Age 21 Cost-Benefit Analysis of the Title I Chicago Child-Parent Centers

**Technical Report**

Revised May 2007

Barry A.B. White

Judy A. Temple

Arthur J. Reynolds
PREFACE
This document provides details of the methods employed by Reynolds, Temple, Robertson, & Mann (2002) in deriving the costs and benefits arising from participation in the Chicago Child-Parent Center (CPC) program, a high quality early childhood education program attended primarily by at risk African American children living in inner-city Chicago. In this technical report, the estimated discounted costs and benefits related to three levels of intervention (preschool, school-age, and extended) are described. Program costs were incurred for up to six years after program entry at age 3, and program benefits are projected using information from the Chicago Longitudinal Study (CLS) on the effects of participation in the Child-Parent Centers. For additional information on the CPC intervention and a discussion of the costs and benefits associated with the Chicago CPC program see Reynolds et al. (2002).

I. Discounting future benefits and costs
The net present value (NPV) of benefits minus costs as of program entry at age 3 is calculated using the following formula for real inflation-adjusted benefits \(B_t\) and costs \(C_t\) in time \(t\). To adjust for inflation, estimates are converted to 1998 dollars using the Consumer Price Index for All Urban Consumers (CPI-U). Benefits and costs are discounted by the real annual discount rate \(r\), assumed to be 3%. Certain benefits (e.g., lifetime earnings and tax contributions) are projected through age 65 which is equivalent to \(t = 62\) \((t = 0\) at age 3).

\[
NPV = \sum_{t=0}^{62} \frac{B_t}{(1+r)^t} - \sum_{t=0}^{62} \frac{C_t}{(1+r)^t}
\]

II. Estimating the Cost of the Chicago CPC Program
The number of years of program participation varied across students. Students were able to enroll in one or two years of the preschool intervention and one, two or three years of the school-age intervention from grades 1 through 3. In 1998 dollars, the cost for one year of the preschool program in 1986 was $4,425 per student. The annual per pupil cost of the preschool program has also been reported as $4,400; however, this disparity proves to be non-significant in the overall analysis of the CPC program. The undiscounted cost in 1998 dollars for one year of the school-age program was $1,580. Students could have up to two years of preschool and up to three years of school-age intervention.

II A. The cost of the preschool program
In calculating the present value of the cost of the preschool program, 100% of the preschool participants had one year of preschool and 55% had two years. Assuming that the students with only one year of preschool intervention entered the program in 1984 (age 4) rather than 1983 (age 3), the present value of the average cost of the preschool program per participant is:

\[(.55)(4,425) + (1.00)(4,425/1.03) = $6,730^1\]

\(^1\) Employing the alternative annual cost estimate of $4,400, the present value of the average cost for 1.55 years of the preschool program is $6,692.
II B. The cost of the extended program
Students that participated in the extended program had 4-6 years of intervention services. In calculating the present value of the extended program, 100% of the program participants had at least one year of preschool and 55.7% had two years. All of the extended program participants had at least two years of the school-age intervention (in first and second grade) while 31.3% had a third year. With an annual cost of $4,425 in 1998 dollars for the preschool program and $1,580 for a year of the school-age program, the cost of the extended program is:

\[(.557)(4,425) + (1.00)(4,425/1.03) + (1.00)(1,580/1.03^3) + (1.00)(1,580/1.03^4) + (.313)(1,580/1.03^5)\]
\[= \$10,038\]

II C. The cost of the less-extended program
Students with less-extended intervention had at least one year of intervention (either in preschool or school-age) but fewer than 5 years of intervention. There are a variety of combinations of intervention experiences for students in this group. For example, 50.7% of these students had one or two years of preschool but no participation in the school-age program. Approximately 27.6% had zero years of preschool but 1 to 3 years of the school-age program. The frequencies of the various combinations of 1 through 4 years of intervention are presented in table 1.

<table>
<thead>
<tr>
<th>Years of Intervention</th>
<th>Preschool 0 years</th>
<th>Preschool 1 year</th>
<th>Preschool 2 years</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>School-age 0 years</td>
<td>0%</td>
<td>24.3%</td>
<td>26.4%</td>
<td>50.7%</td>
</tr>
<tr>
<td>School-age 1 year</td>
<td>6.3%</td>
<td>10.6%</td>
<td>10.8%</td>
<td>27.7%</td>
</tr>
<tr>
<td>School-age 2 years</td>
<td>8.0%</td>
<td>0%</td>
<td>0.3%</td>
<td>8.3%</td>
</tr>
<tr>
<td>School-age 3 years</td>
<td>13.3%</td>
<td>0%</td>
<td>0%</td>
<td>13.3%</td>
</tr>
<tr>
<td>Total</td>
<td>27.6%</td>
<td>34.9%</td>
<td>37.5%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Employing the various participation rates, the present value of the average cost of the less-extended program is:

\[(.375)(4,425) + (.349+.375)(4,425/1.03) + (.277+.083+.133)(1,580/1.03^3)\]
\[+ (.083+.133)(1,580/1.03^4) + (.133)(1,580/1.03^5) = \$5,970\]

The marginal cost of the extended program, above and beyond less extensive participation is equal to the present value of the average cost of the extended program minus the present value of the less-extended program. The marginal cost of the extended program is:

\[10,038 – 5,970 = \$4,068\]

In calculating the present value of the school-age program, 100% of the students in that intervention group had one year of the school-age program, 80.4% of the students had a second
year, and 29.8% were enrolled in the third year of the program. The present value of the average cost of the school-age program is:

\[(1.00)(1,580/1.03^3) + (.804)(1,580/1.03^4) + (.298)(1,580/1.03^5) = 2,981\]

III. Estimating the Economic Returns to Chicago CPC Participation

The present value of the program effect is calculated for the following categories: (A) reductions in expenditures for child care services, (B) reductions in expenditures for school remedial services, (C) reductions in criminal justice system expenditures, (D) reductions in tangible expenditures to the victims of crime, (E) reductions in expenditures for the child welfare system and for victimization from child abuse or neglect, (F) increases in the projected earnings and compensation of program participants and associated increases in government tax revenues, and (G) increases in expenditures for post-secondary education (college or university). Monetary benefits and costs associated with CPC program participation are estimated by multiplying the program effect (Table 4; Reynolds, et al., 2002) by the present value of the outcome (Appendix B; Reynolds et al., 2002). See Appendix A in this document for a break down of the costs and benefits.

III A. Reductions in expenditures for child care services

The estimate for child care services is calculated assuming an average of 540 hours per year over 1.5 years, assuming that the value of parents’ time was equal to the minimum wage of $3.35 per hour in 1986 (adjusted for inflation). In estimating the reduction in expenditures for child care services, we account for the proportion of control group participants that attended an alternative preschool program (e.g. Head Start), thus, the estimates presented below represent marginal benefits. In evaluating the childcare effect associated with the extended intervention, three children were removed from the intervention group and placed in the comparison group because they were no longer able participate in the CPC intervention. Of the three children removed from the program group, one student had one year of the CPC preschool intervention and two students had two years of the CPC preschool intervention.

<table>
<thead>
<tr>
<th>Preschool Participation</th>
<th>CPC Program Group</th>
<th>Control Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Original sample size</td>
<td>989</td>
<td>550</td>
</tr>
<tr>
<td>Number of cases 1 year (%)</td>
<td>455</td>
<td>37</td>
</tr>
<tr>
<td>Number of cases 2 years (%)</td>
<td>534</td>
<td>47</td>
</tr>
</tbody>
</table>

TABLE 2
Preschool Participation for Assessing the Childcare Savings from the Preschool Intervention

<table>
<thead>
<tr>
<th>Preschool Participation</th>
<th>CPC Program Group</th>
<th>Control Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adjusted sample size</td>
<td>986</td>
<td>553</td>
</tr>
<tr>
<td>Number of cases 1 year</td>
<td>454</td>
<td>38</td>
</tr>
<tr>
<td>Number of cases 2 years</td>
<td>532</td>
<td>49</td>
</tr>
</tbody>
</table>

TABLE 3
Preschool Participation for Assessing the Childcare Savings from the Extended Intervention
**Child care services**

*Estimated benefit of the preschool program*

- Preschool participation, % 1 year (Program = .460, Control = .067, diff. = .393)
- Preschool participation, % 2 years (Program = .540, Control = .085, diff. = .455)

The present value of reduced expenditure for child care services associated with the preschool program is:

\[(1.00)(.393)(540)(5.00) + (.5)(.455)(540)(5.00/1.03) = $1,657\]

*Estimated benefit of the school-age program*

The effect of the school-age program is assessed by comparing students that participated in the school-age program for one or more years with those who did not attend the school-age program regardless of their preschool experience. Because all study participants were eligible for participation in a full-day kindergarten program, the present value of reduced expenditures for child care services associated with the school-age program is $0.

*Estimated benefit of the extended program*

- Preschool participation, % 1 year (Program = .460, Control = .069, diff. = .391)
- Preschool participation, % 2 years (Program = .540, Control = .089, diff. = .451)

The present value of reduced expenditures for child care services associated with the extended program is:

\[(1.00)(.391)(540)(5.00) + (.5)(.451)(540)(5.00/1.03) = $1,646\]

**III B. Reductions in expenditures for school remedial services**

The estimate for school remedial services includes grade retention by age 15 and special education placement from ages 6 to 18. The estimate for grade retention ($7,211 in 1998 dollars) is average per pupil annual expenditures in Chicago for general education (Illinois State Board of Education, 1997). The estimate for special education services ($7,791 in 1998 dollars) is the weighted average annual cost per pupil reported by the Chicago Public Schools for specific learning disabilities, emotional or behavioral disturbances, speech and language impairment, and mental retardation (Chicago Public Schools, 1995).

**Grade retention**

Assuming that addition years of schooling occur at an average age of 19, the present value of expenditures for an additional year of school is:

\[7,211/1.03^{16} = $4,494\]
**Estimated benefit of the preschool program**  
Grade retention by age 15 (Program = .230, Control = .384, diff. = .154, \( p < .001 \),  
\( N = 1281 \))

The present value of reduced expenditures for grade retention associated with the preschool program is:

\((.154)(4,494) = $692\)

**Estimated benefit of the school-age program**  
Grade retention by age 15 (Program = .238, Control = .343, diff. = .105, \( p = .001 \),  
\( N = 1281 \))

The present value of reduced expenditures for grade retention associated with the school-age program is:

\((.105)(4,494) = $472\)

**Estimated benefit of the extended program**  
Grade retention by age 15 (Program = .219, Control = .323, diff. = .104, \( p = .001 \),  
\( N = 971 \))

The present value of reduced expenditures for grade retention associated with the extended program is:

\((.104)(4,494) = $467\)

**Special education**

Assuming that special education placements occur at an average age of 12, the present value of expenditures for special education services is:

\($7,791/1.03^9 = $5,971\)

**Estimated benefit of the preschool program**  
Number of years of special education from ages 6 to 18 (Program = .73,  
Control = 1.43, diff. = .70, \( p = .06 \),  
\( N = 1281 \))

The present value of reduced expenditures for special education services associated with the preschool program is:

\((.70)(5,971) = $4,180\)
Estimated benefit of the school-age program
Number of years of special education from ages 6 to 18 (Program = .76, Control = 1.24, diff. = .48, \( p = .08, N = 1281 \))

The present value of reduced expenditures for special education services associated with the school-age program is:

\[ (.48)(5,971) = \$2,866 \]

Estimated benefit of the extended program
Number of years of special education from ages 6 to 18 (Program = .56, Control = 1.23, diff. = .67, \( p = .080, N = 971 \))

The present value of reduced expenditures for special education services associated with the extended program is:

\[ (.67)(5,971) = \$4,001 \]

III C. Reductions in expenditures for the criminal justice system
The estimate for reduced criminal justice system (CJS) expenditures includes reductions in juvenile and adult CJS expenditures.

Estimated juvenile CJS expenditures are based on per person annual costs for juvenile institutions from the Illinois Department of Corrections (IDOC) and include administrative costs associated with juvenile arrests. A national rate of adjudication for juvenile arrests of 58% is employed (Stahl et al., 1999). 19% of juvenile arrests are assumed to result in residential treatment and 39% are assumed to result in community treatment or probation services. The remaining 42% of juvenile arrests are assumed to result in release (Bureau of Justice Statistics, 1997; Cohen, 1988; Illinois Department of Corrections, 1999). In 1998 dollars, the cost for juvenile residential treatment is assumed to be $32,237 (Illinois Department of Corrections, 1999), and the annual per person costs for community treatment and probation services are $17,649 and $7,017, respectively. CJS costs per case for trial and processing are assumed to be $4,512 and $2,170 ($1,466 in adjudication costs and $704 in police costs), respectively (Greenwood et al., 1994, Table 3.1). Based on the above values, weighted annual per person criminal justice system expenditures, including administrative costs for trial and processing, associated with a juvenile court petition are estimated to be $18,950, in undiscounted 1998 dollars.

\[
\begin{align*}
\text{Residential treatment:} & \quad 4,512 + 2,170 + 32,237 + 7,017 = \$45,936 \\
\text{Community treatment and probation:} & \quad 4,512 + 2,170 + .50(17,649 + 7,017) = \$19,015 \\
\text{Release:} & \quad 4,512 + 2,170 = \$6,682 \\
\text{Weighted annual expenditure per case:} & \quad .19(45,936) + .39(19,015) + .42(6,682) = \$18,950
\end{align*}
\]
The estimate for adult CJS expenditures is based on juvenile arrests. The estimate assumes a 10% rate of desistance per year through age 44, a target population crime rate of 30%, and an incidence of arrest equal to 80% of juvenile arrests (Greenwood et al., 1998, Model, Rydell, & Chiesa, 1998; Karoly et al., 1998). Estimated expenditures per juvenile crime (ages 10 to 18) are $18,950 in 1998 dollars, and the estimated cost of an adult criminal career (ages 19 to 44) is $69,038 in 1998 dollars.

**Juvenile CJS expenditures**

Assuming the average juvenile offense in the CLS sample occurred at age 14 years, the present value of CJS expenditures for juvenile delinquency is:

\[
\frac{18,950}{1.03^{11}} = 13,690
\]

**Estimated benefit of the preschool program**

Number of petitions to juvenile court by age 18 (Program = .45, Control = .78, diff. = .33, \( p = .02, N = 1404 \))

The present value of averted CJS expenditures associated with the preschool program is:

\[
(0.33)(13,690) = 4,518
\]

**Estimated benefit of the school-age program**

Percentage of petitions to juvenile court by age 18 (Program = 19.8, Control = 19.8, diff. = 0.00 \( p = .99, N = 1404 \))

The present value of averted CJS expenditures associated with the school-age program is:

\[
(0.00)(13,690) = 0
\]

**Estimated benefit of the extended program**

Number of arrest by age 18 (Program = .48, Control = .62, diff. = .14, \( p = .320, N = 1067 \))

The present value of averted CJS expenditures associated with the extended program is:

\[
(0.14)(13,690) = 1,917
\]

**Adult CJS expenditures**

Assuming that the large majority of adult arrests occur over the ages 19-44, the present value of adult CJS expenditures is:

\[
\frac{69,038}{1.03^{25}} = 32,973
\]
**Estimated benefit of the preschool program**
Number of petitions to juvenile court by age 18 (Program = .45, Control = .78, diff. = .33, $p = .02$, $N = 1404$)

The present value of averted CJS expenditures associated with the preschool program is:

\[(.33)(.80)(.30)(32,973) = $2,611\]

**Estimated benefit of the school-age program**
Percentage of petitions to juvenile court by age 18 (Program = .198, Control = .198, diff. = .000, $p = .99$, $N = 1404$).

The present value of averted CJS expenditures associated with the school-age program is:

\[(.00)(.80)(.30)(32,973) = $0\]

**Estimated benefit of the extended program**
Number of arrest by age 18 (Program = .48, Control = .62, diff. = .14, $p = .320$, $N = 1067$)

The present value of averted CJS expenditures associated with the extended program is:

\[(.14)(.80)(.30)(32,973) = $1,108\]

**III D. Reductions in tangible expenditures to the victims of crime**
The estimates for tangible expenditures to the victims of juvenile and adult crime are based on national estimates of the amount and proportion of tangible losses to crime victims for violent and property offenses (Barnett, 1996; Karoly et al., 1998; Miller, Cohen, & Wiersema, 1996). It’s assumed that expenditures to the victims of crime are 4.5 times CJS expenditures and that 23.3% of expenditures to the victims of crime are tangible. The national estimates are applied to the estimated juvenile and adult CJS expenditures in III C. To determine the amount of savings to victims of juvenile crime, the mean number of arrest for violent and property charges in the sample is multiplied by tangible expenditures to the victims of juvenile crime. Projected savings to victims of adult crime are estimated from the cost of an adult criminal career ($69,038 in 1998 dollars), based on a target population crime rate of 30% and an incidence of arrest equal to 80% of juvenile arrest.

**Victimization expenditures associated with juvenile crime**
The estimate for tangible expenditures to the victims of juvenile crime is:

\[(4.5)(.233)(18,950) = $19,869\]
Assuming that juvenile arrests occur at an average age of 14, the present value of tangible expenditures to the victims of juvenile crime is:

\[ \frac{19,869}{1.03^{11}} = 14,354 \]

**Estimated benefit of the preschool program**

Mean number of juvenile arrest = .236

The present value of averted tangible expenditures to the victims of juvenile crime associated with the preschool program is:

\[ (0.236)(14,354) = 3,388 \]

**Estimated benefit of the school-age program**

Mean number of juvenile arrest = .019

The present value of averted tangible expenditures to the victims of juvenile crime associated with the school-age program is:

\[ (0.019)(14,354) = 273 \]

**Estimated benefit of the extended program**

Mean number of juvenile arrest = .165

The present value of averted tangible expenditures to the victims of juvenile crime associated with the extended program is:

\[ (0.165)(14,354) = 2,368 \]

**Victimization expenditures associated with adult crime**

The estimate for tangible expenditures to the victims of adult crime is:

\[ (4.5)(0.233)(69,038) = 72,386 \]

The present value of tangible expenditures to the victims of adult crime is:

\[ \frac{72,386}{1.03^{25}} = 34,572 \]

**Estimated benefit of the preschool program**

The present value of averted tangible expenditures to the victims of adult crime associated with the preschool program is:
(0.33)(0.80)(0.30)(34,572) = $2,739

**Estimated benefit of the school-age program**

The present value of averted tangible expenditures to the victims of adult crime associated with the school-age program is:

(0.019)(0.80)(0.30)(34,572) = $158

**Estimated benefit of the extended program**

The present value of averted tangible expenditures to the victims of adult crime associated with the extended program is:

(0.165)(0.80)(0.30)(34,572) = $1,369

**III E. Reductions in expenditures for the child welfare system and for victimization from child abuse and neglect**

The measure used to indicate child maltreatment is referrals to juvenile court by the Department of Child and Family Services or others between the ages of 4 and 17. These petitions are substantiated reports of child abuse or neglect. One third of all reports of maltreatment to child welfare agencies are substantiated (U.S. Department of Health & Human Services, 1997).

**Child welfare system expenditures**

The weighted average per child welfare services expenditure for a substantiated report of child abuse or neglect is estimated to be $9,051 in 1998 dollars. The estimate assumes that 70% of substantiated cases receive in-home services, while the remaining 30% of cases are placed in foster care. The costs employed for in-home services and foster care are, respectively, $2,890, and $23,425 in 1998 dollars, exclusive of investigation costs (American Humane Association, 1994; Courtney, 1998; Larner, Stevenson, & Behrman, 1998). Adding investigation expenditures of $870 and administrative costs of $1,466 for judicial processing associated with referrals, the estimate for child welfare system expenditures is:

(0.70)(2,890) + (0.30)(23,425) + (870) + (1,466) = $11,387

Assuming that referrals occur at an average age of 10, the present value of the average cost is:

11,387/1.03^7 = $9,259

**Estimated benefit of the preschool program**

Indicated reports of abuse/neglect from ages 4 to 17 (Program = .050, Control = .103, diff. = .053, p < .001, N = 1408)
The present value of reduced expenditures for the child welfare system associated with the preschool program is:

\[(.053)(9,259) = $491\]

**Estimated benefit of the school-age program**  
Indicated reports of abuse/neglect from ages 4 to 17 (Program = .063, Control = .077, diff. = .014, \( p = .35 \), N = 1408)

The present value of reduced expenditures for the child welfare system associated with the school-age program is:

\[(.014)(9,259) = $130\]

**Estimated benefit of the extended program**  
Indicated reports of abuse/neglect from ages 4 to 17 (Program = .036, Control = .069, diff. = .033, \( p = .024 \), N = 1070)

The present value of reduced expenditures for the child welfare system associated with the extended program is:

\[(.033)(9,259) = $306\]

**Expenditures for victimization from child abuse and neglect**

Child abuse and neglect victim costs ($6,916 in 1998 dollars) are based on the tangible losses associated with child abuse and neglect as estimated by the National Institute of Justice (Miller, Cohen, & Wiersema, 1996). The estimate includes medical care/Ambulance services, mental health care, police/fire services, and lost productivity of victims and their families, with respective average costs of $488, $3,847, $35, and $2510 in 1998 dollars. In addition, the estimate includes administrative costs equal to 7.5% of medical care/Ambulance services costs (Miller et al., 1996).

The estimate for tangible expenditures to the victims of child abuse and neglect is:

\[(488) + (.075)(488) + (3,847) + (35) + (2510) = $6,916\]

Assuming that referrals occur at an average age of 10, the net present value of the average costs for child abuse victimization is:

\[6916/1.03^7 = $5,623\]
Estimated benefit of the preschool program
Indicated reports of abuse/neglect from ages 4 to 17 (Program = .050, Control = .103, diff. = .053, \(p < .001\), N = 1408)

The present value of averted tangible expenditures to the victims of child abuse and neglect associated with the preschool program is:

\[(.053)(5,623) = $298\]

Estimated benefit of the school-age program
Indicated reports of abuse/neglect from ages 4 to 17 (Program = .063, Control = .077, diff. = .014, \(p = .35\), N = 1408)

The present value of averted tangible expenditures to the victims of child abuse and neglect associated with the school-age program is:

\[(.014)(5,623) = $79\]

Estimated benefit of the extended program
Indicated reports of abuse/neglect from ages 6 to 17 (Program = .036, Control = .069, diff. = .033, \(p = .024\), N = 1070)

The present value of averted tangible expenditures to the victims of child abuse and neglect associated with the extended program is:

\[(.033)(5,623) = $186\]

III F. Increases in the projected earnings and compensation of program participants and associated increases in government tax revenues

Increases in lifetime earnings and compensation are projected from differences in high school completion between the program and control groups, where high school completion is defined as graduating from a regular high school or earning an equivalent diploma (e.g., GED). Using 1999 data from the Current Population Survey (CPS) March Supplement for African American full-time employees aged 25-29 (U.S. Census Bureau, 2000), lifetime earnings are projected across four categories of educational attainment (less than high school, high school completion, some college, and 4 years of college or more). Estimates are derived for both males and females. The annual earnings data reported in table 2 represent weighted averages for those with less than a high school education (where the original CPS categories “less than 9th grade” and “9th to 12th grade” are combined) and for those with some college (where the CPS categories “some college - no degree” and “associate degree” are combined).

There are different methods of predicting lifetime earnings given data on educational attainment and earnings in a particular year. In Barnett (1996), similar cross-sectional data on educational attainment and earnings for African Americans of different ages are used to generate information
on the lifetime pattern of earnings for a particular individual. One might argue, however, that the current earnings of a 60 year old man or woman are not an accurate predictor of the future earnings of an individual who is currently a young adult. Certainly, the career opportunities available to young African Americans are different from the opportunities faced by members of older generations.

We employ an alternative method of projecting lifetime earnings. Instead of using information on the current earnings of individuals of different ages, we focus solely on the earnings of the age 25-29 cohort. We use this age group to compute the lifetime earnings of the CLS students with differing levels of educational attainment because these individuals were fairly close in age to the students in the intervention so they might be assumed to face similar career opportunities, but were old enough so that many of them had completed their educations.

The increase in lifetime earnings associated with high school completion was computed employing the following assumptions:

1. 1999 earnings are converted to 1998 dollars. Using the CPI-U, the 1999 figures are multiplied by 0.98.
2. Because the earnings of individuals aged 25-29 represent not only their educational attainment but the return to experience, these earnings are discounted by a real rate of 2% a year in order to represent the earnings of the students in the sample at the time they entered the workforce. For dropouts assumed to be starting work at age 17, the earnings of the 25-29 cohort are discounted by 2% a year for 10 years (age 27 to age 17). For high school graduates and GED completers, the earnings of the age 25-29 cohort are discounted back 9 years (age 27 to age 18). For those with some college, the age 25-29 cohort earnings are discounted back 7 years (age 27 to age 20) and for those with 4 years of college or more, the 25-29 cohort earnings are discounted back 4 years (age 27 to age 23). In other words, the earnings of the 25-29 cohort are multiplied by $\frac{1}{(1+r)^t}$ where $r$ is 0.02 and $t$ is 10, 9, 7, or 4. This multiplication factor is equal to 0.8203, 0.8368, 0.8706, and 0.9238 for dropouts, high school graduates, those with some college, and those with 4 years of college or more respectively. The adjusted earnings figures in table 2 below represent the 1999 earnings converted to 1998 dollars and discounted for years of experience assumed to be inherent in the age 27 data.
3. Students with less than a high school education are assumed to have started work at age 17. Students with some college education are assumed to have graduated from high school on time and then completed two years of college. Students with 4 years of college or more are assumed to have spent five years in college. Students are assumed to have worked part time in college earning one-fourth of a high school graduate's earnings with no fringe benefits.
4. The present values of earnings from each of the four different levels of educational attainment are calculated assuming that individuals work continuously through age 65.
5. Income taxes are assumed to be 33.3% (15% Federal, 3% State, and 15.3% FICA). Employers and employees each paid 50% of FICA or 7.65% FICA.
6. Fringe benefits are assumed to be 20% of earnings.
7. Earnings are assumed to grow at a real rate of 2% per year.
8. Accounting for the growth rate of earnings, annual after-tax earnings plus fringe benefits are discounted to age 3 using an annual discount rate of 3%.

TABLE 4
Unadjusted and Adjusted Mean Annual Earnings by Educational Attainment for African Americans Employed Full-time Year-round

<table>
<thead>
<tr>
<th></th>
<th>Male</th>
<th>Male (adj.)</th>
<th>Female</th>
<th>Female (adj.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than high school</td>
<td>16,462</td>
<td>13,234</td>
<td>14,851</td>
<td>11,939</td>
</tr>
<tr>
<td>HS graduate including GED</td>
<td>26,938</td>
<td>22,091</td>
<td>20,402</td>
<td>16,731</td>
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<tr>
<td>Some college</td>
<td>28,654</td>
<td>24,447</td>
<td>23,680</td>
<td>20,203</td>
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<tr>
<td>4 years of college or more</td>
<td>41,460</td>
<td>37,534</td>
<td>32,261</td>
<td>29,207</td>
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</table>

TABLE 5
Projected Present Value of Lifetime Earnings and Compensation by Educational Attainment for African Americans Employed Full-time Year-round

<table>
<thead>
<tr>
<th></th>
<th>Male</th>
<th>Female</th>
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<tbody>
<tr>
<td>Less than high school</td>
<td>323,098</td>
<td>291,477</td>
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<tr>
<td>HS graduate including GED</td>
<td>515,266</td>
<td>390,251</td>
</tr>
<tr>
<td>Some college</td>
<td>525,002</td>
<td>433,506</td>
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<tr>
<td>4 years of college or more</td>
<td>707,415</td>
<td>548,252</td>
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</table>

TABLE 6
Projected Present Value of Taxes by Educational Attainment for African Americans Employed Full-time Year-round

<table>
<thead>
<tr>
<th></th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than high school</td>
<td>114,039</td>
<td>102,886</td>
</tr>
<tr>
<td>HS graduate including GED</td>
<td>181,850</td>
<td>137,722</td>
</tr>
<tr>
<td>Some college</td>
<td>185,794</td>
<td>152,010</td>
</tr>
<tr>
<td>4 years of college or more</td>
<td>250,019</td>
<td>194,430</td>
</tr>
</tbody>
</table>

**Lifetime earnings and compensation**

Projected lifetime earnings for high school dropouts are compared to the weighted average lifetime earnings for those with a high school diploma including GED, some college, and 4 years of college or more. Employing CPS weights for male and female African Americans, ages 25-29, with at least a high school education, the proportion of high school completers with high school only, some college, and 4 years of college of more are .53, .30, and .17, respectively.

The estimated present value of the difference in lifetime earnings between male African American high school dropouts and high school graduates is:

\[
[(.53)(515,266) + (.30)(525,002) + (.17)(707,415)] - (323,098) = 227,754
\]
The estimated present value of the difference in lifetime earnings between female African American high school dropouts and high school graduates is:

\[ (.53)(390,251) + (.30)(433,506) + (.17)(548,252) - (291,477) = \$138,611 \]

The present value of the average difference in lifetime earnings between male and female African American high school dropouts and high school graduates is:

\[ \frac{(227,754 + 138,611)}{2} = \$183,183 \]

**Estimated benefit of the preschool program**

High school completion by age 20 (Program = .497, Control = .385, diff. = .112, \(p = .01\), \(N = 1233\))

The present value of the increase in lifetime earnings and compensation associated with the preschool program is:

\[ (.112)(183,183) = \$20,517 \]

**Estimated benefit of the school-age program**

High school completion by age 20 (Program = .460, Control = .456, diff. = .004, \(p = .91\), \(N = 1233\))

The present value of the increase in earnings and compensation associated with the school-age program is:

\[ (.004)(183,183) = \$732 \]

**Estimated benefit of the extended program**

High school completion by age 20 (Program = .487, Control = .440, diff. = .047, \(p = .193\), \(N = 937\))

The present value of the increase in earnings and compensation associated with the extended program is:

\[ (.047)(183,183) = \$8,610 \]

**Tax revenues**

The estimated present value of the difference in taxes on lifetime earnings between male African American high school dropouts and high school graduates is:

\[ (.53)(181,850) + (.30)(185,794) + (.17)(250,019) - (114,039) = \$80,583 \]
The estimated present value of the difference in taxes on lifetime earnings between female African American high school dropouts and high school graduates is:

\[\[(.53)(137,722) + (.30)(152,010) + (.17)(194,430)] - (102,886) = $48,763\]

The present value of the average difference in taxes on lifetime earnings between male and female African American high school dropouts and high school graduates is:

\[(80,583 + 48,763) / 2 = $64,673\]

**Estimated benefit of the preschool program**  
High school completion by age 20 (Program = .497, Control = .385, diff. = 112,  
\[p = .01, N = 1233\])

The present value of the increase in tax revenues associated with the preschool program is:

\[(.112)(64,673) = $7,243\]

**Estimated benefit of the school-age program**  
High school completion by age 20 (Program = .460, Control =.456, diff. = .004,  
\[p = .91, N = 1233\])

The present value of the increase in tax revenues associated with the school-age program is:

\[(.004)(64,673) = $259\]

**Estimated benefit of the extended program**  
High school completion by age 20 (Program = .487, Control = .440, diff. = .047,  
\[p = .193, N = 937\])

The present value of the increase in tax revenues associated with the extended program is:

\[(.047)(64,673) = $3,040\]

**III G. Increase in expenditures for post-secondary education**

Estimated expenditures for college tuition ($7,741 in 1998 dollars) are based on the average tuition for two and four years at the three most frequently attended colleges in Chicago (Northern Illinois University, Southern Illinois University, and City Colleges of Chicago). In estimating the monetary value of the program effect, the discounted present value of the estimated college tuition rate was multiplied by the difference in high school completion rates between program and control group participants. Therefore, the following estimates assume that all participants that completed high school by age 20 enroll in post-secondary education for at least two years. This method likely overestimates expenditures for post-secondary education.
2/3 of expenditures are allocated to taxpayers and the remaining 1/3 are allocated to program participants.

**College tuition**

Assuming that the average age of college entry is 18, the present value cost of attending college for two years is:

\[
\frac{7,740}{1.0315} = 4,968
\]

(7,740/1.0315) = $4,968

Public and private expenditures are, respectively, $3,313 and $1,656.

**Estimated benefit of the preschool program**

High school completion by age 20 (Program = .497, Control = .385, diff. = .112, \(p = .01\), N = 1233)

The present value of the increase in expenditures for college tuition associated with the preschool program is:

\[(.112)(4,968) = 557\]

(.112)(4,968) = $557

Public and private expenditures for two years of college are, respectively, $371 and $186.

**Estimated benefit of the school-age program**

High school completion by age 20 (Program = .460, Control = .456, diff. = .004, \(p = .91\), N = 1233)

The present value of the increase in expenditures for college tuition associated with the school-age program is:

\[(.004)(4,968) = 20\]

(.004)(4,968) = $20

Public and private expenditures for two years of college are, respectively, $13 and $7.

**Estimated benefit of the extended program**

High school completion by age 20 (Program = .487, Control = .440, diff. = .047, \(p = .193\), N = 937)

The present value of the increase in expenditures for college tuition associated with the extended program is:

\[(.047)(4,968) = 234\]

(.047)(4,968) = $234

Public and private expenditures for two years of college are, respectively, $156 and $78
References


### Appendix A

#### Breakdown of Benefits and Costs for Estimating Economic Returns of the Chicago Child-Parent Centers

<table>
<thead>
<tr>
<th></th>
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<td></td>
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</tr>
<tr>
<td>Grade retention (ages 5-14)</td>
<td>1996</td>
<td>7,211</td>
<td>19</td>
<td>4,494</td>
<td>.154</td>
<td>692</td>
<td>.105</td>
<td>472</td>
<td>.104</td>
<td>467</td>
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<td>Expenditure for one additional year of school</td>
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<td></td>
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<td></td>
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</tr>
<tr>
<td>Special education (ages 6-18)</td>
<td>1995</td>
<td>7,791</td>
<td>12</td>
<td>5,971</td>
<td>.70</td>
<td>4,180</td>
<td>.48</td>
<td>2,866</td>
<td>.67</td>
<td>4,001</td>
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<td>Expenditure for one year</td>
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<td></td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>Projected lifetime earnings/compensation</td>
<td>1998</td>
<td>285,393</td>
<td>18</td>
<td>183,183</td>
<td>.112</td>
<td>20,517</td>
<td>.004</td>
<td>732</td>
<td>.047</td>
<td>8,610</td>
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<td>High school completion vs. non-completion</td>
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<td></td>
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</tr>
<tr>
<td>Projected taxes on earnings (ages 18-65)</td>
<td>1998</td>
<td>100,758</td>
<td>18</td>
<td>64,673</td>
<td>.112</td>
<td>7,243</td>
<td>.004</td>
<td>259</td>
<td>.047</td>
<td>3,040</td>
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<td>High school completion vs. non-completion</td>
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<td>Justice system (ages 10-44)</td>
<td>1998</td>
<td>18,950</td>
<td>14</td>
<td>13,690</td>
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<td>NA</td>
<td>.14</td>
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<td>Expenditures per crime (ages 19-44)</td>
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<td>Crime victims (ages 10-44)</td>
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<td>14</td>
<td>14,354</td>
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<td>.019</td>
<td>273</td>
<td>.165</td>
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<td>34,572</td>
<td>.33*.80*.30</td>
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<td>.019*.80*.30</td>
<td>158</td>
<td>.165*.80*.30</td>
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<td>Tangible costs per victim (ages 19-44)</td>
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<tr>
<td>Child abuse and neglect</td>
<td>1993</td>
<td>6,916</td>
<td>10</td>
<td>5,623</td>
<td>.053</td>
<td>298</td>
<td>.014</td>
<td>79</td>
<td>.033</td>
<td>186</td>
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<td>Tangible victim costs per report (ages 4-17)</td>
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<td>9,259</td>
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<td>Average per child (1.5 years of preschool)</td>
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<td>Public expenditures for two years (2/3)</td>
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<td>Personal expenditures for two years (1/3)</td>
<td>1998</td>
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<td>Preschool (ages 3-4)</td>
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<td>4,425</td>
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<td>4,296</td>
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<td>One year per child</td>
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<td>School-age (ages 6-9)</td>
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<td>3,381</td>
<td>6-9</td>
<td>2,981</td>
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<td>Average per child (2.14 yr.)</td>
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<tr>
<td>Extended intervention (ages 3-9)</td>
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<td>10,565</td>
<td>3-9</td>
<td>10,038</td>
<td>NA</td>
<td>NA</td>
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<td>Average per child (3.87 yr.)</td>
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</tr>
<tr>
<td>Total Program (ages 3-9)</td>
<td>1987</td>
<td>10,201</td>
<td>3-9</td>
<td>9,673</td>
<td>NA</td>
<td>NA</td>
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<td>NA</td>
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<tr>
<td>Average per child (3.69 yr.)</td>
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<td>Net Present Value</td>
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</table>

Notes: Original Estimates were converted to 1998 dollars using the Consumer Price Index for All Urban Consumers (CPI-U). The CPI-U for 1986, 1987, 1993, 1995, 1996, and 1998 are respectively, 109.6, 113.6, 144.5, 152.4, 156.9, and 163.0. The benefits of program participation were estimated by multiplying the program effect by the present value of the outcome. For program benefits or costs, “average age when benefit or cost occurred” represents the average age at which the relevant program effect occurred.
## Appendix B

**Primary Sources and Original Estimates for Estimating Economic Returns of the Chicago Child-Parent Centers**

<table>
<thead>
<tr>
<th>Category of Benefits and Cost</th>
<th>Year of Original Estimate</th>
<th>Original Estimate</th>
<th>Average Age When Benefit or Costs Occurred</th>
<th>Primary Source</th>
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<td><strong>Program Benefits</strong></td>
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<td>Grade retention (ages 5-14)</td>
<td>1996</td>
<td>6,941</td>
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<td>Illinois State Board of Education (1997)</td>
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<tr>
<td>Expenditure for one additional year of school</td>
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<td></td>
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<tr>
<td>Special education (ages 6-18)</td>
<td>1995</td>
<td>7,284</td>
<td>12</td>
<td>Chicago Public Schools (1995)</td>
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<tr>
<td>Expenditure for one year</td>
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<td></td>
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<tr>
<td>High school completion vs. non-completion</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Projected taxes on earnings (ages 18-65)</td>
<td>1998</td>
<td>100,758</td>
<td>18</td>
<td>33.3% tax rate on earnings (15% federal; 3% state; 15.3% FICA)</td>
</tr>
<tr>
<td>High school completion vs. non-completion</td>
<td></td>
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</tr>
<tr>
<td>Justice system (ages 10-44)</td>
<td>1998</td>
<td>18,950</td>
<td>14</td>
<td>Bureau of Justice Statistics (1997); Cohen (1988); Greenwood et al. (1998);</td>
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<tr>
<td>Expenditures per crime (ages 10-18)</td>
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<td></td>
<td></td>
<td>Illinois Department of Corrections (1999); Karoly et al. (1998); Stahl (1999).</td>
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<td>Expenditures per crime (ages 19-44)</td>
<td>1993</td>
<td>61,202</td>
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<td>Crime victims (ages 10-44)</td>
<td>1998</td>
<td>19,869</td>
<td>14</td>
<td>Barnett (1996); Karoly et al. (1998); Miller et al. (1996); Greenwood et al.</td>
</tr>
<tr>
<td>Tangible costs per victim (ages 10-18)</td>
<td></td>
<td></td>
<td></td>
<td>(1998)</td>
</tr>
<tr>
<td>Tangible costs per victim (ages 19-44)</td>
<td>1993</td>
<td>64,171</td>
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<td>Child abuse and neglect</td>
<td>1993</td>
<td>6,131</td>
<td>10</td>
<td>Miller et al. (1996)</td>
</tr>
<tr>
<td>Tangible victim costs per report (ages 4-17)</td>
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</tr>
<tr>
<td>Expenditures to child welfare system</td>
<td>1995</td>
<td>10,647</td>
<td>10</td>
<td>Courtney (1998); Larner, Stevenson, &amp; Behrman (1998)</td>
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<tr>
<td>Average per child (1.5 years of preschool)</td>
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<tr>
<td>College tuition (ages 18-22)</td>
<td>1998</td>
<td>-5,161</td>
<td>18</td>
<td>Northern Illinois University; Southern Illinois University; City Colleges of</td>
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<td>Public expenditures for two years (2/3)</td>
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<td></td>
<td>Chicago</td>
</tr>
<tr>
<td>Personal expenditures for two years (1/3)</td>
<td>1998</td>
<td>-2,580</td>
<td>18</td>
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<tr>
<td><strong>Program Costs</strong></td>
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</tr>
<tr>
<td>Preschool (ages 3-4)</td>
<td>1986</td>
<td>2,975</td>
<td>4</td>
<td>Chicago Board of Education (2001); Chicago Public Schools (1986a)</td>
</tr>
<tr>
<td>One year per child</td>
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<tr>
<td>Average per child (1.55 yr.)</td>
<td>1986</td>
<td>4,611</td>
<td>3-4</td>
<td>Chicago Public Schools (1986a); (1986b)</td>
</tr>
<tr>
<td>School-age (ages 6-9)</td>
<td>1987</td>
<td>1,101</td>
<td>6</td>
<td>Chicago Public Schools (1986a); (1986b)</td>
</tr>
<tr>
<td>One year per child</td>
<td></td>
<td></td>
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<tr>
<td>Average per child (2.14 yr.)</td>
<td>1987</td>
<td>2,356</td>
<td>6-9</td>
<td></td>
</tr>
<tr>
<td>Extended intervention (ages 3-9)</td>
<td>1987</td>
<td>7,363</td>
<td>3-9</td>
<td>Chicago Public Schools (1986a); (1986b)</td>
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<tr>
<td>Average per child (3.87 yr.)</td>
<td></td>
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<tr>
<td>Total Program (ages 3-9)</td>
<td>1987</td>
<td>7,109</td>
<td>3-9</td>
<td>Chicago Public Schools (1986a); (1986b)</td>
</tr>
</tbody>
</table>
Appendix C

Estimating Averted Intangible Expenditures to the Victims of Juvenile and Adult Crime

The undiscounted Criminal Justice System (CJS) expenditures per juvenile and adult crime are estimated, in 1998 dollars, to be $18,950 and $69,038, respectively (Reynolds et al., 2002). In a typical criminal career, the total cost inflicted on the victims of crime is estimated to be 4.5 times CJS expenditures (Schweinhart, 1993; Karoly et al., 1998). In the following calculations, 23.3% of victim costs are tangible and the remaining 76.7% of victim costs are intangible (Miller et al., 1996). To estimate the savings to victims of juvenile crime, the mean number of arrest for violent and property charges in the sample is multiplied by intangible expenditures to the victims of juvenile crime. Projected savings to victims of adult crime are estimated from the present value cost of an adult criminal career, based on a target population crime rate of 30% and an incidence of arrest that is 80% of juvenile arrest.

Averted intangible expenditures to the victims of juvenile crime

Assuming that juvenile arrests occur at an average age of 14, the present value of intangible expenditures to the victims of juvenile crime is:

\[(4.5)(.767)(18,950/1.0311) = $47,251\]

Estimated benefit of the preschool program

Mean number of juvenile arrests = .236

The present value of averted intangible expenditures to the victims of juvenile crime associated with the preschool program is:

\[.236(47,251) = $11,151\]

Estimated benefit of the school-age program

Mean number of juvenile arrests = .019

The present value of averted intangible expenditures to the victims of juvenile crime associated with the school-age program is:

\[.019(47,251) = $898\]

Estimated benefit of the extended program

Mean number of juvenile arrests = .165

The present value of averted intangible expenditures to the victims of juvenile crime associated with the extended program is:

\[.165(47,251) = $7,796\]
Averted intangible expenditures to the victims of adult crime

Assuming that the large majority of adult arrests occur over ages 19-44, the present value of intangible expenditures to the victims of adult crime is:

\[(4.5)(.767)(69,038/1.0325) = $113,806\]

Estimated benefit of the preschool program

The present value of averted intangible expenditures to the victims of adult crime associated with the preschool program is:

\[(.33)(.80)(.30)(113,806) = $9,013\]

Estimated benefit of the school-age program

The present value of averted intangible expenditures to the victims of adult crime associated with the school-age program is:

\[(.019)(.80)(.30)(113,806) = $519\]

Estimated benefit of the extended program

The present value of averted intangible expenditures to the victims of adult crime associated with the extended program is:

\[(.165)(.80)(.30)(113,806) = $4,507\]

Table 1 Appendix C

<table>
<thead>
<tr>
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<tr>
<td>Crime Victims (ages 10-44)</td>
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<tr>
<td>Intangible cost per victim (ages 10-18)</td>
<td>65,406</td>
<td>47,251</td>
<td>11,151</td>
<td>898</td>
<td>7,796</td>
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<tr>
<td>Intangible cost per victim (ages 19-44)</td>
<td>238,285</td>
<td>113,806</td>
<td>9,013</td>
<td>519</td>
<td>4,507</td>
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</tbody>
</table>

Notes: Estimates are discounted to program entry (age 3) and reported in 1998 dollars. Including intangible expenditures to the victims of crime increases the benefit-costs ratio for the preschool, school-age, and extended programs by 42.3% (7.10:1 to 10.10:1), 28.9% (1.66:1 to 2.14:1), and 49.8% (6.09:1 to 9.12:1), respectively.