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Seong Hyeok Moon
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ABSTRACT

This paper summarizes our recent work on the rate of return and cost-benefit ratio of an influential early childhood program.

James J. Heckman
Department of Economics
The University of Chicago
1126 E. 59th Street
Chicago, IL 60637
and University College Dublin and IZA
and also NBER
jjh@uchicago.edu

Seong Hyeok Moon
Department of Economics
The University of Chicago
1126 E. 59th Street
Chicago, IL 60637
moon@uchicago.edu

Rodrigo Pinto
Department of Economics
The University of Chicago
1126 E. 59th Street
Chicago, IL 60637
rodrig@uchicago.edu

Peter Savelyev
Department of Economics
1126 E. 59th Street
Chicago, IL 60637
psavel@uchicago.edu

Adam Yavitz
Department of Economics
1126 E. 59th Street
Chicago, IL 60637
adamy@uchicago.edu

1 Introduction

The Perry Preschool Program was an early childhood education program conducted at the Perry Elementary School in Ypsilanti, Michigan, during the early 1960s. The evidence from it is widely cited to support the economic argument for investing in early childhood programs.

Only disadvantaged children living in adverse circumstances who had low IQ scores and a low index of family socioeconomic status were eligible to participate in the Perry program. Actual participation was determined by a toss of a coin. Beginning at age 3 and lasting 2 years, treatment consisted of a 2.5-hour preschool program on weekdays during the school year, supplemented by weekly home visits by teachers. The curriculum was based on supporting children's cognitive and socio-emotional development through *active learning* in which both teachers and children had major roles in shaping children's learning. Children were encouraged to plan, carry out, and reflect on their own activities through a plan-do-review process. Follow-up interviews were conducted when participants were approximately 15, 19, 27, and 40 years old. At these interviews, participants provided detailed information about their life-cycle trajectories including schooling, economic activity, marital life, child rearing, and incarceration. In addition, Perry researchers collected administrative data in the form of school records, police and court records, and records on welfare participation. Schweinhart, Montie, Xiang, Barnett, Belfield, and Nores (2005) describe the program and the available data.

As the oldest and most cited early childhood intervention, the Perry study serves as a flagship for policy makers advocating public support for early childhood programs. Schweinhart, Montie, Xiang, Barnett, Belfield, and Nores (2005) and Heckman, Moon, Pinto, Savelyev, and Yavitz (2010a) describe the program and its outcomes in detail and report substantial short-term and long-term treatment effects. They report crime reduction as a major benefit.

However, critics of the Perry program point to the small sample size of the study, the lack of a substantial long-term effect of the program on IQ, and the absence of statistical significance for many estimated treatment effects.[1] Anderson (2008) claims that the program does not work for boys, although he examines only a subset of its outcomes using arbitrarily constructed indices of diverse outcomes, and he does not perform a cost-benefit analysis overall or by gender.[2] The existing cost-benefit analyses of the program do little to assuage these concerns, presenting estimates of rates of returns without standard errors, leaving readers uncertain as to whether the estimates are statistically significantly different from zero.[3] In response, Heckman, Moon, Pinto, Savelyev, and Yavitz (2010b) present the first rigorous cost-benefit study of the Perry program that addresses four major challenges: (a) the compromise inherent in the randomization protocol (see Heckman, Moon, Pinto, Savelyev, and Yavitz, 2010a); (b) the lack of program data past age 40 and the need to extrapolate out-of-sample to obtain earnings profiles past that age to estimate lifetime impacts of the program; (c) missing data for participants before to age 40; and (d) the difficulty in assigning reliable values to nonmarket outcomes, such as crime. The last point is especially relevant for any analysis of the Perry program because crime reduction is touted as one of its major benefits. This paper summarizes the main findings from our study. For more detailed discussion of the results summarized here, see Heckman, Moon, Pinto, Savelyev, and Yavitz (2010b).

Table 1 presents the range of estimates from our preferred methodology, defended in Heckman, Moon, Pinto, Savelyev, and Yavitz (2010b). It supports separate rates of return for benefits accruing to individuals versus those that accrue to society at large. Our estimate of the overall social rate of return to the Perry program is in the range of 7% to 10%. We report a range of estimates because of uncertainty about some components of benefits and costs that cannot be quantified by standard errors alone. These estimates are above the historical return to equity,[4] but generally below estimates reported in previous studies.

[1]See Herrnstein and Murray (1994, pp. 404–405) and Hanushek and Lindseth (2009).

[2]See Heckman, Moon, Pinto, Savelyev, and Yavitz (2010a), who use small sample permutation tests and multiple hypotheses testing methods to establish that there are strong treatment effects for boys and girls, although their life-cycle realizations differ across groups.

[3]See Rolnick and Grunewald (2003) and Belfield, Nores, Barnett, and Schweinhart (2006).

[4]The post-World War II stock market rate of return on equity is 5.8% (see DeLong and Magin, 2009).

2 Program Costs and Benefits

We confine our evaluation to the costs and benefits of education, earnings, criminal behavior, tax payments, and participation in public welfare programs. There are no reliable data on health outcomes, marital and parental outcomes, the quality of social life, and the like. Our estimated rate of return likely understates the true rate of return, although we have no direct evidence on this issue.

Initial Program Cost We use the estimates of initial program costs presented in Barnett (1996), which include both operating costs (teacher salaries and administrative costs) and capital costs (classrooms and facilities). In undiscounted year-2006 dollars, cost of the program per child is $17,759.

Education Perry promoted educational attainment through two avenues: total years of education attained and rates of progression to a given level of education. We estimate tuition and other pecuniary education costs paid by individuals, as well as additional social costs incurred by society to educate them. The amount of educational expenditure that the general public spends will be larger if participants attain more schooling or if they progress through school less efficiently. We estimate the cost of regular K-12 education, GED, special education, higher education, and vocational training. Table 2 summarizes the components of our estimated educational costs. Treated females received less special education, progressed more quickly through grades, earned higher GPAs, and attained higher levels of education than their control group counterparts. (For males, however, the impact of the program on schooling attainment was weak at best.) As a result, society spent comparable amounts of resources on individuals during their K-12 years regardless of their treatment experience, albeit for different reasons.

Employment and Earnings To construct lifetime earnings profiles, Heckman, Moon, Pinto, Savelyev, and Yavitz (2010b) solve two practical problems. First, in the original survey, job histories were determined retrospectively only for a fixed number of previous job spells. Thus, data on missing spells had to be imputed by econometric techniques. Second, because the Perry data were not collected after the age-40 interview, it is necessary to predict earnings profiles beyond this age or else to estimate rates of return through age 40. To impute missing values for ages before the age-40 interview, we use four different imputation procedures:

1. We use simple piecewise linear interpolation, based on weighted averages of the nearest observed data points around missing values.

2. We impute missing values using estimated Mincerian earnings functions fit on the 1979 National Longitudinal Survey of Youth (NLSY79) "low-ability" African American subsample born in the same years as the Perry subjects.[5]

3. We use a kernel matching method that sorts each Perry subject to similar observations in the NLSY79 sample. We match each Perry subject to all observations in the NLSY79 comparison group sample, but with different weights that depend on the estimated kernel function.

4. We estimate dynamic earnings functions using the method of Hause (1980).

Given the absence of earnings data after age 40, we employ three extrapolation schemes to extend sample earnings profiles to later ages:

1. We use March 2002 Current Population Survey (CPS) data to obtain earnings growth rates up to age 65. Because it is not possible to extract "low ability" subsamples from the CPS that are comparable to the Perry control group, we use CPS age-by-age growth rates (rather than levels of earnings) of 3-year moving averages of earnings by gender and educational attainment.

[5]This "low-ability" subsample is selected by initial background characteristics that mimic the eligibility rules used in the Perry program. NLSY79 is a nationally representative longitudinal survey, whose respondents are almost the same age (birth years 1956–1964) as the Perry sample (birth years 1957–1962). See Heckman, Moon, Pinto, Savelyev, and Yavitz (2010b).

2. We use a "low ability" subsample of the Panel Study of Income Dynamics (PSID). We first estimate a random effects model of earnings on the PSID and then use the fitted model to extrapolate earnings in Perry data after age 40.

3. We also use individual parameters from an estimated version of the Hause (1980).

All methods are conservative in that they impose the same earnings structure on the missing data for treatment and controls.[6] The earnings include all types of fringe benefits listed in Employer Costs for Employee Compensation, a Bureau of Labor Statistics compensation measure. Table 2 presents the estimated gross earnings for a selected combination of imputation and extrapolation methods. SeeHeckman, Moon, Pinto, Savelyev, and Yavitz (2010b) for further details.

2.1 Criminal Activity

Crime reduction is a major benefit of the Perry program.[7] Valuing the effect of this reduction in terms of costs and benefits is not a trivial issue, given the difficulty of assigning reliable monetary values to nonmarket outcomes. Heckman, Moon, Pinto, Savelyev, and Yavitz (2010b) improve on previous studies (e.g., Belfield, Nores, Barnett, and Schweinhart, 2006) by exploring the impact of using a variety of assumptions to obtain the benefit-cost ratios. For each subject, the Perry data provide a full record of arrests, convictions, charges, and incarcerations for most of adolescence and adulthood obtained from administrative data sources.[8]

The total social cost of a crime can be calculated as a product of the social cost per unit of crime and the incidence. The empirical challenges of evaluating the cost of crime are twofold: obtaining a complete lifetime profile of criminal activities for each person and

[6] All profiles used here incorporate survival rates by age, gender, and education, which are obtained from National Vital Statistics Reports (National Center for Health Statistics, 2004).

[7] See, for example, Schweinhart, Montie, Xiang, Barnett, Belfield, and Nores (2005) and Heckman, Moon, Pinto, Savelyev, and Yavitz (2010a).

[8] The earliest records cover ages 8–39 and that of the oldest covers ages 13–44.

assigning relevant monetary value to each type of criminal activity. It is difficult to obtain complete lifetime crime profiles because we do not directly observe each person's participation in criminal activity. Instead, we only observe arrests from police records. To fill the gap between the actual level of crime and arrests, we combine three data sets: (a) the Uniform Crime Report (UCR), which provides arrest rates by gender, race, and age for each year; (b) the National Crime Victimization Survey (NCVS), which is a nationally representative household-level data set on criminal victimization that provides information on unreported crime levels across the United States; and (c) Perry crime records. From the first two data sources, we can compute the ratio of the true incidence level to the total arrests for each type of crime; by multiplying this ratio by the number of arrests of each subject in the Perry data and summing them over crime types and subjects, we compute the true incidence level. To assign relevant monetary values to criminal activities, we compute the unit cost of each type of crime, which is broken down into two components — victimization costs and criminal justice system costs — using estimates in existing literatures as well as various data sources such as Expenditure and Employment data for the Criminal Justice System (CJEE).[9] Different types of crime are associated with different unit costs. Table 2 summarizes our estimated social costs of crime.

Our approach differs from that used by Belfield, Nores, Barnett, and Schweinhart (2006) in several respects. First, in estimating victimization-to-arrest ratios, police and court costs, and correctional costs, we use local data rather than national figures. Second, we use two different values of the victim cost of murder: an estimate of "the statistical value of life" ($4.1 million) and an estimate of assault victim cost ($13,000). We report separate rates of return for each estimate. Third, we assume that there are no victim costs associated with "driving misdemeanors" and "drug-related crimes." Whereas previous studies have assigned nontrivial victim costs to these types of crimes, we consider them to be "victimless." However, because such crimes could be the proximal causes of victimizations, we separately

[9]See Anderson (1999) and Cohen (2005).

account for any crimes with victims that result from initially victimless crimes. Our approach results in a substantial decrease of crime cost compared to the cost of crime used in previous studies because victimless crimes account for more than 30% of all crime reported in the Perry study.

2.2 Tax Payments and Welfare Dependence

Taxes are transfers from the taxpayer to the rest of society and represent benefits to recipients that reduce the welfare of the taxed unless services are received in return. Conversely, higher earnings translate into higher absolute amounts of income tax payments (and consumption tax payments) that are beneficial to the general public, excluding program participants. Although there have been changes in U.S. income tax rates over the period covered by this evaluation, in our work we simplify the calculation by applying a 15% individual tax rate and 7.5% FICA tax rate to each subject's taxable earnings for each year. Belfield, Nores, Barnett, and Schweinhart (2006) use the employer's share of FICA tax in addition to these two components in computing the benefit to the general public, but we do not because a recent consensus among economists is that "the employer's share of payroll taxes is passed on to employees in the form of lower wages than would otherwise be paid."[10] (Congressional Budget Office, 2007, p. 3).

Differentials in the use of welfare are another important source of benefits from the Perry program. We distinguish transfers, which benefit one group in the society at the expense of another, from the costs associated with making such transfers. Only the latter should be counted in computing gains to society as a whole. Because of data limitations, we adopt the following method to estimate full lifetime profiles of welfare receipt.[11] First, we use the NLSY79 and PSID comparison samples to impute the amount received from various cash assistance and food stamp programs in a fashion similar to our method for earnings

[10]The Perry data do not provide enough information about receipt of various in-kind transfer programs. Even for cash assistance programs, we do not have complete lifetime profiles of cash transfers for each individual.

[11]See Heckman, Moon, Pinto, Savelyev, and Yavitz (2010b) for further discussion.

imputation and extrapolation. Second, to account for in-kind transfers, we employ the Survey of Income and Program Participation data to calculate the probability of participating in specific in-kind transfer programs for a "less-educated" Black population and then convert it to monetary values using the estimates of Moffitt (2003) for real public expenditures on welfare programs. Table 2 summarizes our estimated profiles of welfare use. For society, each dollar of welfare involves administrative costs. Based on Michigan state data, Belfield, Nores, Barnett, and Schweinhart (2006) estimate a cost to society of 38 cents for every dollar of welfare disbursed. We use this estimate to calculate the cost of welfare programs to society.

3 Internal Rates of Return and Benefit-to-Cost Ratios

We calculate internal rates of return and benefit-to-cost ratios for the Perry program under various assumptions and estimation methods. We compute the associated standard errors in three steps. In the first step, we use the bootstrap to simultaneously draw samples from Perry and other nonexperimental comparison data sets (such as the NLSY79 and the PSID). For each replication, we reestimate all parameters used to impute missing value and recompute all components used in the construction of lifetime profiles. In this process, all components of earnings whose computations do not depend on the comparison group data are also recomputed (e.g., social cost of crime, educational expenditure, etc.) because the replicated sample consists of randomly drawn Perry participants. In the second step, we adjust all imputed values for prediction errors by plugging in an error term that is randomly drawn from comparison group data in a Monte Carlo resampling procedure. Combining these two steps allows us to account for both estimation errors and prediction errors. Finally, we compute point estimates of internal rates of return (IRRs) and benefit-to-cost ratios for each replication to obtain bootstrapped standard errors.

Tables 1 and 3 show estimated IRRs and associated standard errors computed using various methods for estimating earnings profiles and crime costs under various assumptions about the deadweight cost of taxation. We first set the victim cost associated with a murder at $4.1 million, which includes the statistical value of life (column labeled "High"), and then at $13,000, which is set to the victim cost of assault to avoid the problem that a single murder might dominate the evaluation (columns labeled "Low"). To gauge the sensitivity of estimated returns to the way crimes are categorized, we compare results from two aggregation schemes: "Separated" and "Property versus Violent Crimes."[12] The estimates reported in these tables account for the deadweight costs of taxation: dollars of welfare loss per tax dollar. For comparison purposes, we select the the kernel matching imputation and PSID projection of missing earnings in Table 1. Our estimates are robust to the choice of alternative extrapolation/interpolation procedures. Because, as documented by Heckman, Moon, Pinto, Savelyev, and Yavitz (2010a), the randomization protocol implemented in the Perry program is somewhat problematic, we adjust all lifetime cost and benefit streams for the compromise in randomization by conditioning them on relevant pre-program variables. This is a form of matching.

The estimated rates of return reported in Table 3 are comparable for all of the imputation and extrapolation schemes. Alternative assumptions about the victim cost of murder affect the estimated rates of return in a counterintuitive fashion. Assigning a high number to the value of a life *lowers* the estimated rate of return because the one murder committed by a treatment group male occurs earlier than the two committed by males in the control group. The rates of return are not very sensitive to the crime categorization method, as shown by comparison of the last two sets of columns. Adjusting for deadweight losses of taxes lowers the rate of return to the program. Our estimates of the overall rate of return hover in the range of 7% to 10%, and they are statistically significantly different from zero in most cases.

The estimated benefit-to-cost ratios under different discount rates presented in Tables 1 and 4 generally support the rate of return analysis and are substantial for discount rates commonly used in the literature (3% to 5%).[13] Further, as shown in Table 4, a considerable

[12]See Heckman, Moon, Pinto, Savelyev, and Yavitz (2010b) for further discussion.

[13]Note, however, that the higher the assumed value of victim life, the *higher* the benefit-cost ratio. This

portion of benefits is due to crime reduction. Sensitivity analysis establishes that (a) excluding some outliers whose educational attainments are exceptionally high has only modest effects on the estimated IRRs, (b) excluding "hard-core" criminal offenders increases the estimated social IRRs obtained from the pooled sample and strengthens the precision of the estimates, and (c) accounting for local costs instead of relying on national figures increases estimated IRRs, given that criminal justice system costs for Michigan are higher than the corresponding national estimates. When we evaluate the Perry program only through age 40 to avoid uncertainty associated with extrapolation, rates of return and benefit-to-cost ratios fall somewhat, but still remain substantially above the historical rate of return to equity and are precisely determined (Heckman et al., 2010b). A complete analysis of the rate of return to the Perry program under various assumptions can be found in our source paper.

4 Conclusion

This paper summarizes the main results from our previous work on estimating the rate of return to the Perry Preschool Program (Heckman et al., 2010b). We account for locally determined costs, missing data, the deadweight costs of taxation, and the value of nonmarket benefits and costs. Our analysis improves on previous estimates by accounting for compromise in the randomization protocol, by developing standard errors for the estimates, and by exploring the sensitivity of estimates to alternative assumptions about missing data and the value of nonmarket benefits. Our estimates are also robust to a variety of alternative assumptions about interpolation, extrapolation, and deadweight losses. In most cases, they are statistically significantly different from zero. This is true for both males and females. In general, the estimated rates of return are above the historical return to equity of about 5.8% but well below previous estimates reported in the literature. Our benefit-to-cost ratio estimates support the rate of return analysis. Benefits from improvements in health and

occurs because the discount rates in the benefit-to-cost analyses are lower than the discount rates produced by the IRR analysis. Timing of crime matters less in the benefit-cost analysis. See Heckman, Moon, Pinto, Savelyev, and Yavitz (2010b).

the well-being of future generations are not estimated due to data limitations. Our analysis likely provides a lower-bound on the true rate of return to the Perry Preschool Program.

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Table 1: Selected Estimates of IRRs (%) and Benefit-to-Cost Ratios

	Return:	To Individual			To Society[c]			To Society[c]		
	Murder Cost[a]				High ($4.1M)			Low ($13K)		
IRR	Deadweight Loss[b]	All[d]	Male	Female	All[d]	Male	Female	All[d]	Male	Female
	0%	7.6	8.4	7.8	9.9	11.4	17.1	9.0	12.2	9.8
		(1.8)	(1.7)	(1.1)	(4.1)	(3.4)	(4.9)	(3.5)	(3.1)	(1.8)
	50%	6.2	6.8	6.8	9.2	10.7	14.9	8.1	11.1	8.1
		(1.2)	(1.1)	(1.0)	(2.9)	(3.2)	(4.8)	(2.6)	(3.1)	(1.7)
	100%	5.3	5.9	5.7	8.7	10.2	13.6	7.6	10.4	7.5
		(1.1)	(1.1)	(0.9)	(2.5)	(3.1)	(4.9)	(2.4)	(2.9)	(1.8)
Benefit-Cost Ratios	Discount Rate	All[d]	Male	Female	All[d]	Male	Female	All[d]	Male	Female
	0%	–	–	–	31.5	33.7	27.0	19.1	22.8	12.7
					(11.3)	(17.3)	(14.4)	(5.4)	(8.3)	(3.8)
	3%	–	–	–	12.2	12.1	11.6	7.1	8.6	4.5
					(5.3)	(8.0)	(7.1)	(2.3)	(3.7)	(1.4)
	5%	–	–	–	6.8	6.2	7.1	3.9	4.7	2.4
					(3.4)	(5.1)	(4.6)	(1.5)	(2.3)	(0.8)
	7%	–	–	–	3.9	3.2	4.6	2.2	2.7	1.4
					(2.3)	(3.4)	(3.1)	(0.9)	(1.5)	(0.5)

Notes: Kernel matching is used to impute missing values for earnings before age-40, and PSID projection for extrapolation of later earnings. In calculating benefit-to-cost ratios, the deadweight loss of taxation is assumed to be 50%. Nine separated types of crime are used to estimate the social cost of crime. Standard errors in parentheses are calculated by Monte Carlo resampling of prediction errors and bootstrapping. Lifetime net benefit streams are adjusted for compromised randomization. (a) "High" murder cost accounts for statistical value of life, while "Low" does not; (b) Deadweight cost is dollars of welfare loss per tax dollar; (c) The sum of returns to program participants and the general public; (d) "All" is computed from an average of the profiles of the pooled sample, and may be lower or higher than the profiles for each gender group.

Source: Heckman et al. (2009b).

Table 2: Summary of Lifetime Costs and Benefits (in undiscounted 2006 dollars)

		Crime Ratio[a]	Murder Cost[b]	Male		Female	
				Treatment	Control	Treatment	Control
Cost of Education	K-12 / GED[d]			107,575	98,855	98,678	98,349
	College, Age ≤ 27[e]			6,705	19,735	21,816	16,929
	Education, Age > 27[e]			2,409	3,396	7,770	1,021
	Vocational Training[f]			7,223	12,202	3,120	674
	Lifetime Effect[g]			-10,275		14,409	
Cost of Crime	Police / Court			105.7	152.9	24.7	53.8
	Correctional			41.3	67.4	0.0	5.3
	Victimization	Separate	High	370.0	729.7	2.9	320.7
		Separate	Low	153.3	363.0	2.9	16.1
		By Type	Low	215.0	505.7	2.8	43.3
	Lifetime Effect[g]	Separate	High	-433		-352.2	
		Separate	Low	-283		-47.6	
		By Type	Low	-364		-74.9	
Gross Earnings	Age ≤ 27			186,923	185,239	189,633	165,059
	Ages 28-40			370,772	287,920	356,159	290,948
	Ages 41-65			563,995	503,699	524,181	402,315
	Lifetime Effect[g]			145,461		211,651	
Cost of Welfare	Age ≤ 27			89	115	7,064	13,712
	Ages 28-40			831	2,701	11,551	5,911
	Ages 41-65			1,533	2,647	6,528	7,363
	Lifetime Effect[g]			-3,011		-1,844	

Notes: (a) A ratio of victimization rate (from the National Crime Victimization Survey) to arrest rate (from the Uniform Crime Report), where "By Type" uses common ratios based on a crime being either violent or property and "Separate" does not; (b) "High" murder cost accounts for value of a statistical life, while "Low" does not; (c) Source: National Center for Education Statistics (various) for 1975-1982 (annually);(d) Based on Michigan "per-pupil expenditures" (special education costs calculated using (National Center for Education Statistics, 1975-1982, annually)); (e) Based on expenditure per full-time-equivalent student (from National Center for Education Statistics (1991)); (f) Based on regular high school costs and estimates from Tsang (1997); (g) Treatment minus control; (h) In thousand dollars; (i) Gross earnings before taxation, including all fringe benefits. Kernel matching and PSID project are used for imputation and extrapolation, respectively; (j) Includes all kinds of cash assistance and in-kind transfers.

Source: Heckman et al. (2009b).

Table 3: Internal Rate of Return (%), by Imputation and Extrapolation Method and Assumptions About Crime Costs Assuming 50% Deadweight Cost of Taxation

	Returns:	To Individual			To Society, Including the Individual (Nets out Transfers)								
Victimization/Arrest Ration[a]					Separated			Separated			Property vs. Violent		
Murder Victim Cost[b]					High ($4.1M)			Low ($13K)			Low ($13K)		
Imputation	Extrapolation	All[c]	Male	Female	All[c]	Male	Female	All[c]	Male	Female	All[c]	Male	Female
Piecewise Linear Interpolation[d]		6.0	5.0	7.7	8.9	9.7	15.4	7.7	9.7	9.5	7.7	10.1	10.2
	CPS	(1.7)	(1.8)	(1.8)	(4.9)	(4.2)	(4.3)	(2.6)	(3.0)	(2.7)	(3.9)	(4.5)	(3.6)
		4.8	2.5	7.4	7.3	8.0	15.3	7.6	9.2	10.0	7.2	9.5	10.5
	PSID	(1.6)	(1.8)	(1.5)	(5.0)	(4.1)	(3.7)	(2.7)	(3.1)	(2.8)	(3.7)	(4.4)	(3.1)
Cross-Sectional Regression[e]		5.0	4.8	6.8	7.3	8.3	14.2	7.4	10.0	8.7	7.2	10.1	9.2
	CPS	(1.4)	(1.5)	(1.3)	(4.5)	(4.1)	(4.0)	(2.3)	(2.9)	(2.2)	(3.4)	(4.0)	(3.3)
		4.9	4.3	5.9	8.6	9.8	14.9	7.2	10.0	7.8	7.2	10.4	8.7
	PSID	(1.6)	(1.8)	(1.5)	(2.3)	(3.3)	(5.2)	(2.9)	(3.0)	(1.5)	(3.7)	(4.1)	(1.5)
		4.8	4.9	6.8	7.3	8.5	14.9	7.2	10.0	8.7	7.1	10.1	9.3
	Hause	(1.4)	(1.4)	(1.2)	(4.0)	(4.2)	(3.4)	(2.7)	(2.9)	(2.3)	(3.0)	(4.1)	(3.2)
Kernel Matching[f]		6.9	7.6	6.6	8.1	9.5	14.7	8.5	11.2	8.8	8.5	11.1	9.4
	CPS	(1.3)	(1.1)	(1.4)	(4.5)	(4.1)	(3.2)	(2.5)	(2.9)	(2.9)	(3.5)	(4.3)	(3.5)
		6.2	6.8	6.8	9.2	10.7	14.9	8.1	11.1	8.1	8.1	11.4	9.0
	PSID	(1.2)	(1.1)	(1.0)	(2.9)	(3.2)	(4.8)	(2.6)	(3.1)	(1.7)	(2.9)	(3.0)	(2.0)
		6.3	8.0	7.1	8.4	9.7	14.6	8.8	11.2	9.3	8.5	11.2	9.6
	Hause	(1.2)	(1.2)	(1.3)	(4.3)	(4.0)	(4.0)	(2.3)	(2.5)	(2.4)	(3.2)	(4.2)	(3.7)
Hause[g]		7.1	6.5	6.5	8.0	8.9	14.7	8.5	10.5	8.6	8.3	10.5	9.1
	CPS	(2.5)	(2.7)	(2.0)	(4.7)	(4.2)	(4.2)	(2.6)	(2.2)	(2.7)	(3.1)	(4.0)	(3.3)
		7.0	6.0	6.2	9.7	10.5	14.8	8.8	11.0	7.4	8.8	11.3	8.4
	PSID	(3.0)	(2.9)	(2.2)	(3.7)	(3.8)	(5.6)	(3.2)	(3.4)	(2.5)	(3.7)	(3.1)	(3.2)
		6.5	5.7	6.3	7.8	8.7	14.5	8.2	10.6	8.5	8.2	11.0	9.4
	Hause	(2.3)	(2.0)	(1.8)	(4.7)	(4.2)	(3.5)	(2.5)	(3.0)	(2.7)	(3.3)	(4.0)	(3.6)

Notes: Standard errors in parentheses are calculated by Monte Carlo resampling of prediction errors and bootstrapping. All estimates are adjusted for compromised randomization. All available local data and the full sample are used unless otherwise noted. (a) A ratio of victimization rate (from the NCVS) to arrest rate (from the UCR), where "Property vs. Violent" uses common ratios based on a crime being either violent or property and "Separated" does not; (b) "High" murder cost valuation accounts for statistical value of life, while "Low" does not; (c) The "All" IRR represents an average of the profiles of a pooled sample of males and females, and may be lower or higher than the profiles for each gender group; (d) Piecewise linear interpolation between each pair reported; (e) Cross-sectional regression imputation using a cross-sectional earnings estimation from the NLSY79 black low-ability subsample. (f) Kernel-matching imputation matches each Perry subject to the NLSY79 sample based on earnings, job spell durations, and background variables; (g) Based on the Hause (1980) earnings model.

Source: Heckman et al. (2009b).

Table 4: Decomposition of Benefit-to-Cost Ratios: Crime versus Other Outcomes

(a) "High" Murder Cost

Discount Rate	**All**			**Crime**			**Other Outcomes**		
	All	**Male**	**Female**	**All**	**Male**	**Female**	**All**	**Male**	**Female**
	31.5	33.7	27.0	19.7	20.7	16.8	11.8	13.0	10.2
0%	(11.3)	(17.3)	(14.4)	(8.6)	(11.3)	(15.3)	(3.0)	(4.0)	(3.6)
	—	—	—	62.7%	61.3%	62.1%	37.3%	38.7%	37.9%
	12.2	12.1	11.6	8.0	7.2	8.3	4.2	4.9	3.3
3%	(5.3)	(8.0)	(7.1)	(4.0)	(5.1)	(7.6)	(1.1)	(1.4)	(1.4)
	—	—	—	65.3%	59.5%	71.5%	34.7%	40.5%	28.5%
	6.8	6.2	7.1	4.5	3.5	5.5	2.3	2.7	1.6
5%	(3.4)	(5.1)	(4.6)	(2.5)	(3.2)	(5.0)	(0.6)	(0.7)	(0.8)
	—	—	—	66.1%	56.4%	76.8%	33.9%	43.6%	23.2%
	3.9	3.2	4.6	2.6	1.6	3.7	1.3	1.6	0.9
7%	(2.3)	(3.4)	(3.1)	(1.7)	(2.1)	(3.4)	(0.4)	(0.4)	(0.5)
	—	—	—	66.5%	50.5%	80.1%	33.5%	49.5%	19.9%

(b) "Low" Murder Cost

Discount Rate	**All**			**Crime**			**Other Outcomes**		
	All	**Male**	**Female**	**All**	**Male**	**Female**	**All**	**Male**	**Female**
	19.1	22.8	12.7	7.3	9.8	2.5	11.8	13	10.2
0%	(5.4)	(8.3)	(3.8)	(3.2)	(5.5)	(1.5)	(3.0)	(4.0)	(3.6)
	—	—	—	38.10%	42.80%	19.50%	61.90%	57.20%	80.50%
	7.1	8.6	4.5	2.9	3.6	1.2	4.2	4.9	3.3
3%	(2.3)	(3.7)	(1.4)	(1.5)	(2.6)	(0.7)	(1.1)	(1.4)	(1.4)
	—	—	—	40.20%	42.20%	26.50%	59.80%	57.80%	73.50%
	3.9	4.7	2.4	1.6	1.9	0.8	2.3	2.7	1.6
5%	(1.5)	(2.3)	(0.8)	(1.0)	(1.7)	(0.4)	(0.6)	(0.7)	(0.8)
	—	—	—	41.00%	41.30%	31.90%	59.00%	58.70%	68.10%
	2.2	2.7	1.4	0.9	1.1	0.5	1.3	1.6	0.9
7%	(0.9)	(1.5)	(0.5)	(0.7)	(1.2)	(0.3)	(0.4)	(0.4)	(0.5)
	—	—	—	41.90%	39.10%	36.10%	58.10%	60.90%	63.90%

Notes: The categories "Crime" and "Other Outcomes" sum up to the "All. Standard errors in parentheses are calculated by Monte Carlo resampling of prediction errors and bootstrapping. The percentages reported are the contributions of each component. Kernel matching is used to impute missing values in earnings before age-40, and PSID projection for extrapolation of later earnings. In calculating benefit-to-cost ratios, deadweight loss of taxation is assumed at 50%. Lifetime net benefit streams are adjusted for corrupted randomization by being conditioned on unbalanced pre-program variables.