers, our upper bound estimate of additional migration can explain at most 5% of our estimated effect.<sup>35</sup> Even this upper bound is likely an overestimate as the mean rate of criminal conviction for movers to North Carolina (i.e., the equivalent of state of birth leavers) is lower than the rate for those born in North Carolina in our data.

## 4.4 Quantifying the Benefits

How do Head Start’s future benefits of crime reduction compare to the costs of the program? To enable this comparison, we present back-of-the-envelope estimates of the discounted future value of crime reduction in Table 6 by offense for various choices of discount rates (Columns 4-7). Column 2 shows the reduction in number of convictions per Head Start enrollee implied by our difference-in-differences estimate for high poverty counties.<sup>36</sup> Column 3 shows the reduction in the number of crimes associated with this reduction in convictions.<sup>37</sup> We apply McCollister et al (2010) estimates of the social cost (2015 dollars) of each type of crime (Column 1) to arrive at our estimates for the benefits generated by Head Start participation in high poverty counties (Columns 4-7).<sup>38</sup> Undiscounted, we estimate these benefits to be \$9,835, at least three times the cost of the program per individual during this time

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<sup>35</sup>Even assuming the largest estimated effect on migration, it would have to be the case that 65% of the marginal migrants were criminals to account for our estimates.

<sup>36</sup>We convert the difference-in-differences coefficient estimate to the number of convictions per Head Start enrollee in two steps. First, we divide it by the Head Start participation rate to obtain the TOT effect. Second, we convert unique convicts per Head Start enrollee to number of convictions per Head Start enrollee by multiplying by the mean convictions by age for the sample of convicts. Column 2 shows the result across ages 18-35.

<sup>37</sup>North Carolina has roughly 5.4 burglary and larceny arrests per conviction and roughly 5.8 reported burglary and larceny offenses per arrest (authors’ calculations using statistics from the NC State Bureau of Investigation’s “Crime in North Carolina -1995” report).

<sup>38</sup>Benefits are calculated for each age from 18-35 and then discounted back to age 4 (for comparison with the program cost) at the given rate.

period.<sup>39</sup> Under standard discount rates (3-5%), we estimate that the discounted benefits from property crime reduction exceed the costs of the program. With a discount rate of 7%, the estimated benefits fall to \$2,335, somewhat less than the cost of the program. However, we view these figures as quite conservative as they focus exclusively on serious property crimes, despite the high likelihood of effects on other crime types, suggesting that in high-poverty counties the Head Start program passes a cost-benefit test based on its effects on crime alone.

## 5 Conclusion

We contribute to the sparse literature on the developmental factors that influence an individual's likelihood of becoming a criminal by exploring the effect of early childhood education on criminal behavior. Understanding the role of early childhood education in later criminal behavior has become increasingly relevant given recent expansions in the share of children attending public preschools. These expansions have been driven in large part by a belief among policymakers that early childhood education interventions have large impacts later in life. Given the major contribution of crime reduction to cost-benefit analyses of similar programs used to motivate recent expansions (for example, crime reduction accounts for 40-65% of the benefits estimated in the context of Perry preschool), it is critical to better understand the relationship between early childhood education and later criminal behavior and the extent to which this relationship may hold at scale. We bring new evidence to this question by investigating the effect of Head Start availability on criminal behavior.

We use individual-level administrative data for the universe of convicted criminals in North Carolina between 1972 and 2015. These administrative data are particularly well

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<sup>39</sup>We report the benefit cost ratios based on expenditures per pupil during the first few years of the program. The ratios are somewhat smaller using full-time expenditures per pupil estimates from the later years of our sample period.

suited to our estimation strategy as they contain each criminal’s county of birth, allowing us to overcome a variety of measurement and endogeneity concerns that likely inhibited earlier attempts to investigate the effects of the early childhood environment on later criminal behavior. Using these data, we provide the first large-scale evidence that early childhood education reduces later criminal behavior and the first estimates of the effect of Head Start availability on crime using administrative data (and thus not subject to concerns about the reporting of crime in survey data). We find that Head Start availability reduces the likelihood of a serious conviction by age 35 by 1.3 percentage points, but only in high-poverty counties. These estimates imply treatment effects of Head Start participation of roughly 6-9 percentage points. Given the high costs of crime, back-of-the-envelope calculations using these estimates indicate that the size of the discounted external benefits generated by Head Start’s later crime reduction likely exceeded the costs of the program in high poverty counties. This is especially noteworthy considering that later crime reduction was not the stated objective of the program.

While additional analysis of other and more recent early childhood programs is warranted, our results indicate a meaningful connection between targeted, large scale early childhood education interventions and criminal behavior. These results provide evidence in support of recent state efforts to expand early childhood education, but point to large potential gains from targeting these efforts toward higher poverty areas. Additional work is needed to better understand the extent to which the effects of targeted early childhood education programs extrapolate to the increasingly open or universal access programs proposed and implemented in recent years.

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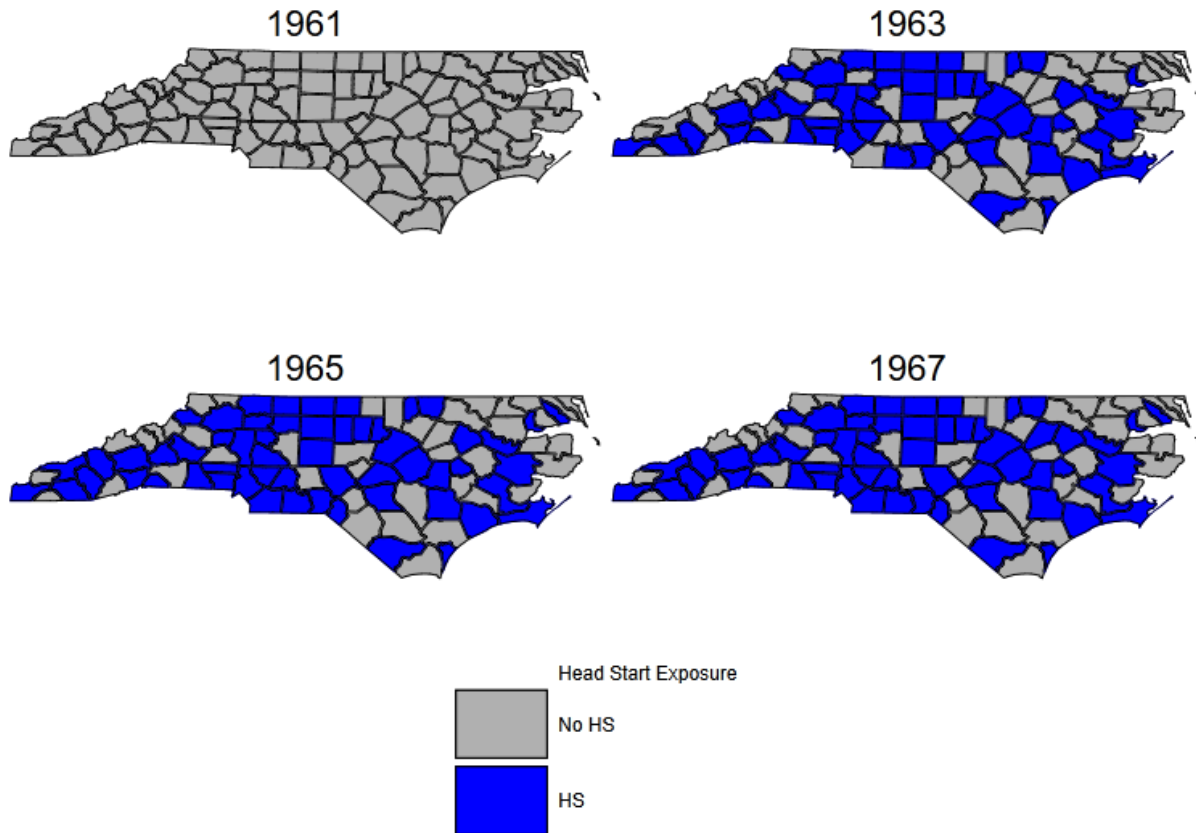
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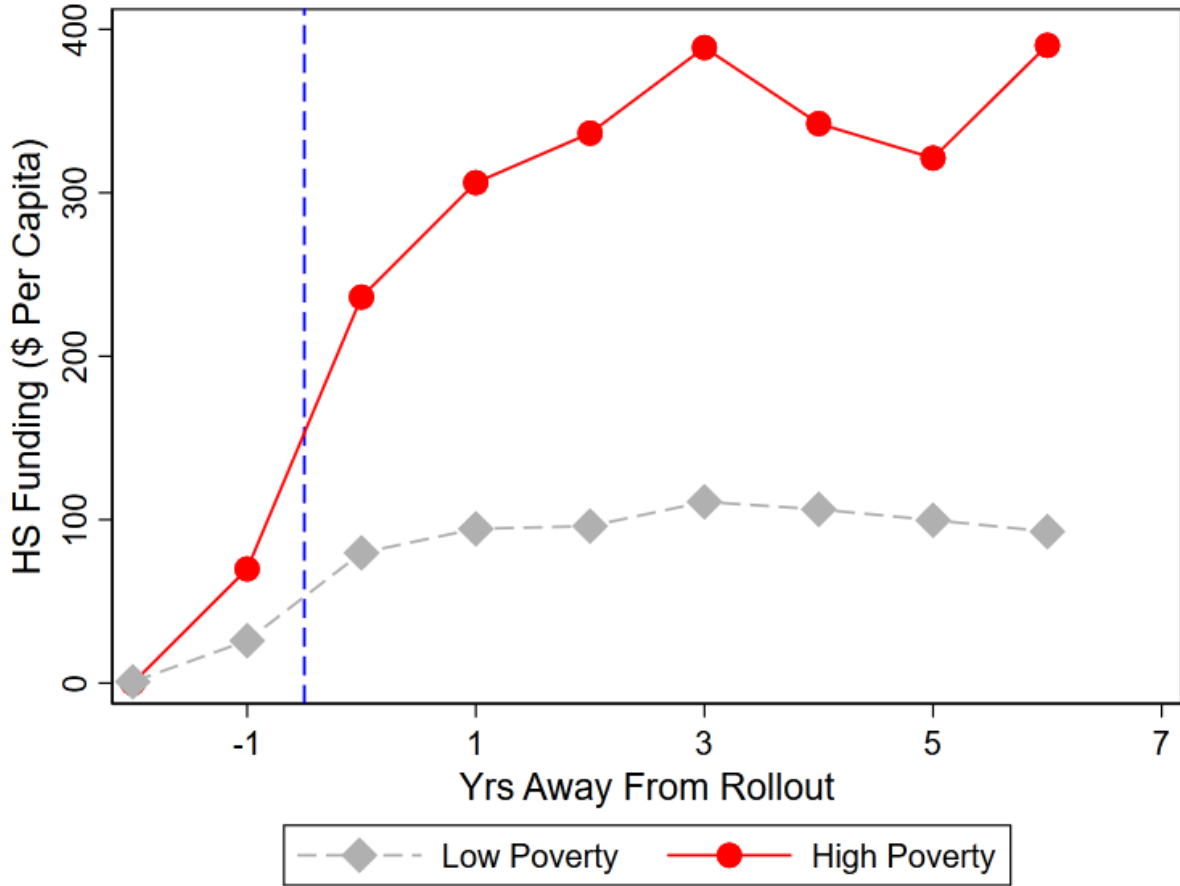
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Figure 1: County by Birth Cohort Head Start Rollout in North Carolina



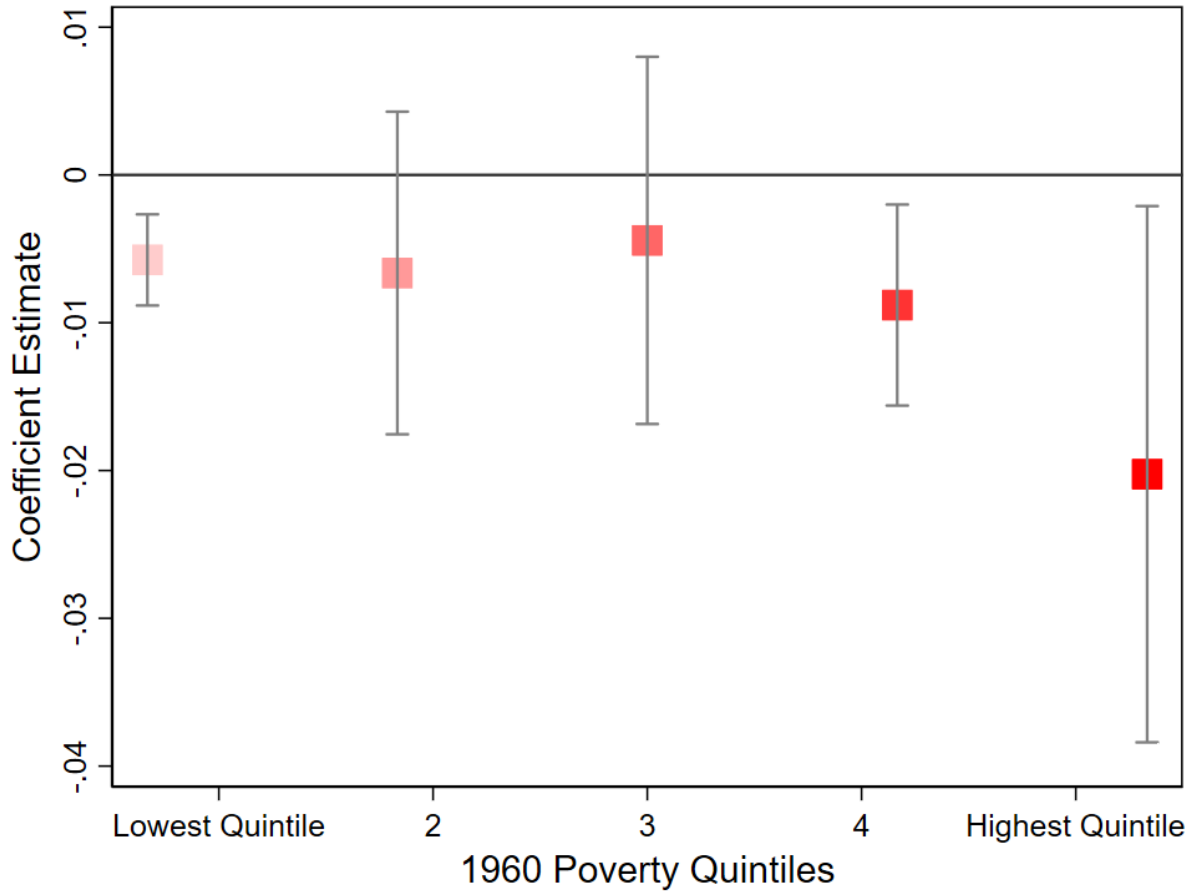
**Note:** Figure shows which birth-cohorts born to which counties had Head Start available to them in North Carolina from 1960 to 1968. Head Start availability is identified from county by year level Head Start funding data following Barr and Gibbs (2017). Head Start funding levels are obtained from Head Start Historical Records.

Figure 2: Head Start Funding By County Poverty Level



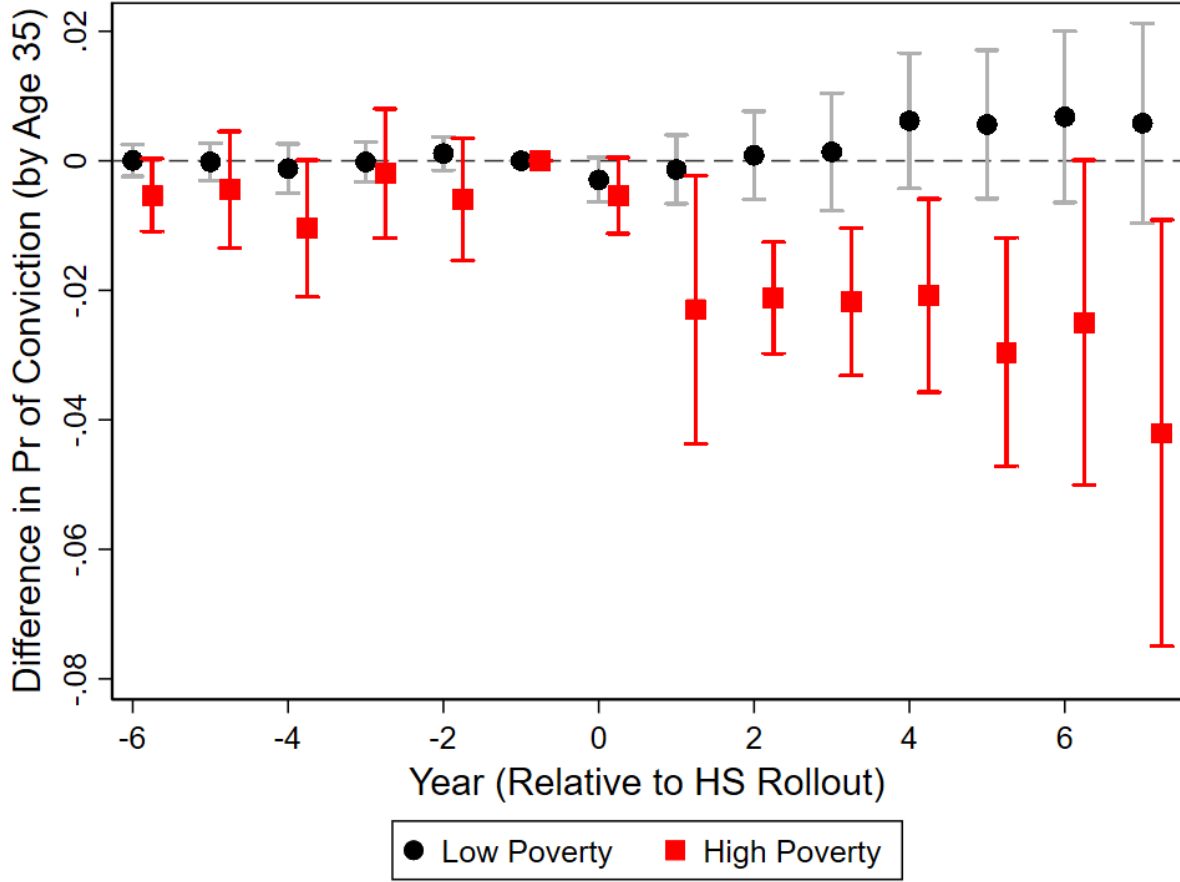
**Note:** Figure shows per capita county level Head Start funding (given in \$ per 4 year olds) separately for high and low poverty counties. There exist non-zero funding levels in the year prior to Head Start rollout for two reasons: first, following Barr and Gibbs (2017), county birth cohorts with very low funding levels are treated as not having Head Start availability, and, second, we do not count 1965 as the first year of availability since the Head Start program was introduced only as a pilot program over the Summer in that year. High poverty counties are those counties with a 1960 poverty rate above the median in North Carolina (40.2% poverty), while low poverty are those with a below median 1960 poverty rate.

Figure 3: DD Estimates by Quintiles



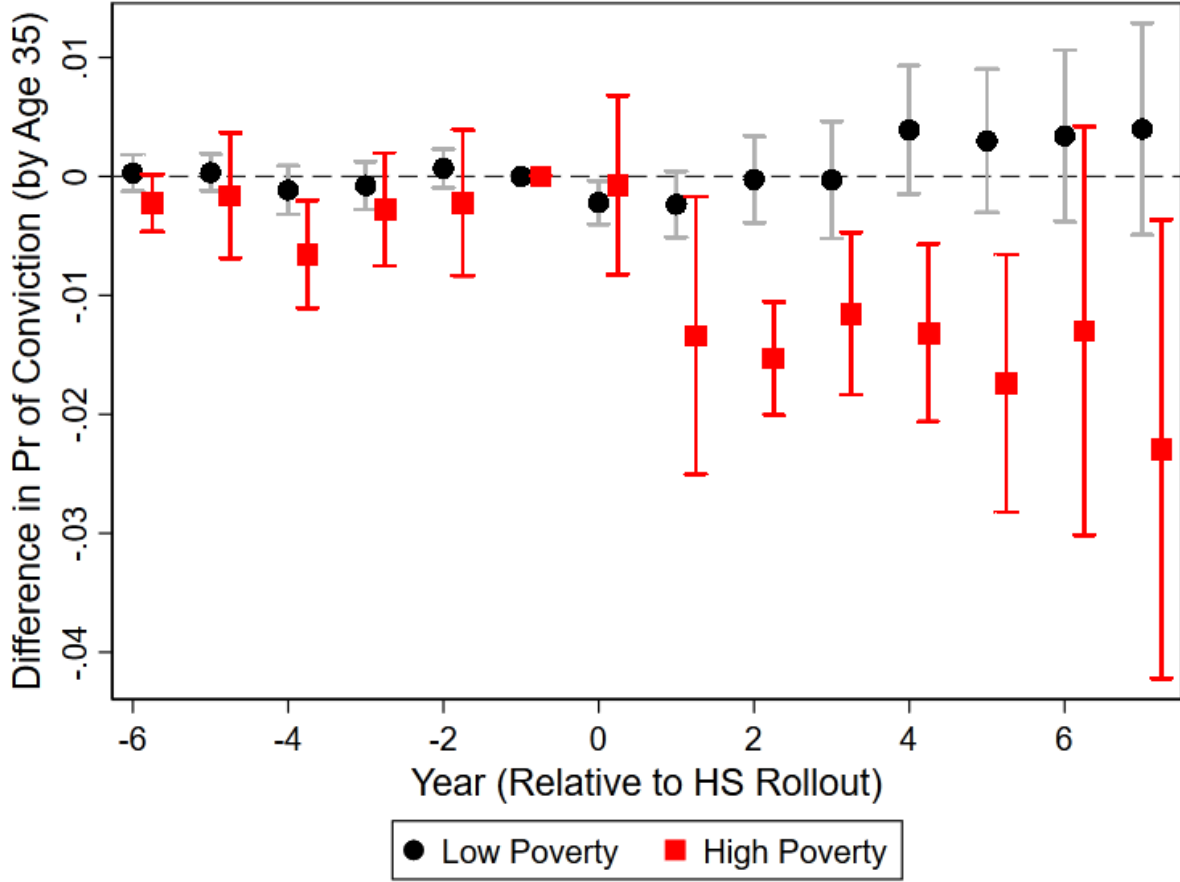
**Note:** Figure shows the coefficient estimates and 95% confidence intervals from estimating our basic difference-in-differences specification separately for counties in each quintile of the 1960 North Carolina poverty rate. Observations are at the birth county by birth year level and are weighted by the number of births in each county in 1955. The dependent variable is the fraction of individuals in a given birth county and birth year cohort that are later convicted of a UCR Part 1 crime in North Carolina by age 35. UCR Part 1 crimes include violent crimes (those in which the description of the offense contains the words “murder”, “assault”, or “robbery” (rape not being included), and property crimes (those in which the description of the offense contains the words “burglary” or “larceny”). All specifications include birth county and birth-cohort fixed effects as well as 1960 county characteristics interacted with a time trend in birth cohort. 1960 county characteristics include: percent of land in farming, percent of people living in families with less than \$3,000, percent of population in urban area, percent black, percent less than age 5, percent greater than age 65, and percent of employment in agriculture. The sample is restricted to counties that ever received Head Start between 1965 and 1976. The sample is further restricted to cohorts who were born between 1955 and 1968.

Figure 4: Event Study



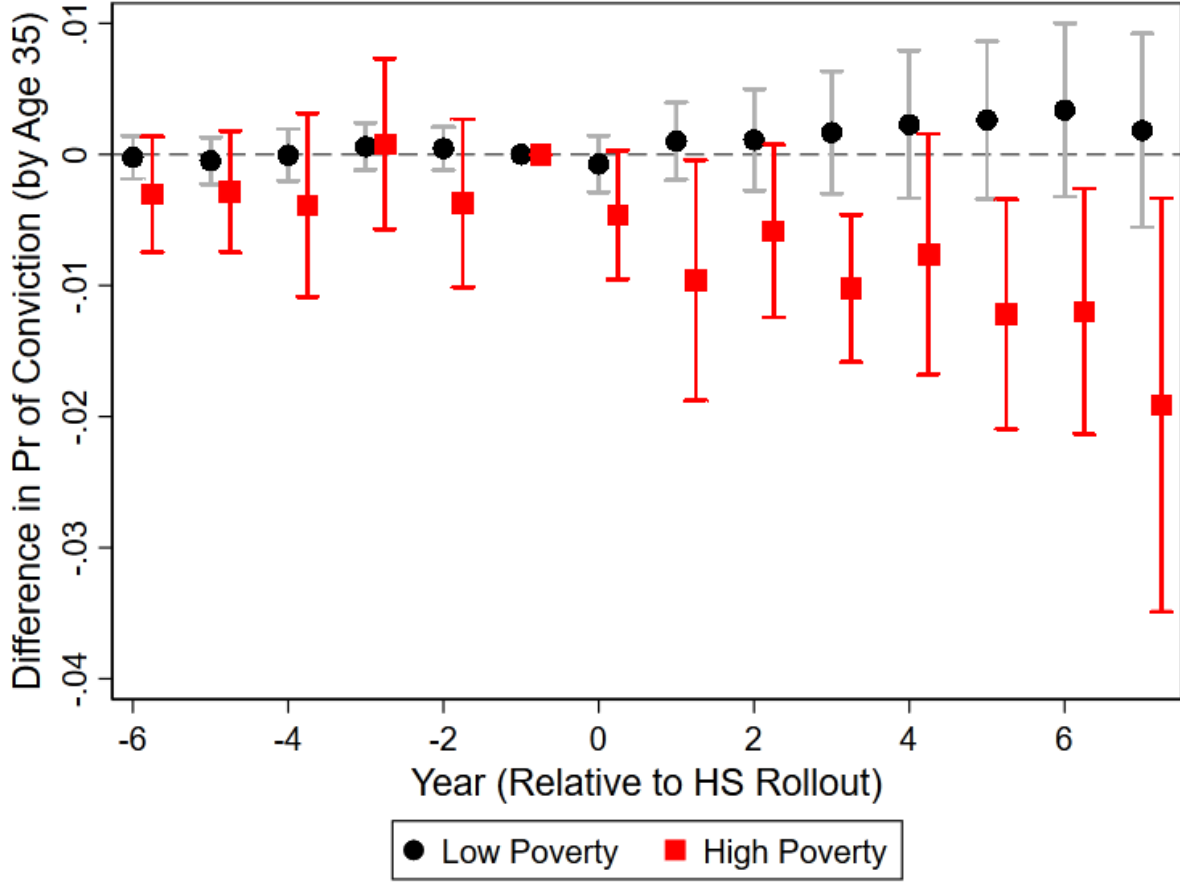
**Note:** Figure shows the coefficient estimates and 95% confidence interval from estimating Equation 4.1 separately for high and low poverty counties. Observations are at the birth county by birth year level and are weighted by the number of births in each county in 1955 (just as in Table 3). The dependent variable is the fraction of individuals in a given birth county and birth year cohort that are later convicted of a UCR Part 1 crime in North Carolina by age 35. UCR Part 1 crimes include violent crimes (those in which the description of the offense contains the words “murder”, “assault”, or “robbery” (rape not being included), and property crimes (those in which the description of the offense contains the words “burglary” or “larceny”). All specifications include birth county and birth-cohort fixed effects as well as 1960 county characteristics interacted with a time trend in birth cohort. 1960 county characteristics include: percent of land in farming, percent of people living in families with less than \$3,000, percent of population in urban area, percent black, percent less than age 5, percent greater than age 65, and percent of employment in agriculture. Those counties whose poverty rate in 1960 was above the median in North Carolina (40.2% poverty) are called “High Poverty”, while those below the median are called “Low Poverty”. The sample is restricted to counties that ever received Head Start between 1965 and 1976. The sample is further restricted to cohorts who were born between 1955 and 1968.

Figure 5: Event Study, Part 1 Property Crimes



**Note:** Figure shows the coefficient estimates and 95% confidence interval from estimating Equation 4.1 separately for high and low poverty counties. Observations are at the birth county by birth year level and are weighted by the number of births in each county in 1955. The dependent variable is the fraction of individuals in a given birth county and birth year cohort that are later convicted of a UCR Part 1 property crime in North Carolina by age 35. UCR Part 1 crimes include violent crimes (those in which the description of the offense contains the words “murder”, “assault”, or “robbery” (rape not being included), and property crimes (those in which the description of the offense contains the words “burglary” or “larceny”). All specifications include birth county and birth-cohort fixed effects as well as 1960 county characteristics interacted with a time trend in birth cohort. 1960 county characteristics include: percent of land in farming, percent of people living in families with less than \$3,000, percent of population in urban area, percent black, percent less than age 5, percent greater than age 65, and percent of employment in agriculture. Those counties whose poverty rate in 1960 was above the median in North Carolina (40.2% poverty) are called “High Poverty”, while those below the median are called “Low Poverty”. The sample is restricted to counties that ever received Head Start between 1965 and 1976. The sample is further restricted to cohorts who were born between 1955 and 1968.

Figure 6: Event Study, Part 1 Violent Crimes



**Note:** Figure shows the coefficient estimates and 95% confidence interval from estimating Equation 4.1 separately for high and low poverty counties. Observations are at the birth county by birth year level and are weighted by the number of births in each county in 1955 (just as in Table 3). The dependent variable is the fraction of individuals in a given birth county and birth year cohort that are later convicted of a UCR Part 1 violent crime in North Carolina by age 35. UCR Part 1 crimes include violent crimes (those in which the description of the offense contains the words “murder”, “assault”, or “robbery” (rape not being included), and property crimes (those in which the description of the offense contains the words “burglary” or “larceny”). All specifications include birth county and birth-cohort fixed effects as well as 1960 county characteristics interacted with a time trend in birth cohort. 1960 county characteristics include: percent of land in farming, percent of people living in families with less than \$3,000, percent of population in urban area, percent black, percent less than age 5, percent greater than age 65, and percent of employment in agriculture. Those counties whose poverty rate in 1960 was above the median in North Carolina (40.2%) are called “High Poverty”, while those below the median are called “Low Poverty”. The sample is restricted to counties that ever received Head Start between 1965 and 1976. The sample is further restricted to cohorts who were born between 1955 and 1968.

Table 1: Descriptive Statistics

	All	High Poverty	Low Poverty
<b>Panel A: Crime Outcome Variables</b>			
Part 1 Conviction by Age 35	0.0476 (0.0230)	0.0469 (0.0265)	0.0478 (0.0220)
Property	0.0256 (0.0125)	0.0255 (0.0146)	0.0257 (0.0118)
Violent	0.0220 (0.0114)	0.0214 (0.0128)	0.0221 (0.0109)
White	0.0135 (0.00730)	0.0128 (0.00851)	0.0137 (0.00689)
Non-White	0.0513 (0.0251)	0.0555 (0.0214)	0.0555 (0.0247)
<b>Panel B: Head Start Availability Variables</b>			
First Cohort with HS Availability	1962.3 (2.480)	1962.3 (2.741)	1962.3 (2.403)
HS Funding (\$ per 4 year old)	139.12 (188.37)	301.73 (299.61)	93.83 (105.11)
Observations	882	308	574

**Note:** Panel A contains summary statistics of crime outcome variables for the sample of birth cohorts born from 1955 to 1968. Each observation is at the county birth-cohort level. The outcome variable is the fraction of individuals in a given birth county and birth year cohort that are later convicted of a UCR Part 1 crime in North Carolina by age 35. UCR Part 1 crimes include violent crimes (those in which the description of the offense contains the words “murder”, “assault”, or “robbery” (rape not being included), and property crimes (those in which the description of the offense contains the words “burglary” or “larceny”). Panel B contains summary statistics for Head Start availability and funding. (Funding levels are given for exposed county-cohorts only, so that only non-zero values are included.) All variables are further broken down by county level poverty status. Those counties whose poverty rate in 1960 was above the median in North Carolina (40.2% poverty) are called “High Poverty”, while those below the median are called “Low Poverty”. The sample is restricted to counties that ever received Head Start between 1965 and 1976. Standard deviations are given in parentheses. Data sources are, respectively, the NC Department of Corrections, and Head Start Historical Records.



Table 2: Effect of Head Start Availability on Rate of Serious Criminal Conviction by Age 35

	All		High Poverty		Low Poverty	
	(1)	(2)	(3)	(4)	(5)	(6)
Head Start Availability	-0.0018 (0.0031)	-0.0030 (0.0030)	-0.0131** (0.0057)	-0.0131** (0.0059)	0.0026 (0.0032)	0.0012 (0.0040)
Observations	882	882	308	308	574	574
Mean	0.0476	0.0476	0.0469	0.0469	0.0478	0.0478
Baseline Chars x Trend		X		X		X

**Note:** Each column reports a separate OLS regression with standard errors clustered at the birth county level and reported in parentheses. Observations are at the birth county by birth year level and are weighted by the number of births in each county in 1955. The dependent variable is the fraction of individuals in a given birth county and birth year cohort that are later convicted of a UCR Part 1 crime in North Carolina by age 35. UCR Part 1 crimes include violent crimes (those in which the description of the offense contains the words “murder”, “assault”, or “robbery” (rape not being included), and property crimes (those in which the description of the offense contains the words “burglary” or “larceny”). The reported variable of interest is an indicator for whether Head Start was available to a given county birth cohort. All specifications include birth county and birth-cohort fixed effects, and, where indicated, 1960 county characteristics interacted with a time trend in birth cohort. 1960 county characteristics include: percent of land in farming, percent of people living in families with less than \$3,000, percent of population in urban area, percent black, percent less than age 5, percent greater than age 65, and percent of employment in agriculture. Those counties whose poverty rate in 1960 was above the median in North Carolina (40.2% poverty) are called “High Poverty”, while those below the median are called “Low Poverty”. The sample is restricted to counties that ever received Head Start between 1965 and 1976. The sample is further restricted to cohorts who were born between 1955 and 1968. Significance levels indicated by:  $^*(p < 0.10)$ ,  $^{**}(p < 0.05)$ ,  $^{***}(p < 0.01)$ .

Table 3: Effect of Head Start Availability on Rate of Serious Criminal Conviction - Dynamics

	All		High Poverty		Low Poverty	
	(1)	(2)	(3)	(4)	(5)	(6)
-6	-0.0011 (0.0011)	-0.0006 (0.0011)	-0.0049** (0.0020)	-0.0053* (0.0029)	-0.0004 (0.0012)	0.0001 (0.0013)
-5	-0.0016 (0.0012)	-0.0011 (0.0013)	-0.0043 (0.0040)	-0.0045 (0.0046)	-0.0007 (0.0014)	-0.0002 (0.0015)
-4	-0.0029* (0.0016)	-0.0024 (0.0016)	-0.0101* (0.0050)	-0.0105* (0.0054)	-0.0017 (0.0019)	-0.0012 (0.0019)
-3	-0.0006 (0.0015)	-0.0003 (0.0016)	-0.0015 (0.0056)	-0.0020 (0.0051)	-0.0006 (0.0015)	-0.0002 (0.0016)
-2	0.0006 (0.0013)	0.0007 (0.0013)	-0.0057 (0.0048)	-0.0060 (0.0048)	0.0009 (0.0013)	0.0011 (0.0013)
First Year of Availability	-0.0031** (0.0013)	-0.0033** (0.0013)	-0.0053** (0.0026)	-0.0054* (0.0030)	-0.0027* (0.0016)	-0.0029 (0.0018)
1	-0.0041* (0.0021)	-0.0044* (0.0023)	-0.0230** (0.0098)	-0.0230** (0.0106)	-0.0012 (0.0021)	-0.0013 (0.0027)
2	-0.0032 (0.0027)	-0.0037 (0.0026)	-0.0198*** (0.0034)	-0.0212*** (0.0044)	0.0012 (0.0028)	0.0008 (0.0035)
3	-0.0038 (0.0035)	-0.0046 (0.0036)	-0.0203*** (0.0052)	-0.0218*** (0.0058)	0.0020 (0.0035)	0.0014 (0.0046)
4	-0.0002 (0.0047)	-0.0013 (0.0044)	-0.0213** (0.0078)	-0.0208** (0.0076)	0.0072 (0.0044)	0.0062 (0.0053)
5	-0.0025 (0.0049)	-0.0041 (0.0049)	-0.0300*** (0.0090)	-0.0296*** (0.0090)	0.0069 (0.0044)	0.0056 (0.0058)
6	-0.0013 (0.0056)	-0.0039 (0.0058)	-0.0253* (0.0123)	-0.0250* (0.0128)	0.0093* (0.0051)	0.0068 (0.0067)
7+	-0.0023 (0.0069)	-0.0071 (0.0068)	-0.0423** (0.0169)	-0.0421** (0.0168)	0.0114* (0.0065)	0.0058 (0.0079)
Observations	882	882	308	308	574	574
Mean	0.0476	0.0476	0.0469	0.0469	0.0478	0.0478
Baseline Chars X Trend		X		X		X

**Note:** Each column reports a separate OLS regression with standard errors clustered at the birth county level and reported in parentheses. Observations are at the birth county by birth year level and are weighted by the number of births in each county in 1955. The dependent variable is the fraction of individuals in a given birth county and birth year cohort that are later convicted of a UCR Part 1 crime in North Carolina by age 35. UCR Part 1 crimes include violent crimes (those in which the description of the offense contains the words “murder”, “assault”, or “robbery” (rape not being included), and property crimes (those in which the description of the offense contains the words “burglary” or “larceny”). The reported variables of interest are a set of indicators for how many years away from the first year of Head Start availability in their birth county a given birth cohort was. All specifications include birth county and birth-cohort fixed effects, and, where indicated, 1960 county characteristics interacted with a time trend in birth cohort. 1960 county characteristics include: percent of land in farming, percent of people living in families with less than \$3,000, percent of population in urban area, percent black, percent less than age 5, percent greater than age 65, and percent of employment in agriculture. Those counties whose poverty rate in 1960 was above the median in North Carolina (40.2% poverty) are called “High Poverty”, while those below the median are called “Low Poverty”. The sample is restricted to cohorts who were born between 1955 and 1968. Significance levels indicated by: \*( $p < 0.10$ ), \*\*( $p < 0.05$ ), \*\*\*( $p < 0.01$ ).

Table 4: Effect of Head Start Availability on Rate of Serious Criminal Conviction: By Crime Type

	All		High Poverty		Low Poverty	
	(1)	(2)	(3)	(4)	(5)	(6)
<b>Panel A: Type 1 Property Crimes</b>						
Head Start Availability	-0.0024 (0.0016)	-0.0028* (0.0015)	-0.0085*** (0.0028)	-0.0086*** (0.0028)	0.0000 (0.0016)	-0.0005 (0.0021)
Observations	882	882	308	308	574	574
Mean	0.0256	0.0256	0.0255	0.0255	0.0257	0.0257
<b>Panel B: Type 1 Violent Crimes</b>						
Head Start Availability	0.0005 (0.0017)	-0.0002 (0.0016)	-0.0046 (0.0031)	-0.0046 (0.0032)	0.0026 (0.0018)	0.0017 (0.0020)
Observations	882	882	308	308	574	574
Mean	0.0220	0.0220	0.0214	0.0214	0.0221	0.0221
Baseline Chars X Trend	X		X		X	

**Note:** Each cell reports a separate OLS regression with standard errors clustered at the birth county level and reported in parentheses. Observations are at the birth county by birth year level and are weighted by the number of births in each county in 1955. The dependent variable is the fraction of individuals in a given birth county and birth year cohort that are later convicted of either UCR Part 1 property crimes (Panel A) or Part 1 violent crimes (Panel B) in North Carolina by age 35. UCR Part 1 crimes include violent crimes (those in which the description of the offense contains the words “murder”, “assault”, or “robbery” (rape not being included), and property crimes (those in which the description of the offense contains the words “burglary” or “larceny”). The reported variable of interest is an indicator for whether Head Start was available to a given county birth cohort. All specifications include birth county and birth-cohort fixed effects, and, where indicated, 1960 county characteristics interacted with a time trend in birth cohort. 1960 county characteristics include: percent of land in farming, percent of people living in families with less than \$3,000, percent of population in urban area, percent black, percent less than age 5, percent greater than age 65, and percent of employment in agriculture. Those counties whose poverty rate in 1960 was above the median in North Carolina (40.2% poverty) are called “High Poverty”, while those below the median are called “Low Poverty”. The sample is restricted to counties that ever received Head Start between 1965 and 1976. The sample is further restricted to cohorts who were born between 1955 and 1968. Significance levels indicated by: \*( $p < 0.10$ ), \*\*( $p < 0.05$ ), \*\*\*( $p < 0.01$ ).

Table 5: Effect of Head Start Availability on Rate of Serious Property Conviction: By Race

	All		High Poverty		Low Poverty	
	(1)	(2)	(3)	(4)	(5)	(6)
<b>Panel A: White</b>						
Head Start Availability	-0.0027 (0.0023)	-0.0031 (0.0022)	-0.0076* (0.0042)	-0.0074 (0.0043)	0.0001 (0.0021)	0.0002 (0.0023)
Observations	667	667	252	252	415	415
Mean	0.0156	0.0156	0.0150	0.0150	0.0158	0.0158
<b>Panel B: Non-White</b>						
Head Start Availability	-0.0037 (0.0037)	-0.0033 (0.0040)	-0.0076** (0.0031)	-0.0085** (0.0033)	-0.0037 (0.0058)	-0.0004 (0.0082)
Observations	667	667	252	252	415	415
Mean	0.0523	0.0523	0.0396	0.0396	0.0562	0.0562
Baseline Chars X Trend	X		X		X	

**Note:** Each cell reports a separate OLS regression with standard errors clustered at the birth county level and reported in parentheses. Observations are at the birth county by birth year level and are weighted by the number of births in each county in 1955. The dependent variable is the fraction of white or non-white individuals in a given birth county and birth year cohort that are later convicted of a UCR Part 1 property crime in North Carolina by age 35. UCR Part 1 property crimes are those in which the description of the offense contains the words “burglary” or “larceny”. Panel A presents these results for white cohorts, while Panel B reports them for non-white cohorts. Sample sizes are smaller for these specifications because the natality files for 25% of counties in North Carolina do not have race breakdowns before 1969, we do not know the race of approximately 13% of births in our sample. The reported variable of interest is an indicator for whether Head Start was available to a given county birth cohort. All specifications include birth county and birth-cohort fixed effects, and, where indicated, 1960 county characteristics interacted with a time trend in birth cohort. 1960 county characteristics include: percent of land in farming, percent of people living in families with less than \$3,000, percent of population in urban area, percent black, percent less than age 5, percent greater than age 65, and percent of employment in agriculture. Those counties whose poverty rate in 1960 was above the median in North Carolina (40.2% poverty) are called “High Poverty”, while those below the median are called “Low Poverty”. The sample is restricted to counties that ever received Head Start between 1965 and 1976. The sample is further restricted to cohorts who were born between 1955 and 1968. Significance levels indicated by: \*( $p < 0.10$ ), \*\*( $p < 0.05$ ), \*\*\*( $p < 0.01$ ).

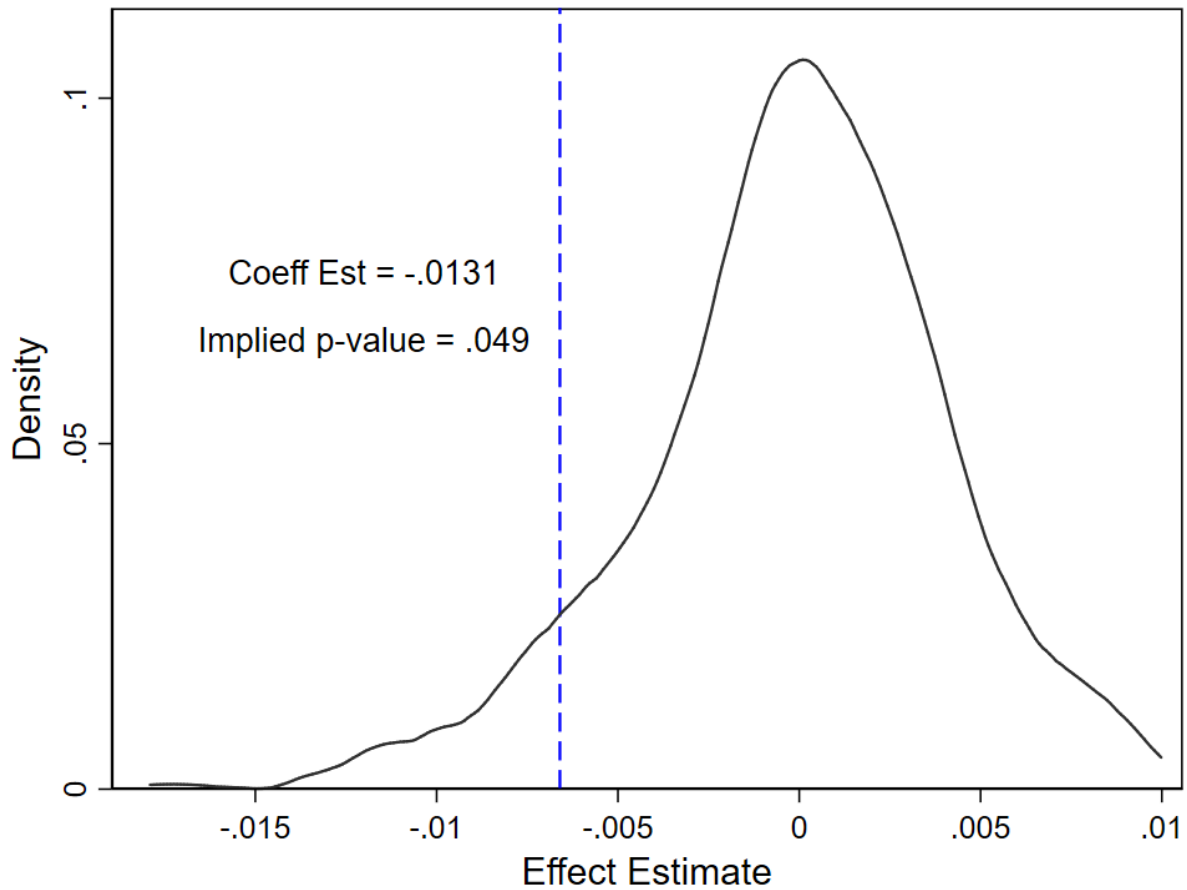
Table 6: Estimates of the Social Benefits of Crime Reduction from Head Start Participation

	Cost Estimate (\$ 2015)	Est. $\Delta$ Convictions	Est. $\Delta$ Crimes	Discounted Social Benefits			
	(1)	(2)	(3)	0%	3%	5%	7%
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
<i>McCollister, French, and Fang (2010) Crime Cost Estimates:</i>							
Larceny	3,911	-0.075	-2.375	9,289	4,884	3,255	2,207
Burglary	7,155	-0.002	-0.076	546	286	189	128
<b>CRIME BENEFITS:</b>				<b>9,835</b>	<b>5,169</b>	<b>3,445</b>	<b>2,335</b>
<b>BENEFIT-COST RATIO:</b>				<b>3.5</b>	<b>1.8</b>	<b>1.2</b>	<b>0.8</b>

**Note:** This table shows back-of-the-envelope calculations of the discounted social benefits of later crime reductions due to Head Start participation in high poverty counties. Social cost estimates for each crime type (Column 1) are adopted from McCollister et al. (2010). These estimates include victimization costs, criminal justice system costs, and the lost value of criminals' time, but do not include private expenditures on crime prevention. In Column 2, we report the estimated change in convictions by crime type, which we obtain by first dividing our property crime coefficient estimate by our estimated first stage and multiplying by mean number of property crimes of a particular type given any property conviction in North Carolina. In Column 3, we report the estimated change in criminal offenses associated with the given change in convictions. North Carolina has roughly 5.4 burglary and larceny arrests per conviction and roughly 5.8 reported burglary and larceny offenses per arrest (authors' calculations using statistics from the NC State Bureau of Investigation's "Crime in North Carolina -1995" report). Estimates of the discounted social benefit, contained in Columns 4-7, are produced by multiplying the dollar value of each offense's social cost by the change in offenses implied by our estimates (by age for ages 18-35) discounting back to age 4 (for comparison with the program cost) at the given rate. All monetary values are in 2015 dollars.

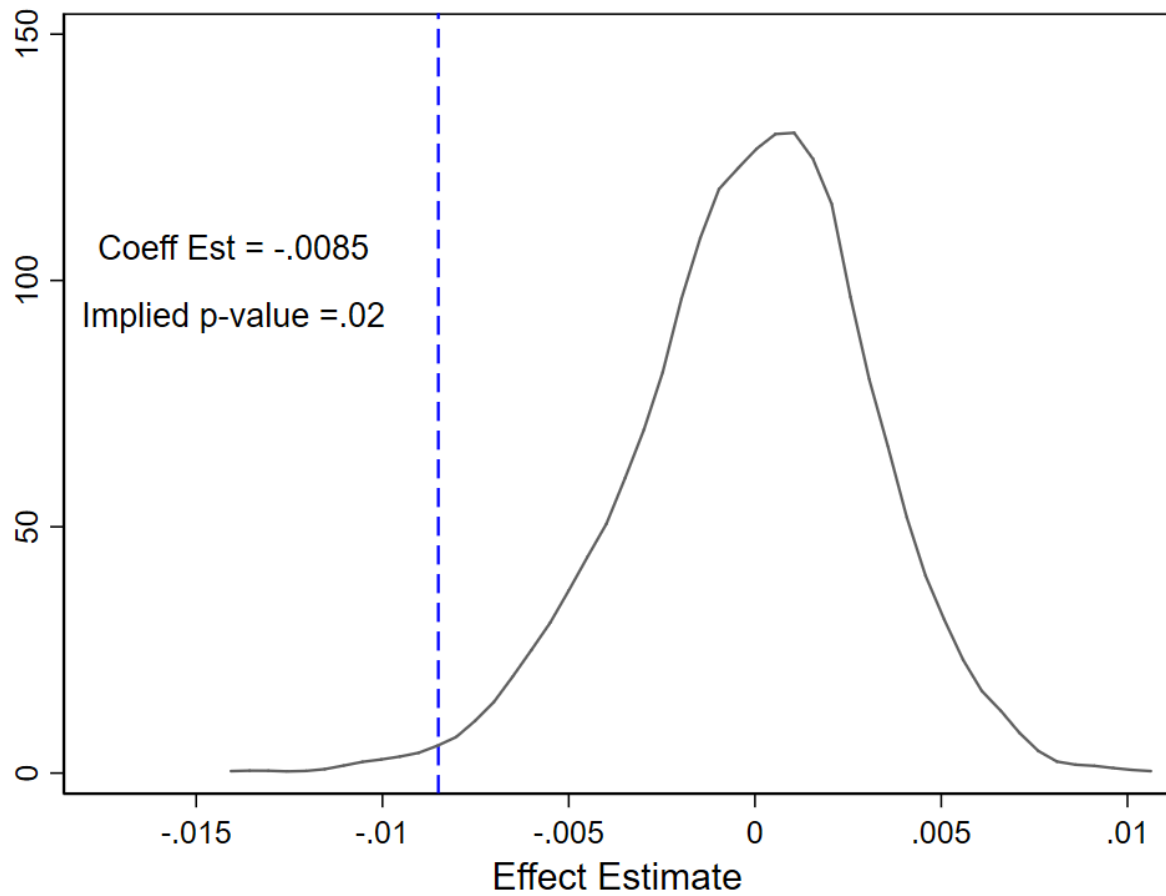
## Appendix: Supplementary Figures

Figure A1: Randomization Inference, All Part 1 Crimes



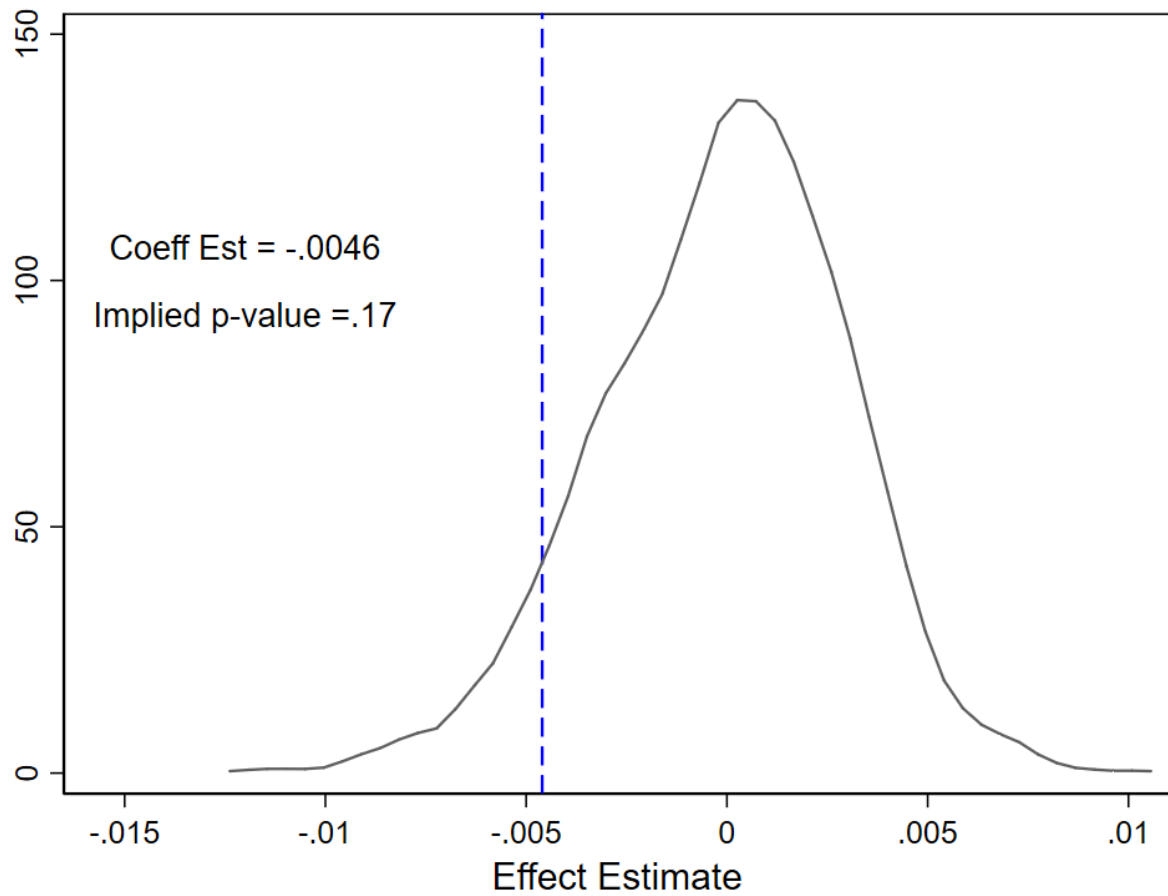
**Note:** Figure shows the kernel density of coefficient estimates under random assignment of Head Start availability to high poverty counties. 1000 repetitions were performed. The vertical line indicates the coefficient estimate obtained using the actual rollout of Head Start (See Table 2). A two-tailed test statistic is calculated as the share of estimates whose absolute value is greater than or equal to the estimate obtained using the actual rollout. Calculating this statistic gives an implied p-value of .049 as compared with the p-value of .038 given by the standard errors clustered at the county level.

Figure A2: Randomization Inference, Part 1 Property Crimes



**Note:** Figure shows the kernel density of coefficient estimates under random assignment of Head Start exposure to high poverty counties. 1000 repetitions were performed. The vertical line indicates the coefficient estimate obtained using the actual rollout of Head Start (See Table 4). A two-tailed test statistic is calculated as the share of estimates whose absolute value is greater than or equal to the estimate obtained using the actual rollout. Calculating this statistic gives an implied p-value of .02 as compared with the p-value of .007 given by the standard errors clustered at the county level.

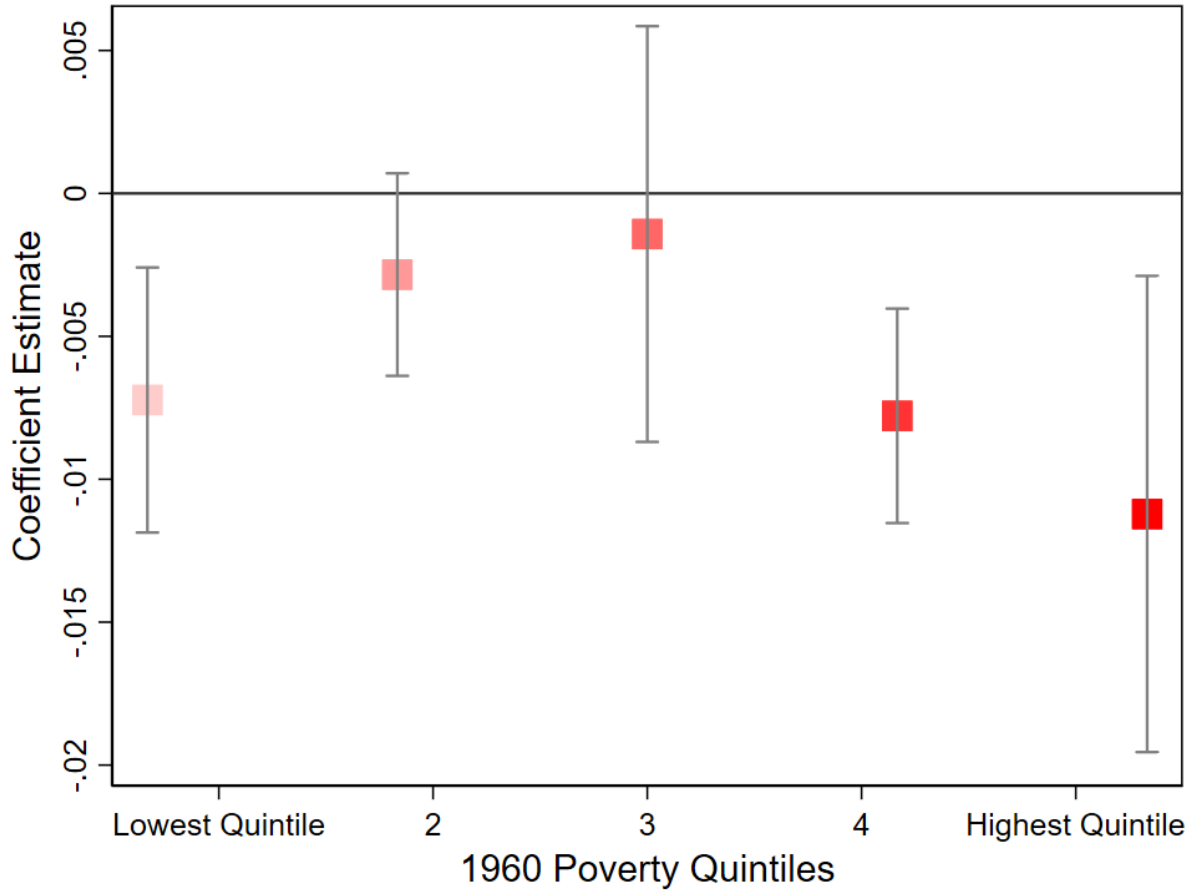
Figure A3: Randomization Inference, Part 1 Violent Crimes



**Note:** Figure shows the kernel density of coefficient estimates under random assignment of Head Start exposure to high poverty counties. 1000 repetitions were performed. The vertical line indicates the coefficient estimate obtained using the actual rollout of Head Start (See Table 4). A two-tailed test statistic is calculated as the share of estimates whose absolute value is greater than or equal to the estimate obtained using the actual rollout. Calculating this statistic gives an implied p-value of .17 as compared with the p-value of .15 given by the standard errors clustered at the county level.

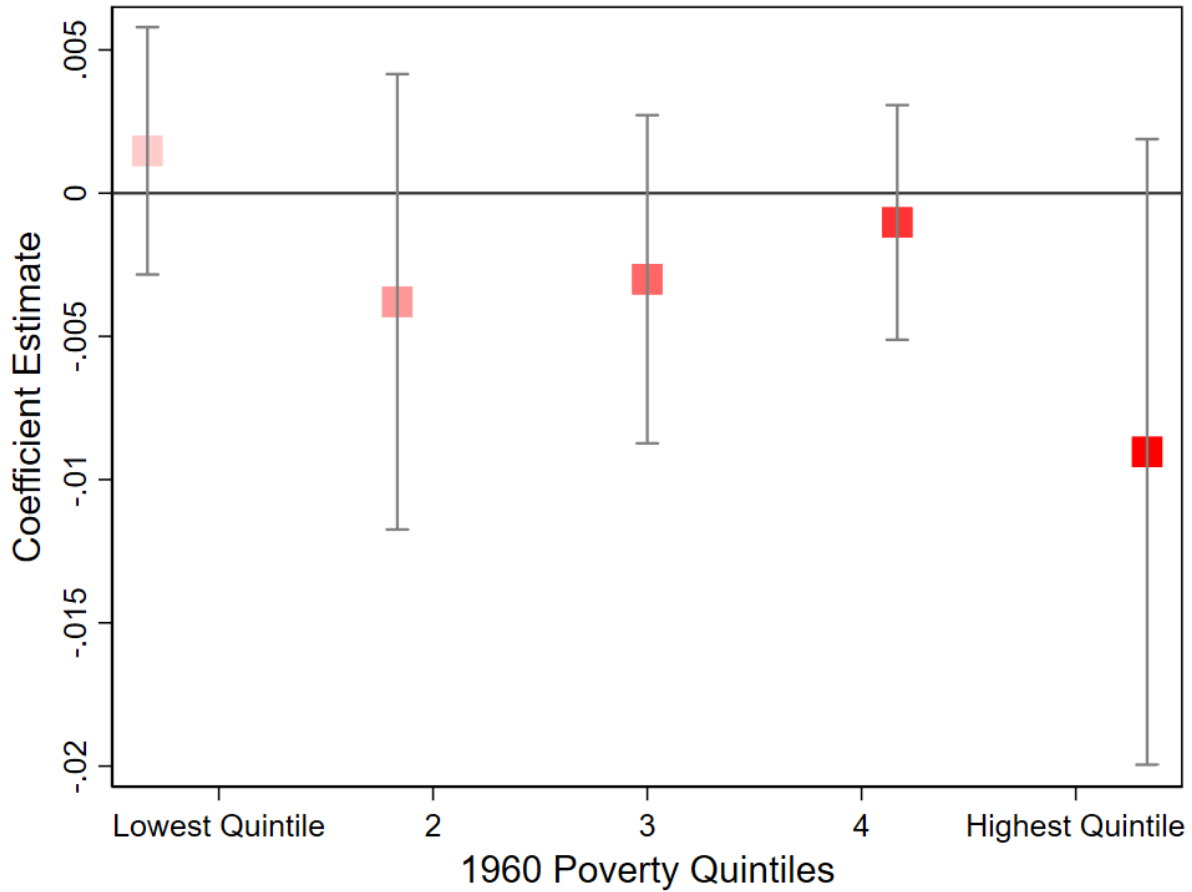


Figure A4: DD Estimates by Quintiles, Property Crimes



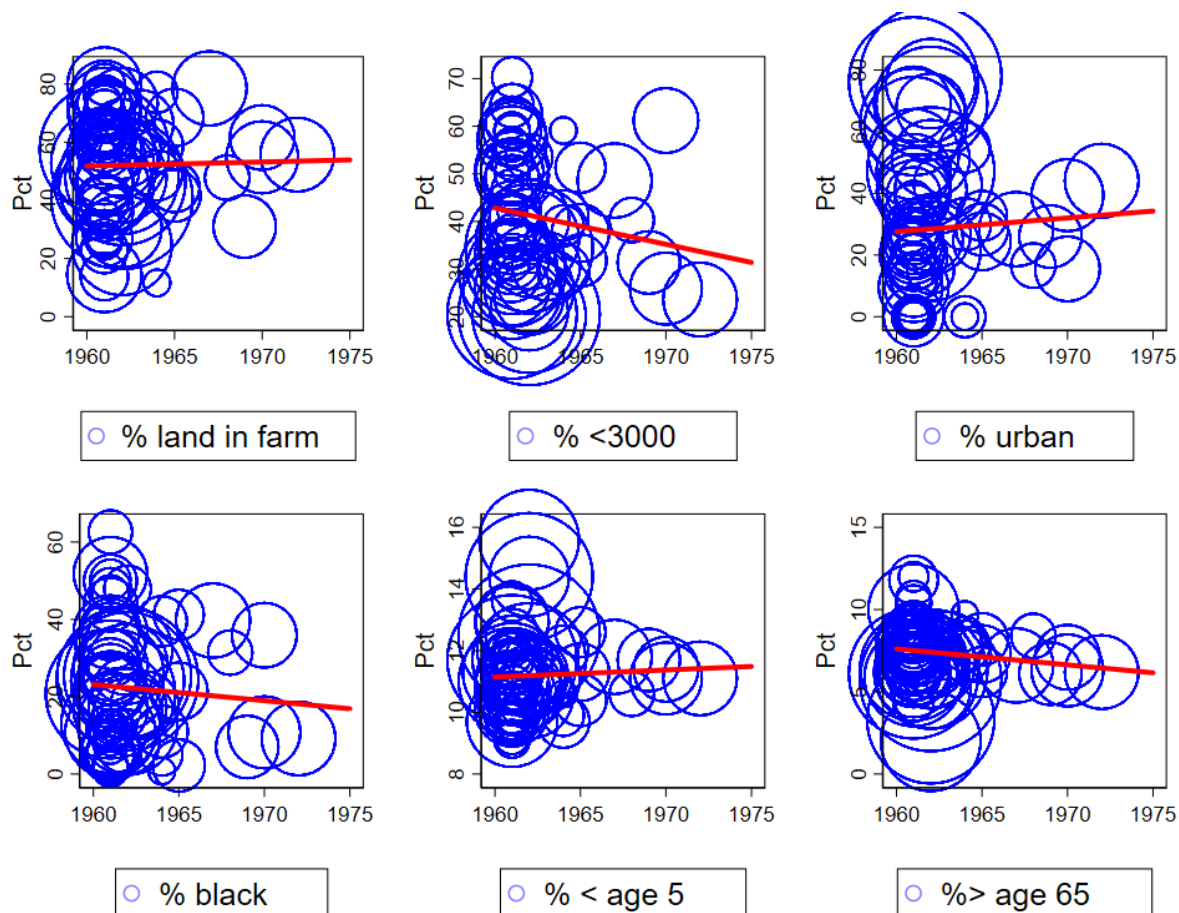
**Note:** Figure shows the coefficient estimates and 95% confidence intervals from estimating our basic difference-in-differences specification separately for counties in each quintile of the 1960 North Carolina poverty rate. Observations are at the birth county by birth year level and are weighted by the number of births in each county in 1955. The dependent variable is the fraction of individuals in a given birth county and birth year cohort that are later convicted of a UCR Part 1 property crime in North Carolina by age 35. UCR Part 1 crimes include violent crimes (those in which the description of the offense contains the words “murder”, “assault”, or “robbery” (rape not being included), and property crimes (those in which the description of the offense contains the words “burglary” or “larceny”). All specifications include birth county and birth-cohort fixed effects as well as 1960 county characteristics interacted with a time trend in birth cohort. 1960 county characteristics include: percent of land in farming, percent of people living in families with less than \$3,000, percent of population in urban area, percent black, percent less than age 5, percent greater than age 65, and percent of employment in agriculture. The sample is restricted to counties that ever received Head Start between 1965 and 1976. The sample is further restricted to cohorts who were born between 1955 and 1968.

Figure A5: DD Estimates by Quintiles, Violent Crimes



**Note:** Figure shows the coefficient estimates and 95% confidence intervals from estimating our basic difference-in-differences specification separately for counties in each quintile of the 1960 North Carolina poverty rate. Observations are at the birth county by birth year level and are weighted by the number of births in each county in 1955. The dependent variable is the fraction of individuals in a given birth county and birth year cohort that are later convicted of a UCR Part 1 violent crime in North Carolina by age 35. UCR Part 1 crimes include violent crimes (those in which the description of the offense contains the words “murder”, “assault”, or “robbery” (rape not being included), and property crimes (those in which the description of the offense contains the words “burglary” or “larceny”). All specifications include birth county and birth-cohort fixed effects as well as 1960 county characteristics interacted with a time trend in birth cohort. 1960 county characteristics include: percent of land in farming, percent of people living in families with less than \$3,000, percent of population in urban area, percent black, percent less than age 5, percent greater than age 65, and percent of employment in agriculture. The sample is restricted to counties that ever received Head Start between 1965 and 1976. The sample is further restricted to cohorts who were born between 1955 and 1968.

Figure A6: Exploring Endogeneity of Head Start Adoption



**Note:** Figure shows population weighted scatterplots of county characteristics against the year in which Head Start first became available in that county. Data are at the county level and weights are defined using 1955 births (represented by circle radius). A flat, horizontal fitted line suggests that the values of a given county characteristic are not systematically connected to the timing of Head Start availability.

## Appendix: Supplementary Tables

Table A1: Head Start Availability and Serious Criminal Conviction: Continuous Measure of Poverty Estimates

	All	
	(1)	(2)
HS Exposure	0.0059 (0.0058)	0.0044 (0.0041)
HS Exposure X Poverty	-0.0202* (0.0111)	-0.0188** (0.0078)
Observations	882	882
Mean	0.0476	0.0476
Baseline Chars X Trend		X

**Note:** Each column reports a separate OLS regression with standard errors clustered at the birth county level and reported in parentheses. Observations are at the birth county by birth year level and are weighted by the number of births in each county in 1955. The dependent variable is the fraction of individuals in a given birth county and birth year cohort that are later convicted of a UCR Part 1 crime in North Carolina by age 35. UCR Part 1 crimes include violent crimes (those in which the description of the offense contains the words “murder”, “assault”, or “robbery” (rape not being included), and property crimes (those in which the description of the offense contains the words “burglary” or “larceny”). The reported variable of interest is an indicator for whether Head Start was available to a given county birth cohort interacted with the county poverty rate in 1960. (The reported estimates are also scaled up by a factor of 100.). All specifications include birth county and birth-cohort fixed effects, and, where indicated, 1960 county characteristics interacted with a time trend in birth cohort. 1960 county characteristics include: percent of land in farming, percent of people living in families with less than \$3,000, percent of population in urban area, percent black, percent less than age 5, percent greater than age 65, and percent of employment in agriculture. These regressions do not restrict the sample based on the county poverty rate in 1960. The sample is restricted to counties that ever received Head Start between 1965 and 1976. The sample is further restricted to cohorts who were born between 1955 and 1968. Significance levels indicated by: \*( $p < 0.10$ ), \*\*( $p < 0.05$ ), \*\*\*( $p < 0.01$ ).

Table A2: Other War On Poverty Programs and Head Start: High Poverty Counties

	High Poverty				
	(1)	(2)	(3)	(4)	(5)
Head Start Availability	-0.0131** (0.0059)	-0.0126** (0.0058)	-0.0126** (0.0059)	-0.0158** (0.0068)	-0.0153** (0.0061)
Observations	308	308	308	308	308
Mean	0.0469	0.0469	0.0469	0.0469	0.0469
Baseline Chars X Trend	X		X		X
WOP Controls	None	FS	FS	FS + Other WOP	FS + Other WOP

**Note:** Each column reports a separate OLS regression with standard errors clustered at the birth county level and reported in parentheses. Observations are at the birth county by birth year level and are weighted by the number of births in each county in 1955. The dependent variable is the fraction of individuals in a given birth county and birth year cohort that are later convicted of a UCR Part 1 crime in North Carolina by age 35. UCR Part 1 crimes include violent crimes (those in which the description of the offense contains the words “murder”, “assault”, or “robbery” (rape not being included), and property crimes (those in which the description of the offense contains the words “burglary” or “larceny”). The reported variable of interest is an indicator for whether Head Start was available to a given county birth cohort. All specifications include birth county and birth-cohort fixed effects, and, where indicated, 1960 county characteristics interacted with a time trend in birth cohort. 1960 county characteristics include: percent of land in farming, percent of people living in families with less than \$3,000, percent of population in urban area, percent black, percent less than age 5, percent greater than age 65, and percent of employment in agriculture. Those counties whose poverty rate in 1960 was above the median in North Carolina (40.2% poverty) are called “High Poverty”, while those below the median are called “Low Poverty”. The sample includes only high poverty counties. The sample is restricted to counties that ever received Head Start between 1965 and 1976. The sample is further restricted to cohorts who were born between 1955 and 1968. In these specifications, controls for exposure to various War on Poverty programs, including the Food Stamp Program (FS) are also included. “Other War on Poverty Programs” are those recommended by Bailey and Goodman-Bacon (2015) and include per capita expenditures on Public Assistance Transfers, Medicaid expenditures, Community Health Centers and Community Action Agencies. Significance levels indicated by:  $*$ ( $p < 0.10$ ),  $**$ ( $p < 0.05$ ),  $***$ ( $p < 0.01$ )

Table A3: Other War On Poverty Programs and Head Start: Low Poverty Counties

	Low Poverty				
	(1)	(2)	(3)	(4)	(5)
Head Start Availability	0.0012 (0.0040)	0.0026 (0.0033)	0.0012 (0.0040)	0.0013 (0.0028)	0.0012 (0.0033)
Observations	574	574	574	574	574
Mean	0.0478	0.0478	0.0478	0.0478	0.0478
Baseline Chars X Trend	X		X		X
WOP	None	FS	FS	FS + Other WOP	FS + Other WOP

**Note:** Each column reports a separate OLS regression with standard errors clustered at the birth county level and reported in parentheses. Observations are at the birth county by birth year level and are weighted by the number of births in each county in 1955. The dependent variable is the fraction of individuals in a given birth county and birth year cohort that are later convicted of a UCR Part 1 crime in North Carolina by age 35. UCR Part 1 crimes include violent crimes (those in which the description of the offense contains the words “murder”, “assault”, or “robbery” (rape not being included)) and property crimes (those in which the description of the offense contains the words “burglary” or “larceny”). The reported variable of interest is an indicator for whether Head Start was available to a given county birth cohort. All specifications include birth county and birth-cohort fixed effects, and, where indicated, 1960 county characteristics interacted with a time trend in birth cohort. 1960 county characteristics include: percent of land in farming, percent of people living in families with less than \$3,000, percent of population in urban area, percent black, percent less than age 5, percent greater than age 65, and percent of employment in agriculture. Those counties whose poverty rate in 1960 was above the median in North Carolina (40.2% poverty) are called “High Poverty”, while those below the median are called “Low Poverty”. The sample includes only low poverty counties. The sample is restricted to counties that ever received Head Start between 1965 and 1976. The sample is further restricted to cohorts who were born between 1955 and 1968. In these specifications, controls for exposure to various War on Poverty programs, including the Food Stamp Program (FS) are also included. “Other War on Poverty Programs” are those recommended by Bailey and Goodman-Bacon (2015) and include per capita expenditures on Public Assistance Transfers, Medicaid expenditures, Community Health Centers and Community Action Agencies. Significance levels indicated by:  $^*(p < 0.10)$ ,  $^{**}(p < 0.05)$ ,  $^{***}(p < 0.01)$ .

Table A4: Effect of Head Start Availability on Rate of Serious Violent Criminal Conviction:  
By Race

	All		High Poverty		Low Poverty	
	(1)	(2)	(3)	(4)	(5)	(6)
<b>Panel A: White</b>						
Head Start Availability	-0.0014 (0.0016)	-0.0016 (0.0017)	-0.0029 (0.0023)	-0.0029 (0.0024)	-0.0003 (0.0022)	-0.0000 (0.0023)
Observations	667	667	252	252	415	415
Mean	0.0114	0.0114	0.0107	0.0107	0.0116	0.0116
<b>Panel B: Non-White</b>						
Head Start Availability	0.0041 (0.0037)	0.0028 (0.0041)	-0.0047 (0.0049)	-0.0052 (0.0052)	0.0074 (0.0052)	0.0086 (0.0070)
Observations	667	667	252	252	415	415
Mean	0.0503	0.0503	0.0354	0.0354	0.0548	0.0548
Baseline Chars X Trend	X		X		X	

**Note:** Each cell reports a separate OLS regression with standard errors clustered at the birth county level and reported in parentheses. Observations are at the birth county by birth year level and are weighted by the number of births in each county in 1955. The dependent variable is the fraction of white or non-white individuals in a given birth county and birth year cohort that are later convicted of a UCR Part 1 violent crime in North Carolina by age 35. UCR Part 1 violent crimes are those in which the description of the offense contains the words “murder”, “assault”, or “robbery” (rape not being included). Panel A presents these results for white cohorts, while Panel B reports them for non-white cohorts. Sample sizes are smaller for these specifications because the natality files for 25% of counties in North Carolina do not have race breakdowns before 1969, we do not know the race of approximately 13% of births in our sample. The reported variable of interest is an indicator for whether Head Start was available to a given county birth cohort. All specifications include birth county and birth-cohort fixed effects, and, where indicated, 1960 county characteristics interacted with a time trend in birth cohort. 1960 county characteristics include: percent of land in farming, percent of people living in families with less than \$3,000, percent of population in urban area, percent black, percent less than age 5, percent greater than age 65, and percent of employment in agriculture. Those counties whose poverty rate in 1960 was above the median in North Carolina (40.2%) are called “High Poverty”, while those below the median are called “Low Poverty”. The sample is restricted to counties that ever received Head Start between 1965 and 1976. The sample is further restricted to cohorts who were born between 1955 and 1968. Significance levels indicated by:  $^*(p < 0.10)$ ,  $^{**}(p < 0.05)$ ,  $^{***}(p < 0.01)$ .

Table A5: Exploring Endogeneity of Head Start Availability

	All	High Poverty	Low Poverty
	(1)	(2)	(3)
Head Start Ever Available In County			
1960 CCDB: % of land in farming	0.00353 (0.0177)	0.00782 (0.0290)	0.00110 (0.0265)
1960 CCDB: % of people living in families with $\leq$ \$3000	-0.0503 (0.0369)	0.0939 (0.0945)	-0.381*** (0.123)
1960 CCDB: % of population urban	-0.0297 (0.0283)	-0.00259 (0.0427)	-0.0712 (0.0621)
1960 CCDB: % of people black	0.00244 (0.0259)	0.0233 (0.0272)	0.00175 (0.0472)
1960 CCDB: % of people $\leq$ age 5	-0.364 (0.404)	-0.766 (0.488)	0.696 (0.678)
1960 CCDB: % of people $\geq$ age 65	-0.112 (0.337)	-0.568 (0.423)	1.137 (1.014)
1960 CCDB: % of employment in agriculture	-9.870 (14.23)	-25.45 (20.82)	16.11 (20.80)
1960 CCBD: log population	1.720** (0.717)	0.988 (0.791)	4.548* (2.478)
Observations	100	50	50
Mean	0.630	0.440	0.820

**Note:** Each column reports a separate logistic regression of an indicator for whether a county ever got Head Start by 1976 against the eight county level characteristics recommended in Hoynes and Schanzenbach (2009) and drawn from the 1960 City and County Data Books (CCDB). Observations are at the county level. Those counties whose poverty rate in 1960 was above the median in North Carolina (40.2% poverty) are called “High Poverty”, while those below the median are called “Low Poverty”. Significance levels indicated by: \*( $p < 0.10$ ), \*\*( $p < 0.05$ ), \*\*\*( $p < 0.01$ )



Table A6: Exploring Endogeneity of the Timing of Head Start Availability

	All	High Poverty	Low Poverty
	(1)	(2)	(3)
First Birth Cohort in County To Have Head Start			
1960 CCDB: % of land in farming	0.00735 (0.0234)	-0.0396 (0.0658)	0.00827 (0.0330)
1960 CCDB: % of people living in families with $\leq$ \$3000	-0.0375 (0.0473)	0.0158 (0.168)	-0.138 (0.105)
1960 CCDB: % of population urban	-0.0122 (0.0235)	-0.00119 (0.0358)	-0.000130 (0.0607)
1960 CCDB: % of people black	0.00251 (0.0328)	0.0215 (0.0756)	-0.0117 (0.111)
1960 CCDB: % of people $\leq$ age 5	-0.198 (0.387)	-0.187 (1.374)	0.115 (0.582)
1960 CCDB: % of people $\geq$ age 65	-0.418 (0.259)	-0.358 (0.898)	-0.350 (0.266)
1960 CCDB: % of employment in agriculture	-4.219 (13.35)	-7.168 (34.97)	1.668 (19.64)
1960 CCBD: log population	-0.397 (0.749)	1.003 (1.483)	-1.444 (1.224)
Observations	63	22	41
Mean	0.381	0.0455	0.561

**Note:** Each column reports a separate OLS regression of the birth year (normalized to 1962) of the first birth cohort in a given county to which Head Start was available against the eight county level characteristics recommended in Hoynes and Schanzenbach (2009) and drawn from the 1960 City and County Data Books (CCDB). Observations are at the county level. Those counties whose poverty rate in 1960 was above the median in North Carolina (40.2% poverty) are called “High Poverty”, while those below the median are called “Low Poverty”. Significance levels indicated by:  $^*(p < 0.10)$ ,  $^{**}(p < 0.05)$ ,  $^{***}(p < 0.01)$

Table A7: Head Start Availability and Serious Criminal Conviction: Includes Birth-county by Birth-year Trends

	All		High Poverty		Low Poverty	
	(1)	(2)	(3)	(4)	(5)	(6)
Head Start Availability	-0.0018 (0.0031)	-0.0056* (0.0031)	-0.0131** (0.0057)	-0.0132* (0.0073)	0.0026 (0.0032)	-0.0022 (0.0032)
Observations	882	882	308	308	574	574
Mean	0.0476	0.0476	0.0469	0.0469	0.0478	0.0478
Birth-county X Birth-year Trend		X		X		X

**Note:** Each column reports a separate OLS regression with standard errors clustered at the birth county level and reported in parentheses. Observations are at the birth county by birth year level and are weighted by the number of births in each county in 1955. The dependent variable is the fraction of individuals in a given birth county and birth year cohort that are later convicted of a UCR Part 1 crime in North Carolina by age 35. UCR Part 1 crimes include violent crimes (those in which the description of the offense contains the words “murder”, “assault”, or “robbery” (rape not being included), and property crimes (those in which the description of the offense contains the words “burglary” or “larceny”). The reported variable of interest is an indicator for whether Head Start was available to a given county birth cohort. All specifications include birth county and birth-cohort fixed effects, and, where indicated, 1960 birth-county by birth-year trends. Those counties whose poverty rate in 1960 was above the median in North Carolina (40.2%) are called “High Poverty”, while those below the median are called “Low Poverty”. The sample is restricted to counties that ever received Head Start between 1965 and 1976. The sample is further restricted to cohorts who were born between 1955 and 1968. Significance levels indicated by: \*( $p < 0.10$ ), \*\*( $p < 0.05$ ), \*\*\*( $p < 0.01$ ).

Table A8: Head Start and Likelihood of Residing in One's State of Birth (Census)

	National				South			
	All		Men Only		All		Men Only	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Fraction with HS Avail.	-0.021 (0.016)	0.004 (0.008)	-0.017 (0.017)	0.009 (0.008)	-0.018 (0.029)	-0.009 (0.020)	-0.013 (0.029)	-0.005 (0.021)
Obs	3,150,292	3,150,292	1,546,355	1,546,355	1,002,875	1,002,875	487,059	487,059
Mean	0.66	0.66	0.66	0.66	0.68	0.68	0.68	0.68
State Linear Trend		X		X		X		X

**Note:** Each cell represents a separate OLS regression with standard errors clustered at the state of birth level (in parentheses). Observations are at the individual level from the 1990 and 2000 Census. The dependent variable is whether an individual is currently living in his or her state of birth. The key explanatory variables are measures of Head Start availability for a birth cohort in a particular state. This is the weighted average of the Head Start availability variable across counties in a state, where the weights are the number of births in each county in 1960. All specifications include birth state and birth year fixed effects as well as indicators for race, age, and sex. Sample restricted to ages 18-35. Significance levels indicated by:  $^*(p < 0.10)$ ,  $^{**}(p < 0.05)$ ,  $^{***}(p < 0.01)$ .