The High/Scope Perry Preschool Program

Cost–Benefit Analysis Using Data from the Age-40 Followup

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ABSTRACT

This paper presents an updated cost-benefit analysis of the High/Scope Perry preschool Program, using data on individuals aged 40. Children were randomly assigned to a treatment or control group. Program costs are compared against treatment impacts on educational resources, earnings, criminal activity, and welfare receipt. Net present values are calculated for participants, the general public, and society. The treatment group obtains significantly higher earnings. For the general public, higher tax revenues, lower criminal justice system expenditures, and lower welfare payments easily outweigh program costs; they repay $12.90 for every $1 invested. However, program gains come mainly from reduced crime by males.

I. Introduction

This paper performs a cost–benefit analysis of the High/Scope Perry Preschool Program using new data on the careers and livelihoods of the participants and control group up to age 40. The program involved intensive preschooling delivered to at-risk children in Michigan in the 1960s. Of the sample of 123 children, 58 were randomly assigned to receive the program and 65 to be in a control group. The children have been surveyed periodically since the program, with the most recent survey being in 1999–2002.

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An earlier cost-benefit analysis of the program was conducted by Barnett (1996), using data on individuals up to age 27 (for analysis up to age 19, see Barnett 1985). Barnett (1996, 65-67) found that the program yielded a high positive return both for society and for participants, describing it as a "social program from which everybody wins". Set against the $12,356 cost for each program participant, societal benefits—mainly in terms of higher earnings, reduced crime, and reduced welfare transfers—amounted to $88,433; the net present value benefit was therefore $76,077 (more than six times the cost). For participants, the program was provided at no cost, and the (net and total) benefits—mainly in terms of higher earnings—were $18,570 (1992 dollars, discounted at 3 percent).

This paper reassesses the long-term benefits that arise from participation in the program and rederives the net present value of providing the program. With data up to age 40, this inquiry serves as both an affirmation and an extension of the earlier analysis. The structure of the paper is as follows. Section II sets out the cost-benefit analysis framework, describes the program and data set, and addresses methodological issues. Section III describes the benefits from the program both for participants and for society; these benefits are obtained from higher earnings, lower welfare receipt, and lower criminal activity. Section IV combines the costs and benefits data to estimate the net present value of the program. Section V concludes.

II. A Cost-Benefit Framework for the High/Scope Perry Preschool Program

A. Cost-Benefit Analysis

This evaluation of the High/Scope Perry Preschool Program adopts a cost-benefit analytical approach following the earlier analysis by Barnett (1996). The approach is well-developed, although only infrequently applied to educational interventions (see Levin and McEwan 2002ab). Simply, the costs of the program should be compared with its causal benefits, expressed in discounted money terms, and a program with high positive net benefits is preferred over one with low net benefits (or net costs). Here, causality is established by comparing the outcomes of a treatment group that was randomly assigned to receive the program to the outcomes of a control group.

The efficacy of cost-benefit analysis depends fundamentally on two key aspects. First, accurate information on the costs of the program are necessary. Barnett (1996) reports itemized program costs, and these data are reapplied below. Second, it must be possible to measure all program benefits (or at least the most salient) in money terms. This is the main challenge addressed here: Using both individual-level data on participants and the control group of nonparticipants and national data sets, the advantages from program participation are calculated in dollar amounts up to age 40 and projected forward to age 65. These advantages are primarily gains in earnings, reductions in crime, and changes in welfare receipt, but there also are differences in schooling and adult-education costs. Because benefits accrue to the individual, the general public, and to society, separate cost-benefit analyses are necessary for each. These pecuniary benefits are compared against the costs of the program to derive the net present value of the program, with all money values expressed in 2000 dollars.

Earnings profiles are derived using self-reported data. Criminal behaviors taken from state records are related to the costs of crimes; estimates of the overall costs to victims and the criminal justice system for each individual are generated. Welfare receipt and payments are calculated, based on self-reported and official information sources. For exposition, undiscounted values are used, with separate analyses for males and females by program status. Net present value figures are calculated, again overall and by gender. Multiple estimates are derived, applying various discount rates, and in each case net present values are presented for participants, the general public, and for society. Sensitivity analysis is undertaken to test whether the results are robust for the assumptions made in the calculations.

B. The High/Scope Perry Preschool Program

The High/Scope Perry Preschool study was conducted in Ypsilanti, Michigan, with 123 children born between 1958 and 1962 (for more details, see Barnett 1985). The participants entered the study as three- and four-year-old African American children, with no physical handicaps but selected on the basis of low parental education and disadvantaged background. The participants were randomly assigned either to the treatment group or a control group.

The treatment group received program provision for one or two short academic years (October through May). The provision was composed of three parts: (1) a center-based program for 2.5 hours per day for each weekday, with a child:teacher ratio of 5:1; (2) home visiting for 1.5 hours per weekday; and (3) group meetings of parents. Overall, the program represented a relatively intensive and structured investment in supporting the preschool development of the participants.

The costs of the program were computed by Barnett (1996, 19–27), and only refer to the taxpayer expenditures (and not expenditures by the participants). Costs information was taken from school district budgets and the program administration unit; both operating costs (instructional staff, administrative and support staff, overhead, supplies, and developmental screening) and capital costs (for classrooms and facilities) are included. In undiscounted 2000 dollars, the cost of the program per participant was $15,827. (A discount rate must be applied to the program costs, because the program was extended over multiple years.) This cost is used in the cost-benefit analysis below.

C. Long-term Benefits of Preschool

Given that prior study found the program to be a high-yield investment with a large, positive net present value, it is legitimate to ask why further analysis is needed. (It is possible that the earlier conclusions would be overturned, but this is highly unlikely.) This analysis draws on updated information about the participants up to age 40; that is, over a sizable proportion of their productive working lives. Prior studies projected forward the likely behaviors and outcomes after age 27, relying on plausible predictions, not actualities. Using more complete, high-quality, and detailed data, it is possible to see whether the prior predictions were overly conservative or overly optimistic and across which economic behaviors. These findings impinge on the program's generality; for example, where the reductions in criminal behavior are

substantiated or reinforced, that suggests directing the program to children in environments where there is a high propensity toward crime. More importantly, these data largely refute questions of program fade-out. Research on fade-out has largely focused on the cognitive impacts of preschool participation (see Barnett 1998). Instead, a cost-benefit framework places little emphasis on cognitive impacts per se, but rather on general economic and social outcomes, which are influenced by noncognitive as well as cognitive differences.

Furthermore, a lifetime approach allows for investigation of the path-dependency of circumstances and behaviors resulting from early education. Growing attention is being paid to how early cognitive development presages later life behaviors, opportunities, and experiences (Shore 1997; Shonkoff and Phillips 2000). Juvenile arrests to strongly predict subsequent adult arrests (Williams and Sickles 2002): A criminal record may convey a strong negative labor market signal, impeding opportunities for future economic betterment; or early involvement with the criminal justice system exacerbates deviant propensities (on labeling, see Bernburg and Krohn 2003). In dissuading youth from crime, preschool programs also may dissuade them from a life of crime (Farrington 2003).

Most likely is that the program's lifetime effects are mediated through differences in educational attainment.[1] Table 1 shows the educational attainment levels by program status and gender for the 119 individuals with complete data up to age 40. The program group has higher educational attainment: The difference is discernible at age 27, and at least maintained or even accentuated by age 40. Program males are more likely to graduate from high school, and in two cases, progress to college after age 27. For females, the differences are more striking: By age 27, the program group is three times more likely to graduate from high school, with further educational accumulation—of associate, college, or masters degrees—by age 40.[2]

The positive effect of educational attainment on earnings is well-established and, importantly, durable over time (even as the strongest impacts are for college graduates, not high school completers; see Heckman 2000). Higher educational attainment reflects both cognitive advantages and enhanced noncognitive attributes, for example, self-discipline or diligence (Murnane et al. 2000; Carneiro and Heckman 2003). In turn, higher attainment is associated with economic well-being; this may explain the durability of any advantages obtained by participants in the program. Although the difference in attainment for males is not large, even one additional year of schooling has been found to be beneficial.

1. Path-dependency may occur through teenage pregnancy/fatherhood (although this is in part mediated through lower human capital accumulation, see Klepinger et al. 1999). An alternative route is via welfare receipt. Initial welfare receipt may either cause poorer labor market outcomes, break down social norms, or increase awareness of welfare eligibility (Green and Warburton 2004).

2. There are some differences in household composition, which may have durable impacts. Most of the individuals are either married at age 40 or have been married. For program males, 57 percent are married/cohabiting; 23 percent are divorced; only 20 percent are single, never married, or not cohabiting. The control group males have a lower marriage rate (the respective figures are 33 percent, 23 percent, and 44 percent). For program females, 37 percent are married/cohabiting and 46 percent are single; this compares to 41 percent and 45 percent, respectively, for the no-program group. However, many are not in stable relationships across adulthood.

Table 1
Educational Attainment (Percent)

	Preschool		No Preschool	
Educational Attainment	Males	Females	Males	Females
Up to age 27				
Less than high school	32	20	36	63
High school	68	72	64	33
Associate degree	0	4	0	4
College degree	0	4	0	0
Masters degree	0	0	0	0
By age 40				
Less than high school	29	16	31	54
High school	65	72	67	38
Associate degree	3	4	0	8
College degree	3	4	0	0
Masters degree	0	4	3	0
N (Total = 119)	31	25	39	24

III. Benefits of Program Participation

A. Earnings Profiles

One important benefit of the High/Scope Perry Preschool Program is that it enhances labor market opportunities—either directly via enhanced skills or indirectly through educational attainment. Labor market participation and earnings premiums convey benefits to the individual and to the general public in the form of higher tax contributions. At age 40, the program group is more likely to be employed, has higher earnings, and relies less on economic support from family or friends.

Using new data from interviews at age 40, it is possible to calculate lifetime economic differences between participants and nonparticipants. Lifetime differences in earnings are calculated for three age-periods: up to age 27; ages 28–40; and ages 41–65. Barnett (1996) reported actual earnings profiles up to age 27 and projected earnings beyond that age. The profile up to age 27 is reapplied here (although it is slightly revised in light of new self-reported information). Data are newly available on earnings for the age-period 28–40; data for these years also are used to extrapolate forward for earnings over the age-period 41–65.

In the age-40 survey, participants were asked detailed questions about their current job and work history. For the current job(s) there is information on annual and monthly earnings, hours of work, and the start date; for other (last three) jobs, there is information on earnings, as well as the start and end dates of those jobs. There is also information on last year's earnings. However, because many participants do not have stable careers, interpolating and extrapolating from these earnings data must be

Table 2
Total Lifetime Gross Earnings (Undiscounted, in 2000 dollars)

	Preschool		No Preschool	
Lifetime Earnings	Males	Females	Males	Females
Up to age 27				
Profile A1	$201,259	$145,099	$173,767	$91,495
Profile A2	$206,235	$141,301	$184,759	$90,607
Profile A3	$131,773	$97,967	$110,535	$48,381
Ages 28–40				
Profile A1	$317,855	$244,052	$240,405	$183,170
Profile A2	$380,805	$312,158	$293,434	$248,381
Profile A3	$231,496	$194,872	$160,717	$137,095
Ages 41–65				
Profile A1	$800,753	$597,308	$754,699	$534,686
Profile A2	$804,268	$626,808	$769,885	$571,528
Profile A3	$511,338	$436,035	$380,045	$351,365
Total, Ages 18–65				
Profile A1	$1,319,868	$986,459	$1,168,871	$809,351
Profile A2	$1,391,307	$1,080,267	$1,248,077	$910,516
Profile A3	$874,608	$728,875	$651,296	$536,842
Program differentials				
Profile A1	+$150,997	+$177,108		
Profile A2	+$143,230	+$169,750		
Profile A3	+$223,312	+$192,033		
N	33	25	39	26

performed cautiously (on measurement error for low-income groups, see Meyer and Sullivan 2003). Although individuals may more accurately report monthly earnings, translating these figures into annual amounts will over-estimate earnings for individuals with intermittent labor market participation. (Self-reports of annual earnings, on the other hand, take into account months unemployed.)[3] To bound estimates of lifetime earnings and to exploit different items in the data set, three profiles are constructed for each gender and by program status. Details of the calculations are given in Appendix 1.

Table 2 reports undiscounted total lifetime gross earnings by gender and program status. For program males, lifetime earnings range from $874,608 to $1,391,307; these totals compare favorably with control group males' earnings of $651,296 to $1,168,871. The program differential is considerable, with earnings 11 percent to 34

3. Data on spells of unemployment and incarceration also are used to estimate labor market participation. At age 40 program males were more likely to be employed (70 percent versus 53 percent) and less likely to be incarcerated (9 percent versus 26 percent). For females, employment rates are almost identical and no one was incarcerated at the survey date.

Table 3
Wealth Levels and Wealth Indicators

	Preschool		No Preschool	
Wealth Measures	Males	Females	Males	Females
Asset possession (percent)				
Home ownership	26.7	50.0	23.1	31.8
Car ownership	80.0	65.5	50.0	77.3
Savings account	73.3	79.2	36.1	72.7
Life insurance	60.0	75.0	47.2	63.6
Credit card	46.7	54.2	36.1	50.0
Checking account	40.0	58.3	38.9	50.0
Wealth levels (undiscounted, in 2000 dollars):				
Weighted by education	$35,970	$39,960	$35,100	$32,140
Weighted by marital status	$48,530	$45,010	$40,620	$39,430
N	33	25	39	26

percent higher than the control group. Similarly, program females report higher lifetime earnings; the absolute earnings differential may even be higher than the males, and the premium ranges from 19 percent to 36 percent.[4] Given that the program conveys other benefits to participants and is delivered at no cost, this amounts to a strongly positive private advantage (even after taxes are subtracted).

Moreover, these calculations do not include incomes from other sources (welfare income is considered separately below), nor do they shed light on money-management skills. By late adulthood, individuals may have markedly different rates of asset accumulation, with implications for wealth and well-being on retirement. Table 3 reports asset possession at age 40. It shows higher rates of asset possession and money amounts of wealth by the program group.[5] However, because these wealth estimates are not directly reported by individuals they are not included in the cost-benefit analysis.

Finally, economic well-being may be measured in terms of financial independence or avoidance of poverty. For this group, a nontrivial proportion subsist at (or below) poverty levels and, as Meyer and Sullivan (2003, 1181) contend, "There is significant

4. Although derived independently, these estimates correspond with lifetime earnings taken directly from the March 2002 CPS for all African Americans. Undiscounted lifetime earnings average around $1.06 million for high school graduates and $1.78 million for college graduates. Alternatively, earnings profiles from the NLSY may serve as a comparison. Earnings profiles are from the NLSY are reported in the Appendix.

5. Money amounts of wealth accumulation are not available for each individual, so wealth status is approximated according to an individual's characteristics. Gittleman and Wolff (2004), using the 1994 wave of the PSID, identify three key factors: greater wealth accumulation is associated with higher incomes, higher education levels, and being married. Therefore, individual-specific data on incomes and education levels are linked to the mean amounts reported in Gittleman and Wolff (2004).

evidence suggesting that income is badly measured for the poor." Further investigations using the Panel Study of Income Dynamics indicate several key risk factors over the lifecycle and, pertinent to this group of African Americans, educational attainment serves as a significant insurance against poverty across the lifecycle (Rank and Hirschl 2001). Therefore, the educational advantages obtained by the program group should further reduce the likelihood of life spent at or below the poverty level.

B. Tax Contributions

Part of the benefits attached to lifetime earnings actually accrue to the general public in the form of tax revenues. Higher earnings translate into higher absolute amounts of income tax payments (and consumption tax payments); with tax progressivity, higher earnings also may lead to proportionately higher income tax payments.

Accordingly, tax incidence was estimated across gender and age profiles for program and no-program individuals on the basis of earnings. The marginal income tax rate applied for all years across the age profiles was 15 percent, which was the U.S. marginal income tax rate for a married couple with taxable income in the corresponding years. In addition, FICA tax amounts payable both by the employer and employee are included (OCWC 2002). Thus, taxes are 31 percent of earnings (excluding fringe benefits).

Tax contributions across age profiles and the three separate earnings profiles are reported in Table 4. Differences across contributions reflect the greater earnings of the program group. Over the lifetime these differences translate into a greater tax payment of $30,146 to $60,849 for program males and $37,191 to $52,839 for program females.

C. Criminal Activity

1. Criminal Behavior Impacts

Crime rates are lower for High/Scope Perry Preschool program participants compared with nonparticipants. This was the case at age 19 and age 27 (Barnett 1996), and the link is maintained up to age 40: as examples, 48 percent of the no-program group had

Table 4
Tax Contributions by Age-Earnings Profile (Undiscounted, in 2000 dollars)

	Preschool		No Preschool	
Age-Earnings Profile	Males	Females	Males	Females
Lifetime Tax Contribution				
Profile A1	$314,740	$234,949	$280,817	$193,456
Profile A2	$311,653	$241,640	$281,507	$204,449
Profile A3	$243,377	$202,550	$182,528	$149,711
N	33	25	39	26

ever been arrested for violent crime, compared with 32 percent of the program group; and 17 percent of the no-program group were incarcerated at the time of interview, compared with 6 percent of the program group. This differential criminal activity has important implications for the cost-benefit analysis because reductions in crime reduce: victims' costs; criminal justice system (CJS) costs for policing, arrest, and sentencing; and incarceration and probation costs (Anderson 1999).

The incidence of each type of crime across the program and no-program groups is identified, and then these incidences are multiplied by the average cost of each type of crime. Individual-specific data on arrests and criminal activity for many types of felonies and misdemeanors are available, taken from newly updated information obtained from reviews of government criminal records for each person at each age point.[6] Crime behaviors are divided into 11 categories: felonies of violent assault, rape, drugs, property, vehicle theft, and other; and misdemeanors of assault/battery, child abuse, drugs, driving, and other.[7]

Three key assumptions underlie the reporting of these incidences. First, there are program differences in murder rates (2 percent versus 5 percent), and murder imposes such high victim costs that it will dominate the overall evaluation. Partly to avoid this implication, but also because of data limitations, Barnett (1996, 53) subsumes murder under assault, which is the mostly clearly associated crime. More accurate data on victim costs are now available: fatal crimes are associated with victim costs of approximately $3 million, which is over 100 times the average victim cost from assault. Nevertheless, Barnett's conservative approach is reapplied here, to include murders under the category felony-violent assault.

The second assumption relates to how arrests translate into overall crime levels. There are many more crimes than arrests, so arrest data greatly understates the actual incidence of crime. In 2002, 5.34 million violent crimes were reported by victims, but only 0.62 million arrests took place (BJS 2002b; FBI 2002). Each arrest represents only a fraction of total crimes committed by an individual, and so arrest incidences must be increased accordingly. BJS and FBI data on the numbers of crimes reported by victims and the number of arrests are used to estimate these factor increases from arrests to actual crimes.

The third key assumption relates to the extrapolation of criminal behaviors beyond age 40. Data up to age 40 should cover the majority of lifetime criminal activity, but

6. Crime data was collected for each individual at ages 19, 27, and 41 (civil infractions were newly counted in the last of these sweeps). At the county level, databases from the Circuit and District Courts were searched to obtain case numbers and so details of each crime. At the state level, the Michigan State Police Law Enforcement Information Network computer database was searched; it includes felony and high misdemeanor convictions (but not arrests that do not result in convictions). Data from Secretary of State driving records also was reviewed. At the federal level, two federal court clerks searched the records for all 123 study participants; they identified five case numbers. Finally, there were 38 residences out of state (for varying durations) across 19 different states. State policy agencies in these states were contacted, and direct criminal record searches across 11 of these states were performed, with supporting information from 7 more. For prison records, the Michigan Department of Corrections' Offender Tracking Information System was used to identify study participants with Michigan state prison records. The Department of Corrections also ran a search for all 123 study participants and found 12, providing detailed information on these individuals.

7. Ideally, the categorization should be as fine as possible, down to each crime. However, categorization is driven by the availability of data for each crime type in three domains: incidences; victim costs; and criminal justice system costs.

the rate of decline of criminality for those who commit crimes is not precisely known.[8] Using arrest rates by age, criminal activity up to age 40 represents 73 percent to 92 percent of total lifetime criminal activity, with proportions varying by crime type.[9] These proportions are used to predict criminal activity after age 40.

Table 5 shows the average number of arrests across the 11 crime types, split by program status, gender, and summed across each age profile. Overall, there is considerably lower lifetime criminal activity by the program group. For males, this conclusion is true for nine of the 11 categories (the exceptions being felony-other and misdemeanor-child abuse). For females, the results are equivocal, in part because all females commit far less crime. In fact, arrest rates are almost equal for each age-period. Program females were arrested more frequently for violent, drugs-related, and other felonies and for driving misdemeanors; no-program females were arrested more frequently for property felonies and for assault/battery, drugs-related, and other misdemeanors.

Table 5 also shows the months sentenced to probation and served in prison. Again, these are considerably lower for program group males. For ages 18–27, probation and incarceration rates were broadly similar (and high) for all males, but they diverge during the ages 28–40. For females, probation sentences were low and similar across program status.

The final column of Table 5 shows the arrests per crime, across each type of crime (based on BJS and FBI data). By assumption, each arrest itemized in Table 5 is associated with a number of undetected crimes, but nonetheless imposes costs on victims and influence the resources required for the criminal justice system (FBI 2002; BJS 2002a). This last column shows that arrests need to be uprated substantially to calculate the total costs of crime.

2. *Unit Costs for Victims and the Criminal Justice System*

The tangible and intangible costs of crime to victims are numerous, including direct expenses for medical treatments and property replacement, reduced productivity, as well as impaired quality of life. These costs vary according to the type of crime and its seriousness (felony or misdemeanor).[10] Also, there are direct expenditures on the criminal justice system for arrests, trials, and sentencing. In 2001 these were $110 billion, of which 34.2 percent was for the judicial system (not including incarceration) and 65.8 percent was for policing (BJS 2001). Thus, reductions in crime rates will generate considerable savings.

For the age-period 18–27, the unit cost figures from Barnett (1996) are reapplied. For the ages beyond 28, new unit cost figures are calculated; these reflect increases in

8. Most crime is committed during adolescence and 20s (Brame and Paquerio 2003). On average, arrest rates decline with age: less than 8 percent of the state prison population is aged over 44; and for African American males [females] who have not been incarcerated before the age of 40, the chances of ever going to prison are low, at 3.6 percent [0.6 percent] (Bonczar and Beck 1997).

9. Age- and gender-specific arrest rates for each crime type are taken from the 2002 Uniform Crime Reports (Tables, 39, 40, *www.fbi.gov/ucr/02cius.htm*). A deterministic model of crime based on individual characteristics is unlikely to yield greater accuracy: as "little is known about the risk factors... for persistence or desistance of offending after age 20" (Farrington 2003, 227).

10. Intangible losses (pain and suffering) are calculated from amounts generally spent on avoiding these eventualities or, for nonfatal injuries, on awards by juries. Miller, Cohen, and Wiersema (1996) use awards from 1,106 assault cases and 361 rape cases (counting only the compensatory awards) to make these estimates.

Table 5
Lifetime Arrest Incidences and Crime/Arrest Ratios Per Type of Crime

Arrests by Type of Crime	Preschool		No Preschool		Crimes Per Arrest
	Males	Females	Males	Females	
Felonies:					
1. Violent assault[a]	0.780	0.150	0.825	0.048	5–8.61
2. Rape	0.187	0.000	0.411	0.000	3.21–4
3. Drugs[b]	0.758	0.249	0.825	0.085	10.87–14
4. Property[c]	0.610	0.231	2.152	0.338	6.64–12
5. Vehicle theft	0.000	0.000	0.141	0.000	6.64–10
6. Other[d]	0.851	0.192	0.622	0.046	10.87–12
Misdemeanors:					
7. Assault/battery	0.462	0.050	1.368	0.635	3.55–14
8. Child abuse	0.041	0.000	0.000	0.000	10.87–14
9. Drugs[e]	0.231	0.149	0.521	0.239	10.87–14
10. Driving[f]	2.848	1.942	4.429	1.772	10.87–14
11. Other[g]	1.770	0.498	2.996	1.389	10.87–14
Months sentenced to probation:					
Up to age 27	5.273	1.920	7.410	2.080	—
Ages 28–40	8.090	1.920	11.440	2.080	—
Ages 41–65	2.405	0.691	3.393	0.749	—
Lifetime total	*15.768*	*4.531*	*22.243*	*4.909*	
Months served in prison:					
Up to age 27	14.515	3.720	17.897	2.038	—
Ages 28–40	12.333	4.120	27.282	1.615	—
Ages 41–65	4.833	1.411	8.132	0.658	—
Lifetime total	*31.681*	*9.251*	*53.311*	*4.311*	
N	33	25	39	26	

Notes: Criminal activity up to age 27 includes juvenile crime. Criminal activity by age 65 is estimated to be 1.25 times that of criminal activity by age 40.
a. Assault with a dangerous weapon; aggravated assault; murder; assault with the intent of bodily harm; kidnapping, assault with intent to murder; failure to stop at the scene of an injury.
b. Dangerous drugs; sale, possession, or trafficking.
c. Larceny over $100; larceny in a building; larceny from a person; breaking and entering; retail fraud over $25,000; receiving stolen property; forgery; welfare fraud.
d. Escape; tampering with witness; fraud; habitual offender; obstructing police; carrying a concealed weapon; and fraud.
e. Possesion; controlled substance use.
f. Driving without license; suspended license; under influence; other driving misdemeanors; failure to stop at accident; improper license plate.
g. All other misdemeanors.

Table 6
Unit Victim Costs and Criminal Justice System Costs per Crime (2000 dollars)

Arrests by Type of Crime	Victim Cost	Criminal Justice System Cost	Total Cost per Crime
1. Felony—violent assault	$26,860	$19,319	$46,179
2. Felony—rape	$97,368	$57,299	$154,667
3. Felony—drugs	$2,238	$8,393	$10,631
4. Felony—property	$8,953	$18,452	$27,405
5. Felony—vehicle theft	$41,409	$8,393	$49,802
6. Felony—other	$8,953	$8,393	$17,346
7. Misdemeanor—assault/battery	$10,520	$4,360	$14,880
8. Misdemeanor—child abuse	$30,218	$8,393	$38,611
9. Misdemeanor—drugs	$2,238	$4,360	$6,598
10. Misdemeanor—driving	$3,022	$4,360	$7,382
11. Misdemeanor—other	$1,567	$4,360	$5,927
Per month of probation	na	$141	$141
Per month of incarceration	na	$2,282	$2,282

Notes: For categorization of types of crime, see Notes, Table 5. Cost figures reported are for age 40. Victim costs for ages 28–40 taken from Miller, Cohen, and Wiersema (1996); CJS costs for ages 28–40 are averages of estimates from Cohen (1998) and the low estimates of Cohen et al. (2004). Probation costs per month and incarceration costs per month are taken from BJS databases (BJS 2001, 2002a). Victim costs, CJS costs, probation costs, and incarceration costs for age 40-65 are extrapolated, based on the trend growth rate in criminal justice costs, 1960s–1990s.

the economic burden of crime, new methods of estimating its costs, and finer levels of disaggregation among types of crime. For periods beyond age 40, growth in real per unit costs is assumed at 0.6 percent per year, which is the real growth rate in costs over the 1960s–1990s (BJS 2001).

Victim costs across crime types are reported in the first column of Table 6, based on Miller, Cohen, and Wiersema (1996 Table 2). [The contingent valuation study by Cohen et al. (2004), combining victim and CJS costs, reports considerably higher values]. These figures show four economically important crimes from the victims' perspectives: violent assault, rape, vehicle theft, or child abuse. CJS costs per crime type are given in Column 2 of Table 6 (Cohen 1998; Cohen et al. 2004). Violent assault and rape felonies impose high costs on the criminal justice system; as with the victim costs, these are the most economically important crimes. However, there are considerable CJS costs from other crimes, particularly felonies; for these crimes, the CJS costs exceed the victim costs. These costs per crime are multiplied by the crime incidences to provide estimates of the total economic burden.[11]

11. Not all CJS costs should be weighted according to the crime:arrest ratios. Policing costs are incurred per crime, but sentencing and trial costs are only incurred per arrest. Thus, policing costs are assumed to be proportional to the numbers of crimes committed, with policing costs being 65.8 percent of total CJS costs (the national ratio). Similarly, sentencing and trial costs are assumed proportional to the number of arrests made, with these costs being 34.2 percent of total CJS costs.

Table 7
Total Costs of Crime to Age 65 (Undiscounted, in 2000 dollars)

	Preschool		No Preschool	
	Males	Females	Males	Females
Up to age 27	$334,844	$107,795	$640,430	$123,402
Ages 28–40	$484,623	$117,598	$773,265	$125,577
Ages 41–65	$255,892	$65,627	$394,558	$66,026
Lifetime	$1,075,359	$291,020	$1,808,253	$315,005
Lifetime program differentials				
By gender	–$732,894	–$23,985		
Program average	–$378,440			

Finally, these criminal activities resulted in probation and incarceration sentences, imposing further costs on society. Unit costs for probation and incarceration per month are reported in the bottom panel of Table 6, based on national data. The monthly cost per inmate of probation is $141 and of incarceration is $2,282.[12]

3. Lifetime Costs of Crime

Table 7 shows the undiscounted costs of crime to age 65, by program status and gender. Males in the program group impose an economic burden of over $1 million. Although this figure is substantial, it is considerably less than the burden of $1.8 million which the no-program males impose (similar estimates for at-risk youth across both genders are given by Cohen 1998). Females impose much lower burdens (by around 70 percent); these are broadly similar across program status, but again show a gain to the general public from program participation (an 8 percent saving).

D. Impacts on Welfare Receipt

1. Welfare Incidences

Welfare payment effects are the third main benefit of the cost-benefit analysis. High proportions of both study groups were intermittently eligible for welfare services. In general, welfare reliance is slightly lower for program participants (for receipt of any social services by age 40, 71 percent versus 86 percent). This differential was large for the ages 17 to 27, but narrowed subsequently with equivalent proportions reporting any services during the ages 33 to 40. Also, welfare receipt differs fundamentally

12. Probation costs are calculated as total direct expenditures for state noninstitutional correctional activities in 1999 divided by the number of adults on probation under state jurisdiction (BJS 2002a, Tables 1.8, 6.1). Incarceration costs are calculated from: total direct expenditures for state institutional correctional activities in 1999 divided by the number of persons in state prisons in 1999 (BJS 2002a, Tables 1.8, 6.12). For periods beyond age 40, growth in real per-unit costs is assumed at 1.7 percent per year, the rate of growth in costs over the period 1984-96 (Stephan 1999).

Table 8
Welfare Incidences and Costs to Age 65 (Undiscounted, in 2000 dollars)

	Preschool		No Preschool	
	Males	Females	Males	Females
Months of Welfare:				
Up to age 27[a]	5.673	26.748	6.000	39.015
Ages 28–40[b]	4.249	59.384	27.550	24.337
Ages 41–65[c]	12.403	107.665	41.938	79.190
Total lifetime amounts	$5,842	$76,276	$23,173	$64,838
Lifetime payment differentials				
By gender	–$17,331	$11,438		
Program average	–$2,974			
Societal cost[d]	$2,221	$28,985	$8,806	$24,639
Total lifetime costs	$8,063	$105,261	$31,979	$89,477
Lifetime disbursement differentials[e]				
By gender	–$23,916	$15,784		
Program average	–$4,066			
N	33	25	39	26

Notes: Months of welfare reliance are reported per welfare program. Individuals may rely on more than one program per month.
a. Welfare receipt over ten years (AFDC, Medicaid, GA, food stamps).
b. Cash assistance, food assistance, medical assistance, family counseling, and other welfare programs.
c. Aggregate predicted estimate.
d. Error rate and administrative costs equals 38 percent of payment amounts.
e. For the general public, payments, and administrative costs must be incurred.

by gender, particularly when females are primary caregivers for children. Moreover, the consequences from differences in welfare receipt across program and no-program groups depend on the perspective adopted. When triggered by increased income, lower welfare payments are a gain for the general public and for society but a loss to the individual (see Wolfe 2002).

The impact by gender on reducing welfare payments is estimated for the three age-periods 18 to 27, 28 to 40, and extrapolated for ages 41 to 65. The top panel of Table 8 shows welfare reliance.[13] Over the ages 18–27, males reported similar and relatively low levels of assistance (six months), but females reported considerable reliance (27 versus 39 months). For the ages 28 to 40, state data shows the extent of cash, food, and medical assistance, as well as the number of months of family counseling and other welfare claims. Strong differences are apparent. Program females reported the greatest reliance on welfare, at an average of 59 months (compared with 24 months for no-program females); this result is consistent with their delayed

13. Updated self-report records are used for the ages 18-27 (Barnett 1996, 58). For the ages 28-40 newly obtained state records are used; these account for changes in state and federal stipulations on funding and eligibility. Finally, for the ages 41 to 65, welfare receipt is predicted based on a deterministic model.

child-rearing and higher educational attainment.[14] For program males, welfare reliance was relatively low, at four months; but no-program males reported very high levels of medical assistance, drawing on welfare support for on average 28 months. Finally, welfare reliance for ages 40 to 65 are estimated as a weighted average over the prior age-period incidences.

2. Welfare Payments

From months of incidence and estimates of per-month welfare benefits, total amounts of funding can be derived. For the ages up to 27, calculations are based on (contemporaneous) payment schedules for welfare entitlements in Michigan (MSIS 2001; although they are close to national estimates, Klawitter, Plotnick, and Edwards 2000). For the ages 28 to 40, direct statements of financial assistance in cash and food stamps are available.[15] Welfare receipt for the third age-period is assumed to be the weighted average of the amounts for the prior age-periods.

The fourth row of Table 8 summarizes the undiscounted lifetime welfare payments, by program status and gender. On average, the program group receives slightly less welfare, but this obscures gender differences. Program males reported lower welfare receipts over the lifetime (by $17,331), but program females had an advantage of $11,438.

For individuals, a dollar received in welfare is equal to a dollar obtained from any other source, such as paid employment. Individuals who report welfare receipts above the earnings of others are therefore better off. Moreover, welfare payments are a willing transfer between recipients and taxpayers, so the net impact to society is only the costs of administering the program, including the error rate in targeting the program. (The deadweight loss to economic outcomes from the imposition of taxes is addressed in the sensitivity analysis.) Based on Michigan state data, the costs of administering all welfare disbursements are 29.7 percent of total disbursements. In addition, the average error rate in terms of overpayments and payments to ineligible families is 6.4 percent (FIA 2003, 8). In sum, for every dollar disbursed in welfare, there is a cost to society of 38 cents. Table 9 shows the net transfer impacts from welfare funding. The average effect was a lower welfare amount of $4,066 (with program males receiving $23,916 less in transfers against the $15,784 more for program females).[16] However, for the general public the total cost of payments and administration must be counted. This is reported in the final panel of Table 8.

14. Family characteristics and household size influence welfare receipt (for example, AFDC). Importantly, the program group appears to delay child-rearing: by age 27, program group females had 1.8 children compared with 2.04 for the no-program group (for males, the figures are 1.06 and 1.21, respectively); but by age 40, program females had 1.40 children compared with 0.73 children (for males, the figures are 0.85 and 1.13). Over this later age-period, program females were therefore eligible for more welfare.

15. The Food Assistance Program is funded by the U.S. Department of Agriculture. Amounts for the other three welfare services are taken from state records and eligibility rulings. Medical assistance and family counseling is administered through the Michigan Family Independence Agency (FIA 2003) and the Michigan Department of Community Health.

16. As noted by an anonymous reviewer, the gap in payments is smaller than the gap in incidence. No data is available on why program females spend more time on welfare but receive smaller rates of welfare receipt.

E. Additional Costs and Benefits of the Program

1. Measurable Impacts

Additional program impacts that can be measured and included in the cost-benefit analysis are childcare and educational attainment. Childcare over the period of the program is a savings to parents, either in free time or lower personal expenses. No new data are pertinent, so we use earlier childcare estimates from Barnett (1996, 27) at $906 per participant. Educational attainment counts both in the benefit and cost column: Where it allows students to progress more efficiently through the education system, it yields savings; where the program promotes further educational attainment, additional costs will be incurred. The former effect is important: Both lower grade retention and less frequent placement in special education classes are associated with program participation. Barnett (1996, 28–35) reports the individual cost savings associated with more efficient progression as $16,594 for program males and $7,239 for program females.

The latter effect also should be considered. In part because of a higher on-time high school graduation rate, the program group had a lower rate of participation in adult schooling (where the goal is to obtain a high school diploma or equivalence) up to age 27. The cost savings are not large, at $338 for males and $968 for females. For higher education, program males reported fewer semester credits, saving $916 per participant, but program females reported higher rates of college progression, increasing average program costs by $1,933. New data indicates that individuals continued to accumulate education credentials after age 28 (no attainment beyond age 40 is assumed).[17] The costs of these credentials are taken from the *Digest of Education Statistics* (NCES 2002).[18] From the state's perspective these additional costs amount to: $2,814 for the program males and $3,195 for the program females compared with $2,445 for the no-program males and $1,570 for the no-program females. The average differential is $992. For the individuals, the expenses incurred were $671 for the program males and $1,089 for the program females, compared with $755 for the no-program males and $235 for the no-program females. The average differential was $385.

2. Nonquantifiable Impacts

Other consequences from the program that cannot be easily quantified include subjective assessments of how worthwhile the program was or judgments about overall

17. Program males obtained one high school diploma, one associate degree, and one college degree. The no-program males obtained two high school diplomas, one college degree, and one Masters degree. The program females obtained one high school diploma, one college degree, and one Masters degree. The no-program females obtained two high school diplomas, and one associate degree. In addition, 11 males and ten females in the program obtained some college credits; the respective numbers for the no-program group were 14 and six.

18. High school diplomas are equivalent to the cost of six months of high school at $3,827 (NCES 2002, Table 166). For associate and college degrees, the per full-time-equivalent median student expenditures in 1999-2000 were $8,924 at two-year colleges and $13,517 at four-year colleges; offsetting this are average tuition of $1,721 and $3,314, respectively (NCES 2002, Tables 312, 314, 334). For the Masters degrees, student expenditures are assumed to equal those at four-year colleges, with the individual's contribution to tuition of $8,429 (NCES 2002, Table 315). Each individual with course credits is assumed to have incurred one-fifth of the costs for a two-year degree, with a commensurate expenditure by the state. (All figures exclude room and board expenditures).

well-being and life satisfaction. In particular, three factors should be noted that are not included in the cost-benefit analysis.

First, there may be health-status differences across the groups. Unadjusted cross-tabulations show the program group is less likely to report that they had stopped working for health reasons (43 percent versus 55 percent); had a health problem (20 percent versus 29 percent); smoked (42 percent versus 55 percent); used soft drugs (45 percent versus 54 percent); used hard drugs (22 percent versus 29 percent); or needed treatment for drug-use or drinking (22 percent versus 34 percent). From the perspective of the general public, many of these health status differences may be captured in differences in earnings or welfare receipt. (Although health costs increase sharply as individuals age, raising reliance on Medicaid and Medicare). For the individual, there may be genuine differences in quality of life.

Second, there is a difference between the groups in terms of mortality rates. Of the initial 58 program participants, one female and one male were deceased by age 40; of the 65 participants in the no-program group, two females and three males were deceased. These mortality differences may be causal: Low wealth and mortality are strongly correlated (Attanosio and Hoynes 2000) and life expectancies vary significantly across family backgrounds and education levels. In this analysis, the levels of earnings, criminal activity, and welfare receipt of these deceased individuals were given zero values across the age profiles.[19] However, no monetary values are included to compensate for loss of life directly.[20] Again, this produces a conservative estimate of the benefits of the program.

Finally, there may be intergenerational program effects not yet detected. These impacts gain salience in a cost-benefit framework, where impacts on the child of a teenage parent are discounted at a much lower rate than earnings differences at age 40, for example. The data show differences in family formation and behaviors that may have intergenerational consequences, such as abortions (17 percent versus 32 percent). Family size differences and two-parent family rates also vary by program status, as does teenage parenting (see Reynolds et al. 2001). These differences are not included in this analysis.[21]

19. An alternative approach would have been to treat these individuals as missing, and the most conservative approach would have been to impute missing values or zero values whenever this would bias downward the program effect. This latter approach was employed in initial testing to compare with the approach used in the final analysis.

20. Imputing these costs is difficult (because of discounting) but they may influence the results substantially. From a meta-analysis of 33 studies, Mrozek and Taylor (2002) estimate the Value of a Statistical Life at $1.58-$2.64 million. Based on the relative probabilities across the program and no-program groups, the mortality impacts may be valued at $74,000 to $93,000 per person (undiscounted).

21. Intergenerational impacts are identified by regressing an offspring characteristic against the same parental characteristic (for example, sons' earnings against fathers'). In a review, Solon (1999) finds mean intergenerational earnings elasticities of 0.4; summarizing 8 studies, Mulligan (1999) estimates the intergenerational coefficient on attainment at 0.29. Assuming equivalent family sizes across the treatment and control groups, and offspring born at age 21, a present value earnings premium of $100 to a program group individual would be associated with a present value earnings premium of $16 from each offspring. That is, single-generation analyses underestimate program impacts by 16 percent. However, although intergenerational heritability of crime and welfare may be similar (see Williams and Sickles 2002; Pepper 2002), fewer individuals are engaged in each of these activities, which dilutes the intergenerational impacts. Moreover, in their overview, Erikson and Goldthorpe (2002) refer to such intergenerational transfers as a 'black box', prompting caution over imputing clear benefits to the program.

IV. Cost-Benefit Analysis Results

A. Results for Participants and the General Public

The above analyses show considerable advantages to participation in the program, and these should be compared with the program costs to produce a full cost-benefit calculation for the participants and for the general public. We made a third calculation for society: the sum of participant and general public benefits excluding transfers. Sensitivity analysis was performed, with variations in the discount rate and manipulations of the underlying assumptions about costs. In each case, tabulations are separated by gender and then averaged to derive the overall cost-benefit ratios.

Tables 9 and 10 report the full cost-benefit analyses, using discount rates of 3 percent and 7 percent respectively (the latter rate being very conservative, see Moore et al. 2004). In each case the top panel shows the program benefits, the middle panel the program costs, and the final row reports benefits minus costs.

The first three columns illustrate the average net program benefits for participants. On average, the program group incurred some small educational costs over the age-period 28-40; group members posted considerably higher earnings over their entire working life but received somewhat lower welfare payments.[22] They incurred no crime costs or program costs. Applying a 3 percent discount rate, the overall gains from participation in the program amount to $49,190 (approximately 6 percent of expected lifetime earnings). The gains are 47 percent greater for the females ($58,554 compared with $39,825 for the males), with a greater advantage in lifetime earnings and with positive welfare receipts after age 28. Applying a 7 percent discount rate, the benefits to participants remain positive, at $17,730 on average.

The second set of columns in Tables 9 and 10 show the benefits to the general public. The K-12 education savings (lower grade retention and special education placement) outweigh the educational subsidies for further education attainment, meaning that pressure on educational budgets is lessened overall. Each age-period shows higher tax payments and lower welfare payments by the program group. However, the most important impact is the reduction in crime costs. Using a 3 percent discount rate, the program costs $15,166, the benefits are $195,261 per participant, and the net benefits are therefore $180,455. At this discount rate the program repays $12.90 for every $1 invested. Almost all these net benefits derive from reductions in crime by the male participants, a result that is compounded by the greater welfare receipt of program females after age 28. Applying a 7 percent discount rate, the net benefits to the general public are $67,029. For each $1 invested, the yield is $5.67. The overall effect for the general public is strongly positive, although the returns for females fall below zero at this discount rate.

Finally, the third set of columns in Tables 9 and 10 shows the overall impact on society, taking both the participants' and the general public benefits into account (but not transfers). These affirm that the program yields high returns.

22. Earnings profile [A2] uses the most information to estimate lifetime earnings, so it is applied in Tables 10 and 11. This is conservative although this profile's estimated total earnings within each group are similar or slightly higher than the other two profiles, it actually provides lifetime differences across program and no-program groups that are lower than the other two profiles.

Table 9
Lifetime Cost-Benefit Analysis of the High/Scope Perry Preschool Program (Discount rate = 3 Percent)

	For Participants Only			General Public			Society (Participants and General Public)		
	Full Sample	Males	Females	Full Sample	Males	Females	Full Sample	Males	Females
Program benefits									
Childcare[a]	906	906	906	0	0	0	906	906	906
Education									
K–12 education[b]	0	0	0	8,434	11,612	5,256	8,434	11,612	5,256
Up to age 27[c]	0	0	0	(719)	784	(2,222)	(719)	784	(2,222)
Ages 28–40	(160)	35	(354)	(412)	(149)	(674)	(571)	(114)	(1,028)
Ages 41–65	0	0	0	0	0	0	0	0	0
Earnings									
Up to age 27	15,855	9,042	22,668	4,611	2,630	6,592	20,466	11,672	29,260
Ages 28–40	24,146	27,917	20,375	7,022	8,118	5,925	31,168	36,035	26,300
Ages 41–65	10,447	8,930	11,964	2,445	1,799	3,091	12,892	10,729	15,055
Crime									
Up to age 27	0	0	0	93,285	177,504	9,066	93,285	177,504	9,066
Ages 28–40	0	0	0	61,477	119,645	3,308	61,477	119,645	3,308
Ages 41–65	0	0	0	16,711	33,325	96	16,711	33,325	96
Welfare									
Up to age 27[d]	(2,793)	(3,364)	(2,221)	3,854	4,643	3,065	1,062	1,279	844
Ages 28–40	810	(2,066)	3,685	(1,117)	2,851	(5,085)	(308)	785	(1,400)
Ages 41–65	(22)	(1,575)	1,531	31	2,174	(2,113)	9	599	(582)
Total benefits	$49,190	$39,825	$58,554	$195,622	$364,936	$26,305	$244,812	$404,761	$84,859
Program costs[e]	0	0	0	$15,166	$15,166	$15,166	$15,166	$15,166	$15,166
Net Benefits	$49,190	$39,825	$58,554	$180,455	$349,770	$11,139	$229,645	$389,595	$69,693

Notes: All money values expressed in 2000 dollars. Figures rounded to nearest dollar. Participant earnings are net of tax. See earlier tables for sources.
a. Barnett (1996, 28).
b. Barnett (1996, Table 13).
c. Barnett (1996, 36–38).
d. Barnett (1996, Table 27).
e. Barnett (1996, Table 4).

Table 10
Lifetime Cost-Benefit Analysis of the High/Scope Perry Preschool Program (Discount rate = 7 Percent)

	For Participants Only			General Public			Society (Participants and General Public)		
	Full Sample	Males	Females	Full Sample	Males	Females	Full Sample	Males	Females
Program benefits:									
Childcare[a]	862	862	862	0	0	0	862	862	862
Education									
K-12 education[b]	0	0	0	5,451	7,362	3,540	5,451	7,362	3,540
Up to age 27[c]	0	0	0	(279)	432	(989)	(279)	432	(989)
Ages 28–40	(64)	(11)	(116)	(135)	(49)	(220)	(198)	(60)	(336)
Ages 41–65	0	0	0	0	0	0	0	0	0
Earnings									
Up to age 27	7,695	4,132	11,258	2,238	1,202	3,274	9,933	5,334	14,532
Ages 28–40	7,854	9,078	6,629	2,284	2,640	1,928	10,138	11,718	8,557
Ages 41–65	2,163	1,995	2,331	505	411	599	2,668	2,406	2,930
Crime									
Up to age 27	0	0	0	46,807	89,064	4,549	46,807	89,064	4,549
Ages 28–40	0	0	0	20,114	39,145	1,082	20,114	39,145	1,082
Ages 41–65	0	0	0	2,837	5,658	16	2,837	5,658	16
Welfare									
Up to age 27[d]	(1,401)	(1,688)	(1,114)	1,934	2,330	1,538	533	642	424
Ages 28–40	265	(676)	1,206	(366)	933	(1,664)	(101)	257	(458)
Ages 41–65	(4)	(267)	260	5	369	(359)	2	102	(99)
Total benefits	$17,370	$13,425	$21,316	$81,396	$149,497	$13,294	$98,767	$162,922	$34,610
Program costs[e]	0	0	0	$14,367	$14,367	$14,367	$14,367	$14,367	$14,367
Net benefits	$17,370	$13,425	$21,316	$67,029	$135,130	($1,073)	$84,400	$148,555	$20,243

Notes: All money values expressed in 2000 dollars. Participant earnings are net of tax. Figures rounded to nearest dollar. See earlier tables for sources.
a. Barnett (1996, 28).
b. Barnett (1996, Table 13).
c. Barnett (1996, 36–38).
d. Barnett (1996, Table 27).
e. Barnett (1996, Table 4).

It also is possible to calculate an internal rate of return to the program. For the general public, the internal rate of return to the program is 17 percent (for males, the rate is 21 percent; for females, it is 8 percent). This gives further corroboration of the gains from the investment, relative to other investments. However, rank-ordering across human capital investments may differ, depending on whether an internal rate of return or net present value criterion is applied (see Carneiro and Heckman 2003, 210–13). Therefore, the internal rate is not used to justify the program.

B. Sensitivity Analysis

1. Setting Parameters for Sensitivity Analysis

This sensitivity analysis focuses on plausible variations in the main determinants on the overall results, with each sensitivity analysis based on an alternative data source. Given that the program yields strongly positive benefits to participants, attention here is on how the net benefits to society vary. Tables 9 and 10 show that a main determinant of the cost-benefit ratio is the crime differential by program status, but the income streams and welfare-receipt patterns are recalibrated. To conduct the sensitivity analysis, new assumptions are applied deliberately to understate and enhance the economic impact of the preschool program, providing brackets for the net present value. However, the main results are already based on conservative assumptions, so the lower-level estimates may be better described as highly conservative and the upper-level estimates as less conservative (but not a measure of the maximum possible returns to the program).

2. Bracketing the Net Present Value of the Program

To estimate the lower range for the net present value, we recalculated earnings, tax impacts, crime, and welfare receipts.[23] In each case, a data source was identified that would yield lower figures. These lower-bound sources were applied to both the program and no-program groups. This analysis lowers the overall lifetime money streams; this does not necessarily reduce the program differentials directly. But, because the program costs must be offset, reducing the absolute money streams reduces the net present value.

The lower-bound estimates of the net present value are reported in Table 11. Even with overly conservative assumptions and a discount rate of 7 percent, the benefits to the male participants, the general public, and society are strongly positive. Notably, net benefits to the general public from the program females cannot be guaranteed. At discount rates of 3 percent or 7 percent, and applying these very conservative assumptions, there is a net loss to the general public; at its maximum, this loss is $5,524.

23. For earnings, the conservative profile [A1] is used (which assumes only small differences in labor market participation and the lowest fringe benefits rate). Profile [A1] yields lower tax revenues, but a standard deduction also is applied (with no tax on income up to $4,750), along with a marginal tax rate of 15 percent for earnings above the deduction). For the crime burden calculations, CJS costs were only applied to the number of arrests, and not the number of crimes. (An alternative approach—which generates similar results—is to use the FBI arrest-crime ratios, FBI 2002, Table 25.) For welfare, female welfare receipt after age 40 was assumed to be a linear extrapolation of receipt during ages 28 to 40.

Table 11
Sensitivity Analysis for Net Program Benefits

	For Participants Only			General Public			Society (Participants and General Public)		
	Full Sample	Males	Females	Full Sample	Males	Females	Full Sample	Males	Females
Discount rate = 3 percent									
Lower-range estimates	$43,340	$33,945	$52,735	$99,750	$199,999	($500)	$143,090	$233,944	$52,235
Table 10 results	$49,190	$39,825	$58,554	$180,455	$349,770	$11,139	$229,645	$389,595	$69,693
Upper-range estimates	$43,951	$36,657	$51,244	$237,468	$449,590	$25,346	$281,419	$486,247	$76,590
Discount rate = 7 percent									
Lower-range estimates	$15,020	$11,526	$18,513	$32,136	$69,795	($5,524)	$47,155	$81,321	$12,989
Table 11 results	$17,370	$13,425	$21,316	$67,029	$135,130	($1,073)	$84,400	$148,555	$20,243
Upper-range estimates	$13,943	$10,657	$17,318	$88,298	$172,228	$4,367	$102,240	$182,795	$21,865

Note: All money values expressed in 2000 dollars.

A similar approach was adopted to estimate the upper range for the net present value. We recalculated earnings, welfare, crime, and tax impacts using new data sources.[24] Extra benefits in terms of health status also were considered.[25]

The upper range estimates are reported in Table 11. Male and female participants reap significant economic advantages. For the general public, the net benefits are $172,228 and $4,367 for males and females respectively. With an average net benefit to society of $88,298, provision of the program yields benefits which are 6.15 times the costs.

V. Conclusions

The cost-benefit analysis performed here shows strong positive impacts from participation in the program and strong positive gains for the general public in providing this program. Only under very restrictive assumptions (or high discount rates) do the returns become negative and only then for the female subsample. Overall, this conclusion is robust to the choice of discount rate and to variations in assumptions about earnings profiles, the costs of crime, and the burden of welfare support offered to participants. Moreover, this conclusion supports the analysis undertaken by Barnett (1996). Broadly, the earlier study and its empirical projections appear to have been overly conservative in terms of the gains from the program.[26] Similarly positive results have been obtained from economic evaluations of other preschool programs (Masse and Barnett 2002; Reynolds et al. 2001; Conyers, Reynolds, and Ou 2003; see also Currie 2001). Together, this evidence offers a compelling motive for investment in educational provision at an early age for at-risk children.

However, the specific features of the program raise issues about external validity. It is legitimate to ask: (1) Would the same returns be anticipated from a similar investment under current economic conditions? and (2) Would the same returns be anticipated for groups other than children from low-income families at risk of school failure?

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24. For earnings, profile [A3] is used (it assumes faster wage growth beyond age 40), with a 2 percent productivity growth beyond age 40. Tax rates of 25 percent are applied (based on Fullerton and Metcalf 2002). For welfare, associate receipts are added to receipts as principal. For crime, the proportion of CJS costs allocated toward policing costs is assumed at 75 percent. In addition, deadweight loss estimates are included for crime and welfare reliance. Deadweight losses arise because raising tax revenues for welfare payments and policing services imposes an economic distortion. Review evidence puts this loss (conservatively) at 15 cents per dollar of revenue raised (Allgood and Snow 1998). Both crime and welfare costs are uprated by this factor. (A higher uprating is identified by Browning (1993), but a conservative approach is preferred.)

25. For this analysis, differential rates of smoking are included (37 percent [53 percent] of the program group males [females] smoke, compared with 48 percent [59 percent] for the no program group). The average amount of health care spending per person p.a. in the US is $2,500 (Cutler 2002). Hodgson (1992) estimates that smokers spend an extra 20 percent on health care, with 8 percent of all health care spending being smoking-related. Thus, the annual additional health care cost of smoking ranges $200–$500. Assuming health care costs are split between the individual and the taxpayer, these annualized amounts can be included as additional benefits from program participation.

26. There are two main differences between the results presented here and those by Barnett (1996). The projected earnings in Barnett (1996, pp. 43, 46) are lower by 46 percent, because a very conservative extrapolation was deliberately chosen in the earlier study. The crime consequences also are lower because newly available data reports much higher unit costs of crime. The differences in estimation of welfare receipt are trivial.

The first of these questions prompts investigation of whether the relationships between preschooling, outcomes, and high returns still exist and whether they will continue to exist. The second question then considers the relevance of these relationships to the economic well-being of other groups in society.

To project the returns to investment in a similar program under current conditions requires predictions regarding the four main components of the cost-benefit analysis: education, earnings, crime, and welfare. For each component, it seems likely that the relationships reported in this analysis would be maintained or strengthened. Educational costs (including special education) have risen sharply above the rate of inflation over the last two decades (NCES 2002).[27] Thus, it is plausible that the unit cost of schooling will keep rising. Preschool programs that subsequently reduce grade repetition and lower the rate of special-education placement are therefore likely to remain cost-effective. Current earnings profiles also augur well for high returns to investment in preschool. For low-skill males, real earnings have increased little since the 1970s; and education has grown in importance in determining all wages (Carneiro and Heckman 2003). Thus, preschooling that raises education and skill levels may raise economic well-being through enhanced employment prospects. The most important impact of the program is in reducing criminal activity. As with education, policing and CJS costs have been increasing beyond the rate of inflation within the last two decades.[28] Programs that reduce future crime rates should therefore be high-yield. Finally, welfare costs are unlikely to impact adversely on the future yield. Recent reforms have reduced entitlements and tightened time-limits (Blank and Ellwood 2002). Such changes are likely to lower the benefits to individuals (especially females) who participate in preschool programs but they would raise the benefits to taxpayers. However, because welfare differentials were not large, any reforms are unlikely to drive the overall rate of return.[29]

The second policy question relates to the generalizability of these findings. The High/Scope Perry Preschool program targeted at-risk children, and may be strictly applied to children currently meeting this description. However, one interpretation of at-risk relates to educational attainment, and as shown in Table 1, many of the target children did not complete high school. Thus, one way to interpret the overall impact of the program is that it substantially raises the probability that a likely high school dropout instead becomes a high school graduate. In this light, the program may be regarded as yielding advantages typically associated with graduation and being appropriate for all children at risk of being high school dropouts. If so, large-scale provision of preschool programs may be justified: 10.7 percent of 16 to 24 year-olds are high school dropouts, but 30 percent of public school students fail to complete on time

27. This trend may arise because of enhanced opportunities for females outside of teaching and the move toward smaller class sizes (Hanushek 1998). With few technological changes in teaching, along with flat standardized test scores and static dropout rates, productivity growth may be slow (Hoxby 1999).

28. In real terms between 1982 and 2001, police spending rose by 208 percent, judicial spending by 264 percent, and corrections spending by 343 percent (BJS 2002; Stephan 1999).

29. General equilibrium effects may impinge on these results if the program was extended to a large proportion of children. However, evidence on how the returns to education vary with population-wide increases in education levels is not conclusive. Despite substantial educational upgrading in the 1990s, the returns to education rose (Ashenfelter and Rouse 2000).

(Swanson 2004). However, benefits to more advantaged families cannot be ascertained with these data. Equally important is that one cannot identify which components of the High/Scope program make it so effective; full implementation of the program therefore appears to be necessary to ensure that both families and society benefit from preschooling.

Appendix 1

Calculations of the Earnings Profile

Three earnings profiles are calculated for each age-period (18–27, 28–40, and 41–65).

Profile A1 fits a linear trend to the earnings for the ages 16–19 and 25–27 (see Barnett 1996, 43) and from the self-reported annual earnings at age 27 up to age 40. Although these figures adjust for intermittent labor market participation, this method assumes that such participation rates are constant over the entire period.

Profile A2 fits a linear trend from the same earnings at age 16–19 as in A1, but to newly revised estimates of earnings at age 27. For the age-period 28–40, Profile A2 was created by working backward from the self-reported earnings for age 40, and self-reported earnings from previous jobs (where earnings data are not reported, and individuals are either on welfare, in prison, or unemployed, then earnings are assumed to be zero). This approach uses more information than the simple linear trend, by tracking the job history of each individual between the two interviewed ages (with linear trends applied for years with missing data). This additional information is important because many participants either change jobs with reasonable frequency or have multiple jobs, and there are differences in the accuracy of the information reported on previous jobs across individuals, especially for individuals with high job mobility.

Profile A3 adjusts age 27 earnings for expected unemployment rates derived from a predictive model. In the model, the number of months of unemployment within the last two years at age 27 was regressed against gender, number of juvenile/adult arrests, education, and months in prison (R-squared=0.46). Individuals' predicted months of unemployment were then factored in to the overall estimates of earnings at age 27. For the age-period 28–40, Profile A3 incorporates a regression model to predict labor market participation. Using unemployment in the last two years as the dependent variable, individual-specific months of employment are estimated as a function of gender, welfare reliance, education, and incarceration (adjusted R-squared = 41 percent). These predictions are then used to estimate the extent of labor market participation over the ages 28 to 40. Earnings from the Profile A1 were then adjusted in accordance with expected rates of unemployment to generate the Profile A3.

Each of the methods used for the three earnings profiles also are used to project earnings beyond age 40. Also, information is included on African Americans' annual earnings by age, education level, and gender from the March 2002 Current Population Survey (CPS). Average earnings in the CPS (by age and education) are weighted in accordance with educational attainment for program and no-program males and

females. Also, survival rates by age and gender are incorporated (National Center for Health Statistics 1998) to adjust these projected earnings.

Profile A1 is extended on a linear format from age 40 using mean CPS earnings at age 50, and at age 65, and fitting linear trends between these (since around age 50 the CPS data evidences reversal in average earnings). Profile A2 uses average weighted data for each population group as reported in the CPS, and then fits linear trends in-between (at ages 45, 50, 55, 60, and 65). This profile also is adjusted by unemployment, adjusting by the ratio of annual earnings to annualized monthly earnings as reported at age 40. Profile A3 uses estimated unemployment rates for each group for the 27-40 data, and applies these to the earnings predicted in Profile A1.

All earnings estimates are adjusted for employment-related fringe benefits, but without employer-related overhead costs. These fringe benefits are derived from data from the Bureau of Labor Statistics Report on Employer Costs for Employee Compensation (OCWC 2002, 4). For Profile A1, earnings were uprated by the rate of legally required benefits, insurance, and paid leave, which adds 29.2 percent to earnings. For Profile A2 all types of benefits were included, adding 37.6 percent to earnings. For Profile A3, only legally required benefits are included, adding 10.7 percent to earnings.[30]

An alternative source for lifetime earnings is the NLSY (we appreciate this suggestion from James Heckman). Using the sample of black respondents, annual earnings for each year from 1979 to 2002 were analyzed. Earnings profiles were created by gender and by educational attainment levels (less than high school, high school, associate degree, BA, MA). Earnings beyond 2002 were extrapolated with 2002 earnings plus the moving average of the previous three years' earnings gains.

Lifetime earnings in $2000 by gender and education level are calculated. For females, these NLSY data show female earnings of approximately $650,000, a figure within the range of our initial estimates when fringe benefits are included. Because program group females have higher educational attainment, their earnings are on average higher: the program differential is $54,974. This differential is lower than in the above tables, although when fringe benefits are accounted for the discrepancy is not large. For males, lifetime earnings are in the range of $910,000 (again, not including fringe benefits), a figure similar to the results reported above. However, the data show average earnings of the program group *lower* than the no program group (by $29,862). However, this contradictory result is driven by the very high lifetime earnings of males with MA degrees (of which there is only one, a member of the no-program group). Given the small cell size for this group, this high figure may be a consequence of sampling error. Therefore, these results are not used in the final analysis.

30. For individuals who are voluntarily not in the labor market, the shadow price of not working presumably equates to the actual earnings of workers. In this analysis, however, these individuals are given an earnings value of zero. This assumption is legitimate for the taxpayer analysis, but may be questioned for the individual-level analysis. A zero value imputation was chosen in part because it is conservative. As the program group reports more voluntarily inactive individuals, differentials are biased downward.

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