

PATH TO A BETTER FUTURE:

The Fiscal Payoff of Investment in Early Childhood Development in Maine

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I. INTRODUCTION AND SUMMARY

A trajectory, the path of something moving through time, can be fascinating. A small change in direction at a critical time can ultimately have huge consequences. Just a little push one way or the other early on could create either amazingly constructive or incredibly destructive effects. A satellite stays in orbit for decades or crashes to earth. A hurricane is harmless or devastating. A tee shot ends up on the fairway or in the woods. Children grow up to be engineers and doctors, or they end up on welfare or in prison.

The years before kindergarten are the most critical in both brain development and the acquisition of important non-cognitive abilities and habits.² Consequently, the everyday experiences before reaching kindergarten put children on paths that determine their future success in school and as adults. Although some children who start behind catch up, and some who start down promising paths veer off, to a large extent life outcomes are determined by the trajectories created before children start school.

The beginning trajectory is so crucial because of the way that skills (human capital) accumulate and the importance of skills in determining many of the outcomes in life; from performance in school, to success in the labor market, to intelligent decision making about health and risks. The more one learns, the easier it becomes to learn more. As Nobel Prize-winning economist James Heckman has often written, “Early learning begets later learning and early success breeds later success.”³ Human capital accumulation has a self-productive aspect, analogous to the miracle of compound interest in financial investments, but even more pronounced. The nature of this process is why investing in early childhood education has such a high payoff, and why efforts to help the disadvantaged later are so expensive and often ineffective. Waiting until problems manifest is waiting too long.

There is a growing realization that public investment in early childhood development is smart fiscal policy. As President Obama noted in his 2013 State of the Union speech,

You know, study after study shows that the sooner a child begins learning, the better he or she does down the road... Every dollar we invest in high-quality early childhood education can save more than seven dollars later on... We know this works. So let's do what works and make sure none of our children start the race of life already behind.

Moreover, this growing realization is bipartisan. It is bipartisan because investment in early childhood education makes sense in multiple dimensions. If all one cares about is providing the best possible future for our children and grandchildren, investment in early childhood education makes sense. If one is concerned about reducing social injustice and creating greater equality, investment in early care and education makes sense. If one wants a safer world, investment in early childhood education makes sense. If one wishes to promote economic prosperity through greater education attainment and innovation, investment in early childhood development makes sense. Even if one only wants to reduce the size of government and taxes, investment in early childhood education makes sense.

The last on the list might be surprising. In most instances there is a severe tradeoff between egalitarian and prosperity goals. That is, various social-insurance and public-assistance programs that tend to equalize incomes are extremely costly in terms of aggregate prosperity. Arthur Okun famously

² See, for example, Shonkoff and Phillips (2000).

³ For example, Heckman (2000).

described this harsh tradeoff as a “leaky bucket” that spills income in passing it from the rich to the poor.⁴ In the case of early childhood investment, though, the bucket is not only watertight; it actually fills as greater opportunities are created for disadvantaged young children. Unlike perhaps any other egalitarian policy, there is no tradeoff between strict fiscal stewardship and promoting greater equality. The leading proponent of this idea is Nobel laureate James Heckman (from the conservative Economics Department at the University of Chicago):

A large body of research establishes that investing in disadvantaged young children improves the productivity of the economy and, at the same time, reduces social and economic inequality. In the world of politics where “tradeoffs” are the rule, a policy of investing in disadvantaged young children is rare. For this policy, there is no tradeoff between equity and efficiency, between fairness and economic productivity.⁵

As noted by President Obama and Professor Heckman, there is considerable and compelling research demonstrating the fiscal benefits from high-quality early care and education. Although this has fueled growing interest in doing more to promote healthy early childhood development, both nationally and here in Maine, the perception of it being too costly remains a major obstacle. As will be demonstrated in this report, this obstacle is a misperception. The popular misperception about the true cost is due to lack of information about the substantial long-run cost savings created through high-quality early childhood education. This report attempts to provide this information.

This report demonstrates that public investment in early childhood development is smart fiscal policy for Maine. Specifically, it quantifies the likely fiscal repercussions from a proposed integrated system of high-quality, full-time early care and education, from birth to entry into kindergarten, for Maine children from low-income families (defined here as those with incomes less than twice the federal poverty line). The proposed system is not intended to be a specific policy plan, but a simple suggestive case to demonstrate that public investment in high-quality early childhood development is a cost-effective way to provide Maine children with greater opportunities for successful and fulfilling lives, greater equality in these opportunities, healthier lives, safer and more prosperous places to live, as well as less government and lower taxes.

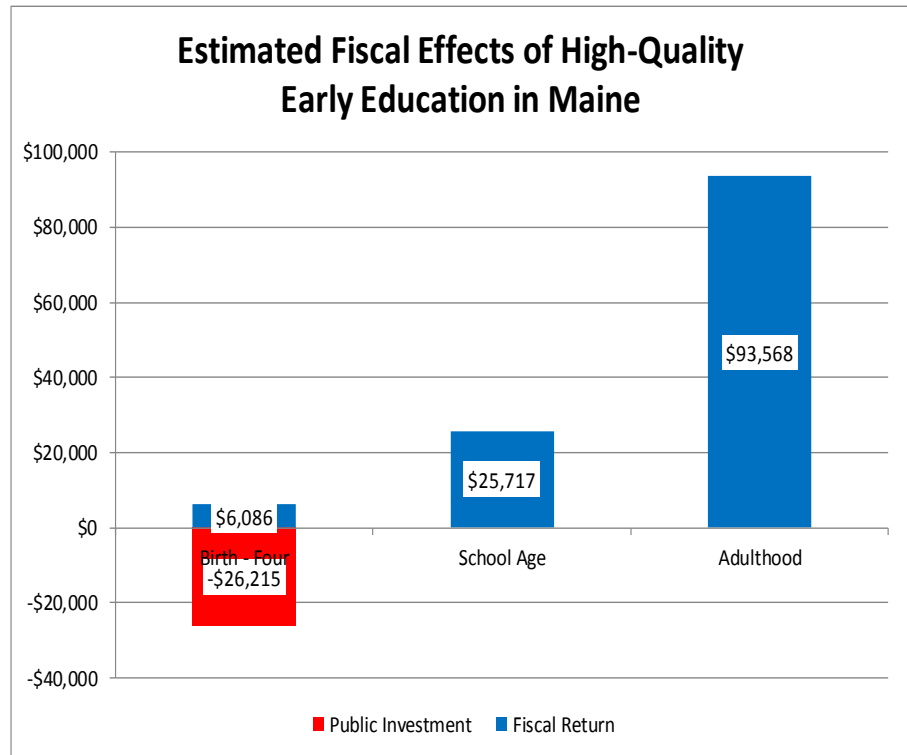
The findings indicate that investing in high-quality early childhood education in Maine more than pays for itself, in addition to achieving fundamental social goals.

- **The initial public cost is more than fully recovered before the children reach high school; that is, the fiscal break-even point is reached before age 14.**
- **The total lifetime fiscal benefit of participating in the high-quality early care and education system is about \$125,400 per individual, which is 4.8 times greater than the initial fiscal cost.**
- **In present value at birth using a 3% real discount rate, the net fiscal payoff per child is more than \$25,700. In other words, even after discounting the future benefits, taxpayers actually earn money from the high-quality early education program.**

⁴ Okun (1975).

⁵ Heckman (2008).

- The real fiscal internal rate of return on public investment in early childhood education is, conservatively, 7.5%.
- The later savings in other government spending are twice as large as the initial taxpayer investment in early education, and total government spending declines by roughly \$27,100 per participant. Public investment in early childhood education is not more government spending, it is a reallocation of government spending (away from special education, child protective services, and so forth).



To be more specific, the proposed suggestive system of high-quality early childhood education for Maine’s poor children is estimated to have the following long-run fiscal effects.

INITIAL COSTS

The anticipated initial investment in early education and care from birth to kindergarten entry is about \$45,000 per child. Contributions from participating families (using a sliding scale based on income) reduce the initial taxpayer investment to roughly \$39,500 per child over five years. Accounting for current public funding for existing programs makes the new initial taxpayer investment \$26,200 per child, which translates into an initial new investment of \$154 million per year.

The fiscal payback begins immediately, however, as more parents are able to work, pay more taxes, and rely less on social assistance. This immediately offsets about \$3,300 of the initial cost per participating child. Spending on child protective services also decreases immediately, offsetting almost \$2,800 of the initial cost per child.

Thus, the net initial cost to taxpayers is about \$20,100 per child in the suggestive program. The total initial net cost to the state is \$118 million per year.

SAVINGS THROUGH CHILDHOOD AND YOUTH

Substantial fiscal benefits from participation in high-quality early care and education occur during school age:

- There are continued savings in spending on child protective services. The total reduction in spending on child protective services is \$71 million annually in the long run.
- Special education costs during the K-12 years fall by roughly \$15,100 per child participating in the early education system. In the long run, Maine’s reduction in special education spending is \$89 million per year.
- Juvenile corrections costs drop by about \$3,100 per early education participant.
- Total government spending during the K-12 years falls by more than \$25,700 per participant.

SAVINGS IN ADULTHOOD

In adulthood, participants in the suggestive high-quality early education program fare much better in the labor market. Consequently, on average:

- Each participant pays \$12,800 more in state income taxes, \$7,000 more in property taxes, and \$5,900 more in sales taxes. Lifetime state and local tax revenues are almost \$25,700 greater per participant compared to nonparticipants.
- Each participant pays an additional \$32,600 in lifetime federal income taxes and \$13,000 in lifetime federal payroll taxes.
- The lifetime reduction in Medicaid, Supplemental Security Income, and other public assistance received is, conservatively, \$23,900 per participant.
- Spending on prisons and jails falls by almost \$3,000 over the participant’s lifetime.

The notion that a high-quality early childhood education system is too costly for Maine in the current tight budgetary environment is shortsighted. What is truly costly is the status quo. We cannot afford, now just as much as any other time, to *not* invest enough in putting more of our young children on paths leading to fiscally responsible futures.

Moreover, making money for taxpayers is clearly not the motivation for providing high-quality early childcare and education in Maine. The reason for public support of early childhood development is the same as for public primary and secondary education – to try to put all children on paths to happy, healthy, successful, and fulfilling lives. The fact that it also makes fiscal sense is just icing on the cake. Accounting for the value to the children and their families as well as the wider benefits to society makes the total return to the early education cake several times larger than the icing estimated in this report.

II. BRIEF REVIEW OF THE LITERATURE

Numerous studies quantify the benefits and costs of early childhood care and education programs. The most compelling of these studies find significant positive returns from investing in early childhood, although the magnitude of the estimated return varies depending mainly on the set of factors included in the analysis. The best-known of the studies estimating benefit/cost ratios from investment in early childhood education are briefly summarized.⁶

⁶ For an excellent survey of the entire literature, see Aos et al. (2004). Curry (2001), Lynch (2004), Karoly et al. (2005), Committee for Economic Development (2006), and Isaacs (2007) also provide nice summaries. In addition, Deming (2009) provides recent corroborating evidence from the Head Start program.

HIGHSCOPE PERRY PRESCHOOL

Widespread interest in early education was sparked by the first benefit/cost analysis of the HighScope Perry Preschool program. This program provided 12.5 hours of enriched preschool per week (along with home visits and curriculum interaction with mothers) for children from low-income families in Ypsilanti, MI, from 1962 to 1967. About three-fourths of the 58 randomly selected participants attended the preschool for two academic years, with the rest attending for one year at age four. Sixty-five children were randomly placed into a control group. The total cost per participating child was \$20,380 in current dollars.⁷ Data on the participants and on the control group have been collected through their school years and well into adulthood.

- Using these data, Schweinhart et al. (1993) and Barnett (1996) estimated the value to parents from child care, higher incomes of the participants in adulthood, reduced spending on special education and remedial education, greater tax revenues, reduced spending on public assistance, lower criminal justice spending, and the value of less crime. The sum of these estimated benefits was 8.7 times greater than the cost, even after discounting the benefits using a 3% real interest rate. The present-value benefit/cost ratio to the public (i.e., not including the higher incomes of the participants in adulthood and the value of the childcare to parents) was 7.2. The largest single benefit by far was from the value of crime reduction (which is not included in the estimates presented below because this report only estimates fiscal effects).
- Rolnick and Grunewald (2003) used the same data to estimate the real (i.e., removing the effect of inflation) internal rate of return on investment. The estimated total internal rate of return was 16%, and the estimated rate of return to the public was 12%.
- Using data further into adulthood, Nores et al. (2005), Schweinhart et al. (2005), and Belfield et al. (2006) reported an even higher benefit/cost ratio. The present discounted value of the total benefits (using a 3% discount rate) was 16.1 times greater than the cost, and the present-value benefit to the public was 12.9 times the cost. The estimated total internal rate of return was 17%. As in the earlier benefit/cost estimates, the largest benefit was from the value of the reduction in crime.
- Heckman et al. (2010) carefully reexamined the data and conducted sensitivity analysis. They estimated the total benefits to be between 31.5 and 19.1 times greater than the cost (or, in present value using a 3% discount rate, between 12.2 and 7.1 times the cost). They concluded that the real internal rate of return was, conservatively, between 7% and 10%. Their estimated rate of return is lower than in the previous studies primarily because they imputed a lower value for the social costs of crime.

ABECEDARIAN PROGRAM

The Abecedarian program, which operated in Chapel Hill, NC from 1972 to 1985, provided full-day, year-round childcare with an educational emphasis to 53 at-risk children from infancy until kindergarten entry (age 5). An additional 51 non-participating children served as a control group. The cumulative

⁷ For more information on the program and its consequences, see Schweinhart et al. (2005).

five-year cost above the control group was \$46,132 per participating child, in current dollars.⁸ Data have been collected on Abecedarian participants and the control group through age 21.⁹

- Barnett and Masse (2007) estimated the value to parents from child care, higher earnings of parents because of the childcare services, higher incomes of the participants in adulthood, higher incomes of the participants' descendants, reduced spending on special education and grade repetition, reduced spending on public assistance, and the value of longer lives because fewer participants were smokers. The present value of these estimated benefits (using a 3% discount rate) was 2.5 times greater than the estimated cost.
- Treating the costs differently, Temple and Reynolds (2007) estimated the present-value of the benefits to be 3.8 times higher than the cost.

The main reason why these estimated Abecedarian benefit/cost ratios are lower than for the HighScope Perry Preschool program is that they do not include the benefits from reduced crime.

CHICAGO CHILD-PARENT CENTERS

The Chicago Child-Parent Center program, begun in 1967, provides educational services and family support to at-risk three- and four-year-olds from low-income families. Data has been collected on preschool participants in the mid-1980s, along with data on nonparticipating children with comparable socio-economic backgrounds, through age 26 (so far). About three-quarters of those participating in the program did so for two school years. The total cost per preschooler was \$9,498 in current dollars.¹⁰

- Reynolds et al. (2002) estimated the value of child care, higher incomes of the participants in adulthood, reduced spending on special education and remedial education, greater tax revenues, reduced spending on child welfare, lower criminal justice spending, and the value of reduced crime and child abuse. After discounting the benefits using a 3% real interest rate, they found the total benefits of the program to be 7.1 times greater than the cost. The discounted benefits to the public (i.e., not including the benefits to the participants) were 3.9 times greater than the cost.
- Using data extending slightly further into adulthood, Temple and Reynolds (2007) estimated that the discounted total benefit of the Chicago Child-Parent Center program was 10.2 times the cost, and the discounted public benefit was 6.9 times the cost. As in the Perry Preschool analyses, the largest benefit by far was from the value of the reduction in crime.
- Reynolds et al. (2011) used data a little further into adulthood and also estimated the value of fewer problems with depression and substance abuse and increased life expectancy due to less smoking. They estimated a discounted total benefit/cost ratio of 10.8, and a discounted public benefit/cost ratio of 7.2. The estimated total internal rate of return on the Chicago Child-Parent Center investment was 18%.

⁸ Families and children in the Abecedarian control group also received some services (at a current-dollar cost of \$40,340 over the five years). For more information, see Temple and Reynolds (2007).

⁹ For more information on this program, see Barnett and Masse (2007).

¹⁰ See Reynolds et al. (2007) for more information on this program.

EXTRAPOLATION STUDIES

Several benefit/cost analyses, including the one presented here, have been conducted by extrapolating the evidence from the primary studies noted above. This method applies the findings from the previous research on the effects of high-quality early childhood programs to different current contexts and policy proposals. Quantifying the effects of early childhood interventions requires longitudinal data collection over a period of decades, which is clearly impractical for making policy decisions in the present. Hence, several studies and this one instead extrapolate the findings from the primary research.

- Perhaps the best-known example of this approach is Karoly and Bigelow's (2005) benefit/cost analysis of providing universal preschool education for four-year-olds in California. They applied the estimated effects from the Chicago Child-Parent Center program to the fiscal and demographic context in California at the time. Their analysis included the value of child care, reduced spending on child protective services, reduced spending on special education and remedial education, higher incomes of the participants in adulthood, lower criminal justice spending, and the reduced tangible costs of crime and child abuse. After discounting the benefits using a 3% real interest rate, they found the total benefits to be 3.2 times greater than the cost. The present value of the benefits to California only was 2.6 times greater than the cost. The real internal rate of return on investment was estimated to be 11.2%, and 10.3% to California only. More than half of the total benefit was from the projected higher incomes of the program participants in adulthood (which is not included in the benefit/cost estimates presented below because this study focuses solely on fiscal effects). The value of reduced crime calculated by Karoly and Bigelow is relatively small because it does not include the intangible costs to crime victims.
- Aguirre et al. (2006) conducted a benefit/cost analysis of a high-quality universal prekindergarten program by applying the estimated effects from the Chicago Child-Parent Center program to the fiscal and demographic context in Texas. They calculated the value of child care, increased parental income because of the childcare services, reduced spending on child welfare, reduced spending on special education and grade repetition, higher incomes of the participants in adulthood, lower spending on criminal justice, and reduced tangible costs of crime and child abuse. After discounting the benefits using a 3% interest rate, they found the total benefits to be 3.4 times greater than the cost. Almost 76% of the estimated total benefit was from the value of child care and the higher incomes of the participants in adulthood (neither of which are included in the benefit/cost ratios calculated below).
- Belfield (2004) conducted an analysis of a significant expansion of prekindergarten for disadvantaged three- and four-year-olds in Ohio. Like this report, it focused only on the fiscal impacts. Applying the estimated effects from the Chicago Child-Parent Center program to the fiscal and demographic context in Ohio, fiscal benefits were calculated for child protective services, taxes paid by parents, special education, grade retention, regular school costs (through effects on teacher satisfaction, absenteeism, and turnover; school safety; and performance programs), criminal justice, and taxes paid by participants in adulthood. After applying a 5% discount rate, the present value of total fiscal benefits was 1.9 times greater than the cost.

- Belfield (2005) performed a benefit/cost analysis of universal voluntary prekindergarten for four-year-olds in Louisiana that was analogous to the Ohio study. The present value of the total fiscal benefits (using a 3.5% discount rate) was estimated to be 2.4 times greater than the cost.
- Similarly, Belfield (2006b) examined the fiscal benefits and costs of universal prekindergarten for three- and four-year olds in Arkansas. The present value of the fiscal benefits (using a 3.5% discount rate) was found to be 1.6 times greater than the cost.
- Belfield (2006a) performed analogous calculations for universal prekindergarten programs in Massachusetts, Ohio (again), and Wisconsin. The present values of the fiscal benefits (using a 5% discount rate) were estimated to be 1.2, 1.6, and 1.6 times the costs, respectively.
- Belfield (2008) estimated the effects of a universal prekindergarten program by applying the estimated effects from the HighScope Perry Preschool and Chicago Child-Parent Center programs to the fiscal and demographic context in Hawaii. The present value of the fiscal benefits (using a 3.5% discount rate) was estimated to be 1.5 times greater than the cost. The total social benefits were also estimated in this study (i.e., including the lifetime benefits to participants, the value of reduced crime, etc.), and found to be 4.2 times higher than the cost in present value.
- Daniels et al. (2007) conducted a benefit/cost analysis of voluntary universal prekindergarten for four-year olds in Maryland following the methodology used by Karoly and Bigelow (2005). The total benefits to society were estimated to be 10.5 times greater than the cost. In present value using a 6% discount rate, the benefit to society was 4.9 times higher than the cost.
- More recently, Chase and Diaz (2011) estimated the benefits of early education for disadvantaged children in Michigan, but they did not calculate a benefit/cost ratio or rate of return on investment.

This study applies the well-established extrapolation methodology to the current fiscal and demographic context in Maine. As will be discussed further in Section VI, this methodology is modified slightly so that the effects of early education from birth through four can be estimated (the previous literature only estimated the effects for ages three and four).

III. EARLY CHILDHOOD INVESTMENT IN MAINE

The estimates presented in this report are from a comparison between two scenarios of investment in early childhood development in Maine: the current situation, and a high-quality system of early care and education from birth to kindergarten.

CURRENT PUBLIC INVESTMENTS IN EARLY CHILDHOOD DEVELOPMENT

All social assistance programs either directly or indirectly promote early childhood development in providing assistance to families. This study focuses only on the programs that directly target the cognitive development of young children. Programs such as Medicaid, CHIP (Children's Health Insurance Program), WIC (Special Supplemental Nutrition Program for Women, Infants, and Children), SNAP (Supplemental Nutrition Assistance Program), TANF (Temporary Assistance to Needy Families), etc. are not examined here because early childhood learning is not their primary intention.

Maine has six broad programs that are designed to promote the cognitive, social, and emotional development of children before they reach kindergarten in the public school system. These programs are listed in Table 1 in order of state- and local-government spending in fiscal year 2011.¹¹

- **Public prekindergarten** for four-year-olds is provided in some public elementary schools. About 28% of Maine’s four-year-old children participated in this program in FY 2010, and this proportion has been rising. Although school districts determine whether and how to offer Pre-K, state funding regulations require the programs to have a certified teacher, a child-to-teacher no higher than 15:1, and at least 10 hours per week of instruction during the school year.
- **Head Start and Early Head Start** are full-year programs targeting children in poverty and in other at-risk situations. Head Start serves three- to five-year-olds with a child-to-staff ratio no higher than 10:1. Early Head Start serves children from birth through age two with a child-to-staff ratio no higher than 4:1. Both operate under federal guidelines.
- **Early intervention and special education and related services** (part of Maine’s Child Development Services system) identifies and manages therapies for preschool children with disabilities.
- **The Maine Families Home Visiting Program** provides home visitation services for first-time families with children from prenatal through five years old. It is based on the national *Parents as Teachers* model. Services are generally targeted toward those most in need and at risk.
- **The Childcare Development Fund (CCDF)** has two broad programs, childcare subsidies and “childcare quality investments.” CCDF is mostly federally funded and follows general federal guidelines. The childcare subsidies are for low-to-middle-income families with all parents working. It covers part of the childcare costs for working parents using a formula that directs larger subsidies to the poorest families. The childcare quality investments are a group of programs to promote workforce development and training of childcare workers, licensing of childcare providers, and the state’s childcare quality rating system (Quality for ME).

Total government spending in Maine on these six early childhood programs was just under \$100 million in FY 2011.¹² The largest program in terms of total government spending in Maine is Head Start, which was almost 36% of the total. But most of the spending on Head Start (88.8% in FY 2010) is from federal funding. Much of the CCDF spending on childcare subsidies and childcare quality investments is also federally funded (76.6% in FY 2011).

The largest of the six early childhood investment programs in terms of state spending is early intervention and special education and related services for children younger than age six. Although

¹¹ The numbers shown in Table 1 are from Reidt-Parker and Berkowitz (2012). This report also provides an excellent concise summary of Maine’s early childhood investment programs.

¹² Pressure on the state budget has increased since FY 2011. For example, state spending on primary and secondary education decreased 2.5% from FY 2011 to FY 2012 (Maine Office of Fiscal and Program Review, 2012a), following decreases in the preceding four years. Also, at the end of the 2012 legislative session, Head Start and other child welfare programs were cut by \$3.2 million for FY 2013 (Maine Office of Fiscal and Program Review, 2012b).

some of it is federally funded (14.3% in FY 2011), early intervention and early special education still make up more than 45% of the almost \$53 million in total state- and local-government funding for early childhood education. The other large early childhood investment in Maine is prekindergarten for four-year-olds. Together, early intervention and prekindergarten make up more than 77% of the state's total early childhood investment.

Table 1
Public Investments in Early Childhood Development in Maine in FY 2011

Derived from *Investments in Maine's Young Children*

	Participants	State and Local Funding (in millions)	Federal Funding (in millions)	Total Funding (in millions)
Early Intervention	4,754	\$23.87	\$3.98	\$27.85
Prekindergarten	4,050	\$16.77 *		\$16.77
Home Visiting	2,357	\$4.92		\$4.92 ◊
Head Start & Early Head Start	3,955	\$3.88 †	\$31.68 ‡	\$35.57
Childcare Subsidies	2,062	\$2.51	\$8.20	\$10.71 ○
Childcare Quality Investments	▪	\$0.78	\$2.55	\$3.33 ○
		\$52.74	\$46.42	\$99.15
Total				

* State-government funding was \$7.34 million and local-government funding was \$9.43 million.

◊ This funding includes all services provided by the Maine Families Home Visiting Program, not just narrowly defined childhood development.

† This does not include local-government contributions.

‡ Unlike the other numbers in this table, federal funding for Head Start in Maine was for FY 2010.

○ Estimated based on 60% of participating children being age zero through five.

▪ The quality rating system covers all childcare participants.

Head Start and Early Head Start are only the fourth-largest category of early childhood investment in Maine in terms of state funding. However, the funding amount shown in Table 1 does not include local-government contributions, which mostly take the form of time volunteered by Head Start parents.

A HIGH-QUALITY SYSTEM OF EARLY CARE AND EDUCATION

As noted earlier, this study follows a well-established approach to demonstrate the cost-effectiveness of public investment in early childhood development. In the absence of data from an expensive longitudinal study performed in Maine over a period of decades, the estimated outcomes from earlier programs elsewhere are extrapolated to the current fiscal and demographic context in Maine. This approach also requires specifying a counterfactual scenario or comparison case. In other words, some sort of policy change must be proposed to conduct a benefit/cost analysis of early childhood investment in Maine.

To demonstrate the cost-effectiveness of public investment in early childhood education most effectively, a simple comparison scenario is proposed and analyzed. The steering committee for this project (comprised of policymakers, administrators, and experts in early childhood development) chose to examine the effects of a general high-quality system of early care and education. The proposed system is a suggestive comparison case, not a specific plan for policy reform. The simple suggestive proposal is, however, based on current evidence about what works best to promote early childhood development.

Specifically, the proposed system of early care and education has the following important features.

- **It is comprehensive and coordinated rather than either a one-size-fits-all program or a piecemeal collection of programs operating in isolation.** Children’s needs differ, and a high-quality system should meet these different needs and prevent slips into the cracks between programs. At the same time, services must be integrated to avoid duplication of efforts.
- **Quality is high.** The standard of childcare and early learning services and environments must reach at least the Step 3 level in Maine’s quality rating system.
- **It is full time.** Early care and education services are mostly full-day (six hours per day) and year-round (or at least full-school-year). Some evidence indicates that “low-dosage” early childhood education is not as cost-effective.
- **Support begins at birth (if not prenatally) and continues until entry into the school system.** As in the case of low dosage, some evidence indicates that short durations of early childhood education are not as cost-effective.

KEY FEATURES OF THE COMPARISON CASE

- Comprehensive and coordinated system
- High-quality
- Mostly full-day
- Year-round
- From birth through age four
- Targets children from low-income families
- Voluntary participation

- **Public funding is targeted toward children from low-income backgrounds.** Targeting services toward poor children not only promotes greater equality of opportunity, it also increases the fiscal payoff by reaching those most at risk of falling into traps of crime, poverty, bad health, etc.
- **Participation is voluntary.**

Other than these important features, the proposed comparison case is kept as simple and general as possible. This allows the report to focus on quantifying the fiscal effects without getting sidetracked by important debate over the optimal mix and integration of programs. The proposed system is not intended to be a specific and detailed recommendation, but a broad comparison case.

Although the comparison case is intentionally simple and general, its details need to be made explicit. **The proposal is for a mostly full-time (25 hours per week), year-round (48 weeks per year), high-quality child care, education, and related services from birth up to kindergarten.** The idea behind 25 hours per week is that about two-thirds of children would enroll full time (i.e., 30 hours per week) and one-third would enroll half time (15 hours per week), and 25 hours per week is meant to be interpreted as the average. No assumption is made about the specific form of the expansion of child development services. Targeting the proposed system toward poor children is assumed to closely follow Maine's existing CCDF formula for childcare subsidies. Again, the intention is not to promote the expansion of the CCDF program or to promote its subsidy formula, but only to use its current targeting scheme as a reasonable guide for expected family contributions for early education and childcare costs.

The existing CCDF formula allows for families with incomes up to 2.5 times the poverty guideline to be eligible for subsidized child care. The suggestive proposal here, however, is to target families with incomes only up to twice the poverty guideline.¹³ Other than this difference, the proposed program follows the CCDF formula which makes the childcare cost to families smaller and state subsidies larger for the poorest families.¹⁴ By restricting eligibility to those with incomes only up to twice the poverty level, the proposed program is for children from the lower half of the income distribution. Data from the 2010 Public Use Microdata Sample of the American Community Survey from the U.S. Census Bureau suggest that 60.8% of Maine's children younger than age five are from families with incomes up to 2.5 times the poverty line, compared to 46.9% of children being from families with incomes up to two times the poverty line.¹⁵

¹³ The 2012 poverty guideline for a family of four, for example, is \$23,050. Thus, families of four with incomes up to \$46,100 would be eligible.

¹⁴ For families with one eligible child, the copayment is: 2% of income if family income is less than 0.25 times the poverty guideline, 4% of income if family income is between 0.25 and 0.5 times the poverty line, 5% of income if family income is between 0.5 and 0.75 times the poverty line, 6% of income if family income is between 0.75 and 1.0 times the poverty line, 8% of income if family income is between 1.0 and 1.25 times the poverty line, 9% of income if family income is between 1.25 and 1.5 times the poverty line, and 10% of income if family income is between 1.5 and 2.0 times the poverty line. For families with two eligible children the copayment rates are 1.5 times larger (i.e., the copayment rates per child are 0.75 times as large). For families with three eligible children the copayment rates are 1.75 times larger (i.e., the copayment rates per child are 0.583 times as large). And for families with four eligible children the copayment rates are 2.0 times larger (i.e., the copayment rates per child are half as large). But the maximum family copayment in any scenario is capped at 10% of income.

¹⁵ These proportions may seem higher than expected, but two facts may help reconcile them. First, parents of young children are typically early in their work careers, and consequently their incomes are generally lower than average family income across all ages. Second, the proportion of young children under twice the poverty line is

IV. ASSUMPTIONS

The extrapolation methodology used in this report imposes the underlying assumption that, other than differences in socio-economic backgrounds that can be at least partly controlled for, children in Maine are basically the same as children in the rest of the nation. Several additional assumptions and details in the analysis need to be made explicit.

SIMPLIFICATIONS

This study assumes that fiscal policies in Maine will not change in the future. This assumption is not made because it is likely, but because it is virtually impossible to forecast which policies will change and by how much.

The comparison case examined in this study is for a high-quality child development system from birth until kindergarten entry. Ideally, the benefits and costs of public investment could be quantified at each age from birth through age four. There is evidence that both the costs and later payoffs are higher for earlier investments in childhood development. The current empirical evidence on this issue, however, is not sufficient to be able to quantify the differences in returns at each age without adding a significant element of conjecture to the estimates. Thus, this analysis lumps early childhood investments from birth through age four together and estimates a weighted-average fiscal benefit and fiscal rate of return.

This study does not account for transitional effects; it does not account the likely gradual implementation of a new policy toward early care and education. It will take time to develop the infrastructure and workforce needed to accommodate a more comprehensive early care and education system. Moreover, children age three and four at the time of implementation would not receive a full dose of early education. Accounting for these transitional effects would, however, add little to the understanding of the likely fiscal impacts from public investment in early childhood development and would clutter the analysis unnecessarily.

Interstate (and international) migration is not accounted for. Emigration of Maine youth could significantly reduce the fiscal benefits to the state from investment in early childhood development, but accounting for it would substantially complicate the analysis. The timing of emigration of Maine's low-income youth would have to be determined, as well as the extent and timing of their return immigration. It is unlikely that this could be done with a reasonable degree of precision, and it would be a significant research project by itself just to find out. Moreover, there is also a potentially even more complicating factor. There is evidence that job creation, and hence people, are drawn to areas with highly skilled people.¹⁶ Since investments in early childhood education ultimately create more highly skilled people, these investments could attract people from away to offset those who leave Maine. The extent of the net migration is thus unclear.

Each age cohort is assumed to be equal size to remove the unnecessary clutter that small demographic fluctuations would add in trying to interpret the results on the fiscal impacts from public investment

slightly higher than the proportion of families with incomes under twice the poverty line (which is how income-distribution data are typically presented) because poorer families have more children, on average.

¹⁶ For more discussion of this issue see Trostel (2010b).

early childhood development. Allowing for the fiscal interactions created through demographic changes would add more confusion than useful information.¹⁷

DEMOGRAPHICS

The U.S. Census Bureau's estimate for the number of children in Maine age five and under in 2010 is 82,247. If the number of children at each age within this group is equal (i.e., 13,708), the estimated number of children age four and under is 69,520.¹⁸ Using the earlier estimate that 46.9% of Maine's young children are from families with incomes no more than twice the federal poverty line, the estimated number of children eligible for the proposed early childhood development system is 32,631.

PARTICIPATION RATES

Not every eligible family will participate in the voluntary program. Most of the extrapolation studies noted earlier assumed a participation rate of 70%, largely based on the rate of voluntary participation in Oklahoma's universal prekindergarten program for four-year-old children.¹⁹ But Oklahoma's participation rate increased to 74% recently, after having seemingly reached an equilibrium value close to 70%. Moreover, the voluntary participation rate in Florida's relatively new universal prekindergarten program for four-year-olds reached 76% last year. In addition, when including Head Start and Early Intervention, Oklahoma and Florida's most-recent participations rates of four-year-olds are 88% and 87%, respectively.²⁰

In Maine's school districts that offered prekindergarten in all of their elementary schools, the average participation rate in AY 2011 and 2012 was about 77%.²¹

Participation rates for infants and toddlers are likely to be lower than for four-year-olds. Committee for Economic Development (2006) assumed a 50% participation rate is assumed for three-year-olds. There does not appear to be much evidence on participation rates at younger ages, though.

This report follows the previous literature in assuming a participation rate of 70%, but this is the average across all ages from birth through age four. To arrive at this average, a 90% participation rate is assumed for four-year-olds, 80% for three-year-olds, 70% for two-year-olds, 60% for one-year-olds, and 50% for infants. The average participation rate is thus 70%, but under these assumptions 90% of Maine's children from families with incomes below twice the poverty line would participate for at least one year in public early education before kindergarten.

To simplify matters, and without any evidence to the contrary, these participation rates are assumed to be the same for all relevant income ranges. Eligible families with relatively higher incomes might be expected to participate at higher rates because their incomes and labor-force participation rates are

¹⁷ For more on forecasted demographic changes, see Maine State Planning Office (2010). Projections based on data through 2008 suggest that the number of young children in Maine will shrink by about 13% over 15 years.

¹⁸ This is very close to the Maine State Planning Office's (2010) projected estimate of 69,769 for 2013.

¹⁹ The assumed participation rates in previous studies have ranged between 50% and 80%, but 70% is used most frequently (e.g., Karoly and Bigelow, 2005; Aguirre et al., 2007; and Daniels et al., 2007).

²⁰ Barnett et al. (2011).

²¹ This was calculated using data from the Maine Department of Education.

higher, but they would also face higher copayments as percentage of income. Hence, it is unclear whether participation rates will vary with income.

Given these assumptions about voluntary participation rates, **the expected number of young children in the proposed high-quality system is 22,842 annually.** This is 32.9% of Maine’s children age four and younger. Under the assumptions above, there would be 5,874 four-year-olds in the program, with the number of participating children decreasing at each age down to 3,263 infants.

DOLLAR VALUES

This report incorporates dollar amounts from different years. To make the amounts consistent, unless otherwise noted all dollar amounts reported here are converted to September 2012 dollars using the Consumer Price Index from the U.S. Bureau of Labor Statistics.

The timing of the costs and benefits from investment in early childhood development obviously differ substantially. Thus, the fiscal effects occurring in the future are discounted into present value. **The “present” year in this study is defined to be the first year of life in 2012.** That is, all dollar values from age one onward are discounted into the present value at birth. This study uses a 3% real interest rate (the amount by which the observed risk-free interest rate exceeds the rate of inflation) to discount future values, which is typical in studies of this type. The 3% rate probably errs on the high side, so it is conservative in quantifying the payoffs to investment in early childhood development.²²

V. UPFRONT COST

To estimate the cost of the high-quality early education system, this study relies on the careful analysis of Head Start and Early Head Start costs by Besharov et al. (2007).

Although the suggestive comparison case is for generic, high-quality childcare and education (rather than an expansion of a particular program or programs), the costs of Head Start and Early Head Start serve as a reasonable guide because, like the proposed system, they provide comprehensive, high-quality child development services to low-income families.

Besharov et al.’s estimates are based on actual government costs, not on an idealized perfectly efficient scenario. Besharov et al. also contend that, to be conservative, their estimates err on the side of understating the costs. Even so, their estimate of Head Start cost per child is about 39% higher than the official published figures (they argue that the official numbers are misleading). Furthermore, the children served by Head Start (generally those from families below the poverty line) are more at-risk and hence costlier to serve, on average, than the children who would be served by the suggestive system proposed for Maine (those from families under twice the poverty line). Thus, overall, **the cost estimates in this study are likely to err on the high side, and the benefit/cost ratio probably errs on the low side.**

²² A 3% discount rate was used by Schweinhart et al. (1993), Barnett (1995 and 1996), Oppenheim and MacGregor (2002), Reynolds et al. (2002), Aos et al. (2004), Karoly and Bigelow (2005), Karoly et al. (2005), Schweinhart et al. (2005), Belfield et al. (2006), Aguirre et al. (2006), Barnett and Masse (2007), Isaacs (2007), Temple and Reynolds (2007), Chase and Diaz (2011), and Reynolds et al. (2011). Some studies of this type have used higher discount rates, including 3.5% (Belfield (2005 and 2006b), 5% (Currie 2001, and Belfield 2004 and 2006a), and 6% (Daniels et al. 2007). King et al. (1999), however, used a discount rate of 2%. Historically, real interest rates have generally averaged about 2%, and in the last decade (even before the recession) average real interest rates were about 1%.

The basis for the cost calculation is Besharov et al.'s estimates that full-time Head Start for children ages three to five costs \$8.41 per child per hour and full-time Early Head Start for children from birth through age two costs \$10.17 per child per hour in 2004. Three adjustments are made to these numbers.

Besharov et al.'s estimates include funding to Head Start providers as part of the Child and Adult Care Food Program. Food assistance to low-income households is not part of the proposed early education system, thus this cost is deducted from the calculation. This makes the cost per child per hour \$7.36 for preschoolers and \$9.42 for infants and toddlers. These costs in 2004 are converted to 2012 dollars. After adjusting for inflation, the amounts are \$9.02 for preschoolers and \$11.54 for infants and toddlers. The per-child cost of Head Start and Early Head Start in Maine averaged about 5.5% less than the national average over the past five years.²³ After this adjustment, the estimated per-child per-hour cost is \$8.53 for three- and four-year-olds and \$10.91 for children from birth through age two.

COST PER CHILD

The suggestive proposal is for a system broadly similar to Head Start for an average of 25 hours per week for 48 weeks per year.²⁴ The resulting estimated annual cost is \$10,234 per preschooler and \$13,093 per infant/toddler. Given the assumptions discussed earlier (the number of children at each age is equal, 90% of four-year-olds participate, 80% of three-year-olds participate, etc.), **the weighted-average annual cost per child is \$11,704 for a coordinated system providing high-quality childcare, education, and related services for Maine children under the age of five.**

The cumulative cost per child is \$45,516 for an average of 3.89 years of participation. In present value (at birth, using a 3% discount rate) this is \$42,763. Admittedly, this is an expensive proposal.²⁵

As noted earlier, the estimated number of Maine children participating in the proposed early childhood development system is 22,842 per year. Thus, the system's total cost before accounting for family contributions is \$267 million annually.

FAMILY CONTRIBUTIONS

Expected family contributions amount to \$35.4 million annually. This figure is reached by applying the current CCDF subsidy formula to the estimated family incomes of each eligible child age four and younger (assuming a 70% participation rate) using data from the 2010 Public Use Microdata Sample of

²³ Office of Head Start's *Head Start Program Fact Sheets*.

²⁴ As noted earlier, five hours per day is intended as a rough average for all participating children. Children with all parents working would participate for six hours per day, while children with a parent at home would be in the program for three hours per day. The usual practice in Early Head Start is for 48 weeks per year.

²⁵ This estimated cost per participant is considerably higher than in most studies of this type because it provides services for up to five years per child; it covers infants and toddlers who are more expensive to serve; and it is for full-time, year-around early education and services. But the \$45,516 estimated cost is less than King et al.'s (1999) estimated \$54,500 (in current dollars) cost per child for a proposed four-year program for disadvantaged Texas children. The annual \$11,704 weighted-average cost per child is also less than the per-child cost of Central Maine's Educare program, although this is not apples-to-apples comparison. In FY 2011 and 2012, its average cost per child was \$15,254 in current dollars (calculated from Educare Central Maine annual reports). But this is not directly comparable to the estimated cost here because the average time in the Educare program appears to be much higher than the 25 hours per week assumed in this study, and because the infant/toddler proportion in the Educare program is much less than in this study (less than 20% versus more than 50%).

the American Community Survey. Table 2 shows the cost amounts for each income group. Not surprisingly, most of the \$35 million in copayments comes from families with incomes above the poverty line. For example, families with incomes between 1.5 and 2.0 times the poverty line pay an average of \$3,406 of the \$11,704 annual cost per child.

Income to Poverty Line Ratio	Copayment * Rate (% of income)	Number of Children	Cost (in millions)	Copayments (in millions)	Public Contribution (in millions)	Public Percentage
0	2%	658	\$7.70	\$0.00	\$7.70	100.0%
0.01 - 0.25	2%	2,754	\$32.23	\$0.13	\$32.10	99.6%
0.26 - 0.50	4%	2,344	\$27.44	\$0.64	\$26.80	97.7%
0.51 - 0.75	5%	2,253	\$26.37	\$1.28	\$25.10	95.2%
0.76 - 1.00	6%	3,333	\$39.01	\$3.58	\$35.43	90.8%
1.01 - 1.25	8%	3,569	\$41.77	\$6.34	\$35.43	84.8%
1.26 - 1.50	9%	3,702	\$43.33	\$9.03	\$34.30	79.2%
1.51 - 2.00	10%	4,229	\$49.50	\$14.41	\$35.09	70.9%
Total		22,842	\$267.34	\$35.39	\$231.95	86.8%

Derived by applying the current CCDF formula for childcare subsidies to data from the 2010 American Community Survey and assuming a 70% participation rate.

* These are the copayment rates for families with one child participating in the program. The copayment rates per child are lower for participating families with more than one child under the age of five.

PUBLIC COST

After applying the family contributions, the public cost of the proposed system drops to \$232 million per year. The government pays about 87% of the total cost. The average annual public cost per child in the high-quality system is \$10,154. The average cumulative public cost per child from birth until kindergarten entry is \$39,490. The cumulative public cost in present value (at birth, using a 3% discount rate) is \$36,206 per participant, on average.

As shown in Table 1, Maine’s public investment in early childhood development in 2011 was about \$99 million. In September 2012 dollars this is \$102 million. It is assumed that \$78 million of these current investments will be folded into the proposed new system.²⁶ Thus, **the estimated additional public cost**

²⁶ The \$78 million figure is derived assuming that: all Head Start and Early Head Start spending would have been directed toward the low-income children targeted in the proposed system, 77.1% of CCDF childcare subsidies would have gone to these children (because 77.1% of children eligible for CCDF subsidies would be eligible for the proposed system), 73.5% of the spending on Early Invention and home visiting would have been directed at these children (assuming that these programs are targeted mostly toward low-income children using the method to be

of creating a high-quality early childhood development system for Maine is \$154 million per year. The additional annual public cost per child in the high-quality system is \$6,741. The cumulative additional public cost per child from birth through age four is \$26,215. In present value at birth this is \$24,630.

The suggestive proposed high-quality system is clearly expensive relative to the current system. But, as shown in the next chapter, the fiscal returns are much greater than this cost. The \$154 million additional public cost is not even close to the *net* cost to taxpayers. Maintaining the status quo and *not* having a full-scale, high-quality early childhood development system is more expensive. The usual way of looking at the proposal is that it is more government spending, but actually it is really a reallocation of government spending. There is more spending on early childhood education, but less spending on special education, child protective services, and other expensive programs.

VI. APPLYING EVIDENCE TO MAINE

The previous extrapolation benefit/cost analyses have mostly relied on evidence from the Chicago Child-Parent Center program, and this analysis does as well. The structure of the Abecedarian program is broadly consistent with the proposal here (full-day, year-long, from infancy to kindergarten), thus its evidence would seemingly be more appropriate for guiding the analysis. But the sample size in the Abecedarian study is relatively small and does not allow for precise estimation of the effects. Indeed, this is why the previous analyses of this type generally relied on the effects observed in the Chicago Child-Parent Center (CPC) study, which has a sample size well over ten times as large as the Abecedarian and Perry Preschool studies. Only hugely significant economic effects are statistically significant in samples as small as the Perry Preschool and Abecedarian programs.²⁷ Although there is considerable evidence that investment in early childhood education has a tremendous payoff, quantifying the payoff reasonably well requires relatively precise evidence on the outcomes. That is, it is not a question of if, but specifically how much investment in early education affects lives. Thus, this study extrapolates from the most precise evidence.

There are two problems with extrapolating directly from the CPC results to the context in Maine, however. First, the **children participating in the CPC program and its control group were more disadvantaged, on average, than Maine children from families with incomes below twice the poverty line.** More than three-fourths of CPC participants were from single-parent families; more than half had mothers who did not complete high school; and about 83% of the children were from families with incomes at or below 1.3 times the poverty line. By comparison, of the estimated 32,631 Maine young children from families with incomes at or below twice the current poverty line, “only” 66% are at or below 1.3 times the poverty line. Since the impacts of early childhood education are expected to be greater for the children most at risk, extrapolating the results from the CPC program directly would overstate the effects likely to occur in Maine.

Second, the CPC program provided preschool three hours per day for about 10.5 months, while the proposal for Maine is for an average of five hours per day for 48 weeks—roughly 75% more early

discussed in Section VI), 46.9% of prekindergarten spending would be folded into the proposed system, and none of childcare quality investments would be incorporated into the system.

²⁷ For example, participants in the Abecedarian program were about a third less likely to have a felony conviction by age 21 than those in the control group—a very large difference by any economic standard. But because the numbers of instances were so low (4 compared to 6), this difference is not significant statistically.

education per year than CPC provided. Also, the CPC program served only three- and four-year-old children, while the proposal for Maine is for services from birth through age four. Moreover, not all of the children in the CPC treatment group participated for both years; the average number of participation years was 1.55. Under the assumptions discussed earlier (90% participation for four-year-olds, 80% for three-year-olds, etc.), the average number of participation years in the proposed Maine system would be 3.89 if every child who begins the program remains in it until kindergarten. This is about 2.5 times as many years of early education and comprehensive services as children received in the CPC program. Altogether, the proposal here for **full-time care and education from birth until kindergarten is for 4.4 times as much early care and education as in the CPC program**. Thus, we should expect significantly larger effects for children in the Maine system than from the CPC program, all else being equal.

The two significant differences between the CPC program and the one proposed for Maine make extrapolating the evidence particularly complicated. Indeed, this extrapolation is considerably more complicated than in the similar studies discussed earlier.

The standard approach in research that extrapolates from primary evidence is to take the observed difference in an outcome—say, the high school graduation rate—and simply multiply it by the number of children involved in the proposed program. To deal with the issue that the children involved in a proposed program are not as disadvantaged on average as those in the CPC program, previous studies assumed that the effect on less-disadvantaged children in the proposed program would be fractions of the effect observed in the CPC program. For example, Karoly and Bigelow (2005) assumed that 25% of the children in a universal prekindergarten program for California were high risk and would have the same outcomes as in the CPC study, another 20% were medium risk and would have effects half as large as the CPC outcomes, and 55% were low risk and would have effects one-quarter as large as the CPC outcomes.²⁸

The more challenging difference for this analysis is that the Maine proposal is for more than four times as much early education as in the CPC study. This is particularly challenging because it **requires specifying a form of “returns to scale” in programs for early childhood development**. That is, there could be diminishing returns in CPC-type programs, and additional years spent in the programs would have smaller benefits than the first year. Indeed, there is some evidence that the second year of participation in the CPC program did not produce benefits as high as the first year.²⁹ But there also is some evidence suggesting that there are increasing returns in these types of programs and the payoff grows more than proportionately with additional time spent in early education.³⁰ Moreover, the high payoff to early education compared to K-12 education suggests that the returns are increasing in these early years. Overall, though, the evidence on the returns to scale in early education is inconclusive.

²⁸ Similarly, Daniels et al. (2007) assumed that 28% of the children in a universal prekindergarten program for Maryland would have the same effects as in the CPC study, 49% would have effects half as large as the CPC outcomes, and 23% would have effects one-quarter as large as the CPC outcomes. Another example is Belfield (2008), which assumed that 33% of children of the children in a universal prekindergarten program for Hawaii would have the same effects as observed in the Perry Preschool experiment, while the other 67% of the children would have effects 40% as large.

²⁹ See Reynolds et al. (2011).

³⁰ Puma et al. (2005) and Loeb et al. (2007).

Given this conflicting evidence on the returns to additional time in early education, constant returns is probably the most reasonable assumption. That is, **the effects of early education are assumed to be proportional to the amount of time invested**. Thus, as a starting point, the system proposed for Maine is assumed to create effects 4.4 times as large as those observed in the CPC study.

Unlike previous analyses of this type, which examined policy proposals for roughly the same amount of early education as in the CPC program, this analysis assumes that **the effects are 4.4 times as large as in the CPC study in percentage terms, rather than in absolute terms**. The reason for specifying the effects in percentage terms is that proportions are bounded between zero and one. For example, the high school graduation rate cannot exceed one; the incarceration rate cannot be less than zero; and so on. If the effects were specified as 4.4 times as large in absolute terms, then some effects would exceed their possible bounds. Moreover, the proportion bounds will be approached asymptotically. That is, the absolute changes decrease as a proportion converges gradually to its bound.

To capture this phenomenon it is assumed that each unit of high-quality early education (the amount provided in the CPC study) creates effects described by the following equation:

$$X = Y \times (1 - \alpha).$$

X denotes the value of a proportion (of those in, say, special education, the correctional system, etc.) that occurs after having received a unit of early education. It is defined such that it converges toward zero as more early education is received (so, for example, X is the high school incompleteness rate as opposed to the high school graduation rate). Y denotes the value of the proportion that occurs in the absence of the early education. α is percentage reduction in the proportion caused by the early education program. It is measured as the percentage difference between the treatment and control groups in the CPC study [from the above equation, $\alpha = (Y-X)/Y$, Y is the rate observed in the control group, and X is the rate observed in the treatment group].³¹ Since the proposed system for Maine is for 4.4 times as much early education as in the CPC study, the effects in this analysis follow the equation

$$X = Y \times (1 - \alpha)^{4.4}.$$
³²

The effect of early education per young child in the program is $X - Y$ (both variables are measured as effects per child). Using the above equation makes this effect

$$X - Y = Y \times [(1 - \alpha)^{4.4} - 1].$$

This effect is the same as assumed in the previous research in the case where the proposed amount of early education is about the same as in the CPC study.

³¹ An example might make this clearer. The high school completion rate in the CPC study (at age 21) was 61.9% for the treatment group and 51.4% for the control group (Reynolds et al., 2002). Thus, $X = 38.1\%$ and $Y = 48.6\%$, which makes $\alpha = 21.6\%$ in the case of high school incompleteness.

³² Returning to the example, under the constant-returns assumption, doubling the treatment would have raised the high school completion rate for the treatment group to 70.1%, tripling the treatment would have increased the completion rate to 76.6%, and making the treatment 4.4 times as much would have increased the completion rate to 83.3%. If each unit of early education increased the high school completion rate by 10.5 percentage points as in the CPC study, then 4.4 units of early education would have raised the high school completion rate to 97.6%.

An apparently important drawback to this approach of assuming proportionate changes is that it requires knowing Y, that is, the rate that would occur in the absence of the increase in early education. Knowing this status-quo rate did not appear to be necessary in previous analyses. But actually these analyses had an implicit assumption that the status-quo rate for the high-risk group was the same as the control-group rate in the CPC study (and that the medium- and low-risk groups had status-quo rates some fraction as large as the CPC control-group rate).

This analysis takes a slightly different approach to this issue. Rather than make assumptions about the proportions of children in different at-risk groups, **this analysis first calculates the extreme bounds of the status-quo rate in Maine and then assumes that the status-quo rate, Y, is the midpoint between these bounded values.** To be more specific, recall that an estimated 46.9% of Maine’s young children are from families with incomes low enough to be eligible for the program (incomes less than twice the poverty guideline). One extreme bound for the status-quo rate is if the rate for this relatively low-income group was the same as the observed rate for all Maine children:³³ in other words, the lower-income children in Maine were no more likely to be incarcerated, no more likely to fail to obtain a high school diploma, etc. This is clearly implausible; hence, this is the extreme lower bound for the status-quo rate. The other extreme bound is if the observed rate for all Maine children came completely from the relatively low-income group: in other words, no upper-income children in Maine are incarcerated as juveniles or adults, fail to obtain a high school diploma, etc. This is also clearly implausible; hence, this is the extreme upper bound for the status-quo rate. The actual status-quo rate must lie between these bounds, and this study makes the simple assumption that it lies halfway between the two.

Thus, if Z is the rate observed for all Maine children, it is the extreme lower-bound of the status-quo rate for Maine’s low-income children, and the extreme upper bound of Y is Z/0.469. The midpoint between these bounds is $(Z + Z/0.469) / 2 = 1.566 \times Z$. In other words, the assumption is that the status-quo rate for Maine’s low-income children is 57% higher than the observed rate for all Maine children.³⁴ This assumption makes the effect of early education per young child in the proposed system

$$X - Y = 1.566 \times Z \times [(1 - \alpha)^{4.4} - 1].$$

The slightly different approach developed here has the important advantage of being based on the current situation in Maine.³⁵ Although Maine has many children from low-income families who are at risk of having a negative net fiscal impact during their lifetimes, few of Maine’s children are as at-risk as the children in the CPC study. Even though a high percentage of the children participating in the Maine program come from families with incomes as low as those in the CPC study, most of these

³³ Rates are not actually “observed” for Maine’s current young children, they are observed for Maine’s current older children and adults. It is implicitly assumed that the rates are not changing over time. Time trends in these rates examined here are likely to be sufficiently small that this assumption is unlikely to significantly affect the results.

³⁴ Another example may be helpful. Maine Department of Education data indicate that the state’s average high school incompleteness rate from 2007 to 2011 was 17.6%. Thus, the lower extreme bound for Y is 17.6%, the upper extreme bound is 37.5%, and the midpoint is 27.6%. By way of comparison, using the Karoly and Bigelow (2005) assumptions (i.e., 25% of young children in the state are as at-risk as the CPC children, 20% are half as at-risk, and the remaining 1.9% of children eligible for the program are one quarter as at-risk) would have made Y = 36.8% for the high school incompleteness rate, which is practically the extreme upper bound possible in Maine.

³⁵ The two modifications of the typical approach also ensure that estimated savings in various types of government spending cannot exceed the amounts currently being spent in Maine. Without these modifications, it would be possible for the estimated cost savings in, say, special education, to exceed Maine’s current spending level!

children do not attend schools with the same concentration of disadvantaged children. Moreover, this approach allows adjustment for the current situation in Maine to differ across the different effects (i.e., the adjustment differs between the rates of high school incompleteness, incarceration, special education, etc.)—a flexibility that the previous approach does not have. Thus, the differences between the context in CPC study and the current context in Maine do not necessarily be the same for all of the effects.

Five effects estimated from the CPC study are used to quantify the effects of early childhood investment in Maine and are reported in the first column of Table 3: use of child welfare services, placement in special education, grade repetition, petitions to juvenile courts, and high school incompleteness. The second column in Table 3 reports the current rates of these five effects for the general public in Maine (Z in the equations above). The third column shows estimates of the current rates for Maine children from low-income households targeted by the proposed program (Y). The last column shows the resulting estimated effect per young child in the proposed system (X – Y).

	Percentage Change in the CPC Study α	Current Rate in Maine Z	Estimated Status-Quo Rate Y	Estimated Effect of Proposed Change X - Y
Child Protective Services	43.1%	6.1%	9.6%	-8.8%
Years of Special Education	49.0%	15.8%	24.7%	-23.5%
Grade Repetition	40.1%	1.7%	2.7%	-2.4%
Juvenile Court Cases	42.3%	2.5%	3.9%	-3.6%
High School Incompletion	21.6%	17.6%	27.6%	-18.1%

EFFECT ON CHILD PROTECTIVE SERVICES

Reported instances of child abuse and/or neglect through age 17 was 17.4% for the control group, compared to 9.9% for CPC participants.³⁶ Participation in the preschool program evidently caused this measure of the use child protective services to decline by 43%.³⁷

In Maine, 6.1% of children had reports warranting protective services in 2009 and 2010.³⁸ Using the approach outlined earlier, the estimated status-quo rate for children eligible for the proposed system is

³⁶ Reynolds et al. (2011).

³⁷ The decline in out-of-home placements (another way to measure the use of child protective services) was 39%. The rate for the control group was 8.5% and the rate for the treatment group was 5.2%.

9.6%. The proposed early education system will reduce this rate by an estimated 8.8 percentage points (to 0.8%).

The cost of child welfare services per case in Maine is estimated to be \$8,109 (using 2010 data converted to September 2012 dollars).³⁹ Thus, **the estimated cost savings in child protective services, per child participating in the proposed early education system is \$714 per year from birth through age 17, or \$12,052 in total.**

EFFECT ON SPECIAL EDUCATION

Participants in the CPC program spent an average of 0.73 years in special education through age 18, compared to 1.43 years for the control group.⁴⁰ This is a 49% reduction.

Maine Department of Education data during the most recent four years (AY 2009 through AY 2012) indicate that 15.8% of Maine's students are in special education. Thus, the estimated status-quo rate for children eligible for the proposed system is 24.7%. The proposed system will reduce this rate by an estimated 23.5 percentage points (to 1.3%).

The average additional cost per student in special education in Maine averaged \$4,952 during academic years 2009-2011, according to data from the Maine Department of Education (after adjusting for inflation). Thus, **the estimated cost savings in special education per child participating in the proposed early education system is \$1,164 per year of K-12 education, or \$15,127 in total.**

Combining data from the National Center for Education Statistics with the Maine Department of Education data suggests that 80.6% of these savings will accrue to Maine's state and local governments.

EFFECT ON GRADE REPETITION

Participation in the CPC program evidently reduced grade retention by 40%: 38.4% of children in the control group repeated a grade, compared to 23% of program participants.⁴¹

Maine Department of Education data indicate that state's grade-retention rate is 1.7%.⁴² The estimated status-quo rate for grade retention is 2.7%, and the proposed system would reduce this rate by an estimated 2.4 percentage points.

Maine's average annual cost to educate each student was \$11,607, according to the Maine Department of Education (for academic years 2009-2011, adjusted for inflation). If each retained student repeats

³⁸ This was derived using data from Pronovost (2010), Giguere (2011), Berkowitz et al. (2012), and Maine State Planning Office (2010).

³⁹ This is derived using DeVooght et al.'s (2012) estimate of Maine's FY 2010 spending to address child abuse and neglect by the number of Maine children having reports warranting child protective services in 2010. The "cost of child protective services per case" should not be interpreted literally because the number of children having reports warranting child protective services is just one way to measure caseload.

⁴⁰ Reynolds et al. (2011).

⁴¹ Reynolds et al. (2011).

⁴² Unfortunately, these data are not recent. The 1.7% is the average over academic years 2000 through 2004, the latest data available. There was no indication at the time that the rate was rising or falling.

only one grade, **the estimated grade-repetition cost savings per child participating in the proposed system is \$279** (\$21 for each year of K-12). Because Maine’s rate of grade retention is so low, there is limited scope for cost savings in this category.

EFFECT ON JUVENILE CORRECTIONS

The number of petitions to a juvenile court was 0.78 per person in the control group, but only 0.45 per CPC participants.⁴³ Participation in the high-quality preschool program evidently reduced petitions to juvenile courts by 42%.

Maine’s average rate of juvenile petitions per youth (ages 10-17) is estimated to be 2.5%.⁴⁴ The estimated status-quo rate is 3.9%. The proposed investment in early education will reduce this rate by an estimated 3.6 percentage points.

The fiscal cost per juvenile petition in Maine is estimated to be \$10,886.⁴⁵ This is a conservative estimate, because it only includes the juvenile proportion of the cost of corrections in Maine;⁴⁶ the juvenile proportion of court and police costs could not be determined. **The estimated cost savings in juvenile corrections per participant in the proposed early education system is \$392 per year** from ages 10 through 17 (\$3,135 in total).

EFFECT ON HIGH SCHOOL INCOMPLETION

Participation in the CPC program evidently decreased the high school incompleteness rate by 22%. The rate of high school completion by age 21 was 61.9% for program participants, compared to 51.4% for children in the control group.⁴⁷

Maine Department of Education data from 2007 through 2011 indicate that the state’s high school graduation was 82.4%. The approach outlined earlier yields an estimated graduation rate of 72.4% for Maine’s children from low-income households. **A program of full-time early education from birth to kindergarten is estimated to increase the high school graduation rate for children from low-income families by approximately 18 percentage points, to 90.6%.**

⁴³ Reynolds et al. (2011).

⁴⁴ This estimate was derived using the number of juvenile petitions in 2007 through 2010 from Maine Statistical Analysis Center (2012) and the projected number of children within ages 10 to 17 during those years from Maine State Planning Office (2010).

⁴⁵ This “cost per juvenile petition” should not be interpreted literally. Juvenile petitions is used here as the measure use of the juvenile delinquency system. Thus, “cost per juvenile petition” really reflects cost per use of the juvenile detention system as measured by juvenile petitions.

⁴⁶ The juvenile proportion of correctional costs in Maine is derived from FY 2011 data in Office of Program Evaluation and Government Accountability (2012). This was adjusted for inflation and divided by the number of juvenile petitions in 2010 to get the cost per juvenile petition.

⁴⁷ Reynolds et al. (2002). The rate of high school/GED attainment at age 21 (as opposed to age 23 or age 26) was chosen to focus on regular high school diplomas. Average labor-market outcomes are noticeably higher for those earning regular diplomas than for GED recipients (see Heckman and LaFontaine, 2007).

EFFECTS IN ADULTHOOD

Because the CPC study currently has information only into early adulthood, adult outcomes (e.g., tax revenues, social insurance benefits, etc.) are inferred from this 18 percentage-point difference in high school attainment. This is standard practice in studies of this type.

The standard approach is to use the average difference between the incomes of high school dropouts and graduates to infer the differences in taxes paid and so forth. This study, however, incorporates some refinements to the approach developed in Trostel (2010a). In particular, individual-level data on taxes paid and social assistance received by Maine residents the 2008-2010 March Annual Social and Economic Supplement of the Current Population Survey (CPS) are used to estimate fiscal effects, rather than applying average tax rates to the average difference in income.⁴⁸ This also allows the fiscal effects to be estimated at each age, rather than imposing a constant effect at every adult age—a useful distinction because the differences between high school dropouts and graduates are not constant over their average lifecycles. In particular, the main reason that high school graduates earn more than dropouts is because their earnings grow at a faster rate during their work career, as opposed to earning more right from the start and remaining that way. Accounting for this affects the present values of the estimated effects and the calculation of the fiscal internal rate of return on investment in early education in Maine.⁴⁹

EFFECTS ON PARENTS

An important effect not measured in the CPC study is the effect on parents' ability to work because of the childcare services provided by the program. This effect could be particularly important because of the magnitude of the system proposed for Maine. The proposed system offers up to six hours of child care per day, year-round, from birth to kindergarten. This creates a substantial opportunity for increased work, and hence increased tax revenues and reduced public assistance.

Applying Bartik's (2006) analysis, which was based on a review of research on the effect of childcare costs on labor supply, to the proposed system suggests that it **will reduce the cost of child care by 47.6%, which will lead an increase in earnings of eligible parents of at least 9.5%.**

CPS data from 2008 through 2010 are used estimate the amounts of taxes paid and welfare received (in 2012 dollars) by families eligible for the proposed system (i.e., the 46.9% of lowest-income families in Maine with children under age five). These estimated amounts are assumed to change by 9.5% during the years of participation in the proposed system.

⁴⁸ Actually, the 2009-2011 CPS datasets are used, but they refer to data in the prior calendar years. The Public Use Microdata Sample of the American Community Survey is a much larger sample than the CPS but has less-detailed information on sources of income, particularly government transfers and taxes.

⁴⁹ The life-cycle paths of taxes and social assistance for high school dropouts and graduates are estimated from a fourth-order age polynomial (following Murphy and Welch, 1990). Although the CPS sample is large, it is not large enough to prevent some relatively large sampling variation in means at each year of age. The problem is particularly severe when restricting the sample to observations in Maine only. Thus, an age polynomial is used to capture life-cycle variation while smoothing the sampling variation.

VII. FISCAL BENEFITS OF HIGH-QUALITY EARLY EDUCATION

BIRTH THROUGH AGE 4

Table 4 shows the estimated annual fiscal effects per child participating in the proposed full-time, high-quality early education system in Maine at each age from birth to entry into kindergarten. The effects shown in this table are per child participating for at least one year (which, as discussed earlier, is assumed to be 90% of the eligible children). Although the additional public cost per toddler in the program is \$7,542, only 5/9ths of the children ultimately participating do so during their first year of life, thus the first-year cost is \$4,189 per ultimate participant. Similarly, the effects on parents' work are the lowest in the first year because this is the lowest year of participation in the system.

Table 4
Fiscal Effects per Child Participating in the Proposed Early Childhood System:
Birth through Age 4

Age	Percent Participating	Cost	Parental Taxes	Parental Public Assistance	Child Protective Services	Net Cost
0	50%	\$4,189	\$103	-\$370	-\$396	\$3,320
1	60%	\$5,028	\$123	-\$444	-\$476	\$3,984
2	70%	\$5,865	\$144	-\$518	-\$555	\$4,648
3	80%	\$5,239	\$164	-\$592	-\$634	\$3,848
4	90%	\$5,894	\$185	-\$667	-\$714	\$4,329
Total	90%	\$26,215	\$719	-\$2,592	-\$2,775	\$20,129

As noted previously, the cumulative gross public cost per participant is \$26,215. In present discounted value at birth using a 3% real discount rate the gross cost per participating child is \$24,630.

Parental taxes and public assistance. The childcare element of the proposed system allows parents to work more, pay more taxes, and rely less on public assistance. This offsets some of the up-front cost of the program. As Table 4 shows, public assistance (counting federal Earned Income Tax Credits as public assistance) declines by \$2,592 per participant over the five years. Tax revenues per participant increase by \$719 in total. Together, **these two fiscal benefits offset \$3,311 (12.6%) of the total upfront cost.** Almost one-third (\$1,043, or 31.5%) of this offset of initial cost accrues to the state government.

Savings in child protective services. Table 4 also shows the estimated reduction in spending on child protective services. For simplicity, this cost reduction is assumed to be evenly split at every age up to 17. But this understates the initial reduction in child welfare spending, because these services are most heavily concentrated on young children. Nonetheless, **the estimated cost saving is \$2,775 per child over the first five years.**

Adding everything together, **the net initial cost of the proposed system is \$20,129 per participating child** (an average of \$4,026 per year). In present value at birth using a 3% discount rate, the net initial cost per participating child is \$18,937. **The initial net cost is 76.8% of the gross cost.**

AGE 5 THROUGH AGE 17

The payback of the initial net investment begins in school age, and it is substantial. This is shown in Table 5 which reports the estimated annual fiscal effects per participating child at each school age. The estimated cost savings in just child protective services and special education together are more than the initial gross public cost of the proposed system. The initial public investment in the proposed high-quality early education system is recouped before the participating children reach high school.

Age	Child Protective Services	Special Education	Grade Repetition	Juvenile Corrections	Total Cost Savings
5	-\$714	-\$1,164	-\$21		-\$1,899
6	-\$714	-\$1,164	-\$21		-\$1,899
7	-\$714	-\$1,164	-\$21		-\$1,899
8	-\$714	-\$1,164	-\$21		-\$1,899
9	-\$714	-\$1,164	-\$21		-\$1,899
10	-\$714	-\$1,164	-\$21	-\$392	-\$2,291
11	-\$714	-\$1,164	-\$21	-\$392	-\$2,291
12	-\$714	-\$1,164	-\$21	-\$392	-\$2,291
13	-\$714	-\$1,164	-\$21	-\$392	-\$2,291
14	-\$714	-\$1,164	-\$21	-\$392	-\$2,291
15	-\$714	-\$1,164	-\$21	-\$392	-\$2,291
16	-\$714	-\$1,164	-\$21	-\$392	-\$2,291
17	-\$714	-\$1,164	\$2,079	-\$392	-\$190
Total	-\$9,277	-\$15,127	\$1,822	-\$3,135	-\$25,717

Savings in child protective services. Savings in child protective services continue during school years. **Total savings in child protective services from birth to adulthood \$12,052 per participant.** The present value of this cost savings is \$9,339 per participating child. The state government gets 65% of these cost savings.

Savings in special education. The largest estimated fiscal savings in Maine from investment in early childhood education is in reduced spending on special education. **Total special education savings per**

participant is an estimated **\$15,127** (\$10,995 in present value at birth). About 81% of this fiscal benefit goes to Maine state and local governments.⁵⁰

Mixed effects on remedial education and grade retention. Savings in K-12 education also occur because remedial education decreases as a consequence of early childhood education. The measurable part of this is less grade retention.⁵¹ As noted earlier, though, there does not appear to be much scope for significant cost savings for Maine in this category. **The total savings from grade retention is only \$279 per participant.** Moreover, early education also keeps more children enrolled through high school completion. The average dropout is assumed to occur at the end of the junior year, so the reduction in dropping out of high school creates one additional year of education (senior year). This creates an additional \$2,101 in costs per participant at age 17. Thus, **the cumulative net effect on regular K-12 education spending is an additional \$1,822 per child participating in the proposed early education system.**

Savings in juvenile corrections. The reduction in spending on juvenile corrections from age 10 through 17 is (conservatively) **\$3,135 per early education participant.**

The total fiscal effect during the K-12 years is \$25,717 in less government spending per participant. In present value at birth using a 3% discount rate, this amount is \$18,778. Most (76%) of the fiscal benefit during the school-age years is in state- and local-government spending.

ADULTHOOD

Table 6 reports the estimated fiscal effects adulthood per participant in the proposed early childhood education program.

Additional higher education costs. The proposed early education system will increase the proportion of young adults to college and thus will increase the public cost of higher education. This effect is calculated by multiplying the estimated 18.1-percentage-point difference in high school completion times the estimated college-going rate in Maine times the estimated public cost per college student. Matching the number of high school graduates in Spring 2011 reported by the Maine Department of Education with the number of college freshmen in Fall 2011 reported in the National Center for Education Statistics suggests that Maine's college going rate is 62.1%. State Higher Education Officers data indicates that Maine state support per full-time-equivalent student in FY 2011 was \$6,339. This figure is adjusted to account for Maine students in private institutions using data the National Center of Educations Statistics (because the college going rate is for both public and private institutions). Federal support for college students is primarily in Pell Grants. Unfortunately, the amount per FTE student (\$2,151 in FY 2012) is only reported for the whole country. In 2012 dollars, the estimated state and federal cost per FTE college student in Maine is \$6,446. Thus, the additional public cost of the additional college enrollment is \$681 annually per participant in the proposed early education system. This cost is assumed to occur during the first four years after graduation. Although many college students do not obtain a bachelor's degree, many students also go further than a bachelor's degree.

⁵⁰ The 19% federal share of special education costs in Maine was derived by merging FY 2010 data from the Maine Department of Education and from the National Center for Education Statistics.

⁵¹ As briefly discussed earlier, some studies of this type estimate the value of the reductions in disruptive student behavior and hence teacher turnover (e.g., Belfield, 2004, 2005, 2006a, 2006b, and 2008). There is little evidence to try to quantify this effect in Maine, though.

Table 6, Page 1

Fiscal Effects per Child Participating in the Proposed Early Childhood System:

Adulthood

Age	Higher Education	State Income Taxes	Property Taxes	Sales Taxes	Federal Income Taxes	Payroll Taxes
:	:	:	:	:	:	:
18	\$725	\$14	-\$459	\$62	\$105	\$51
19	\$725	\$24	-\$146	\$67	\$105	\$69
20	\$725	\$34	\$125	\$72	\$110	\$86
21	\$725	\$46	\$357	\$76	\$120	\$103
22		\$58	\$553	\$80	\$134	\$119
23		\$71	\$717	\$83	\$151	\$133
24		\$85	\$851	\$86	\$172	\$148
25		\$99	\$957	\$89	\$195	\$161
26		\$113	\$1,039	\$91	\$222	\$174
27		\$127	\$1,099	\$94	\$250	\$186
28		\$141	\$1,140	\$96	\$280	\$197
29		\$156	\$1,163	\$97	\$311	\$208
30		\$170	\$1,171	\$99	\$344	\$218
31		\$184	\$1,166	\$101	\$377	\$227
32		\$198	\$1,150	\$102	\$411	\$236
33		\$211	\$1,125	\$103	\$445	\$245
34		\$224	\$1,092	\$105	\$479	\$253
35		\$236	\$1,054	\$106	\$513	\$260
36		\$248	\$1,011	\$107	\$546	\$267
37		\$259	\$966	\$108	\$579	\$273
38		\$270	\$919	\$109	\$610	\$279
39		\$279	\$872	\$110	\$640	\$285
40		\$288	\$825	\$110	\$669	\$289
41		\$297	\$781	\$111	\$696	\$294
42		\$304	\$739	\$112	\$721	\$298
43		\$310	\$701	\$112	\$745	\$301
44		\$316	\$667	\$113	\$766	\$304
45		\$320	\$637	\$114	\$785	\$307
47		\$324	\$613	\$114	\$802	\$308
:		:	:	:	:	:
Total	\$2,898	\$12,773	\$6,973	\$5,908	\$32,649	\$13,038
Present Value	\$1,629	\$3,199	\$1,904	\$1,678	\$7,971	\$3,555

Table 6, Page 2

Fiscal Effects per Child Participating in the Proposed Early Childhood System:

Adulthood

Age	Social Security Benefits	Medicare	Medicaid	Public Assistance	Supplemental Security Income	Disability Benefits
:	:	:	:	:	:	:
18			-\$235	-\$224	-\$18	-\$6
19			-\$217	-\$267	-\$76	-\$8
20			-\$201	-\$303	-\$134	-\$9
21			-\$186	-\$333	-\$191	-\$10
22			-\$173	-\$358	-\$247	-\$11
23			-\$161	-\$378	-\$302	-\$12
24			-\$149	-\$393	-\$355	-\$12
25			-\$140	-\$403	-\$407	-\$12
26			-\$131	-\$410	-\$458	-\$12
27			-\$123	-\$413	-\$507	-\$11
28			-\$115	-\$412	-\$553	-\$10
29			-\$109	-\$409	-\$598	-\$10
30			-\$104	-\$402	-\$640	-\$9
31			-\$99	-\$394	-\$681	-\$8
32			-\$95	-\$383	-\$718	-\$7
33			-\$91	-\$371	-\$754	-\$6
34			-\$88	-\$357	-\$786	-\$5
35			-\$86	-\$342	-\$816	-\$4
36			-\$83	-\$326	-\$843	-\$4
37			-\$82	-\$309	-\$867	-\$3
38			-\$80	-\$292	-\$889	-\$2
39			-\$79	-\$274	-\$907	-\$2
40			-\$79	-\$256	-\$923	-\$1
41			-\$78	-\$238	-\$936	-\$1
42			-\$78	-\$220	-\$945	-\$1
43			-\$77	-\$203	-\$952	-\$1
44			-\$77	-\$186	-\$956	-\$1
45			-\$77	-\$170	-\$957	-\$1
47			-\$77	-\$154	-\$955	-\$2
:		:	:	:	:	:
Total	\$212	\$2,665	-\$5,610	-\$11,751	-\$6,502	-\$482
Present Value	-\$9	\$236	-\$2,109	-\$4,355	-\$1,759	-\$135

Table 6, Page 3

Fiscal Effects per Child Participating in the Proposed Early Childhood System:

Adulthood

Age	Unemployment Compensation	Worker's Compensation	Corrections	Public Healthcare Costs	Total Fiscal Benefit
:	:	:	:	:	:
18	\$78	-\$2	-\$48	\$5	-\$503
19	\$70	-\$1	-\$48	\$0	-\$59
20	\$58	-\$1	-\$48	-\$4	\$345
21	\$44	\$0	-\$48	-\$9	\$710
22	\$29	\$1	-\$48	-\$13	\$1,763
23	\$12	\$2	-\$48	-\$16	\$2,058
24	-\$7	\$3	-\$48	-\$19	\$2,321
25	-\$26	\$3	-\$48	-\$20	\$2,553
26	-\$45	\$4	-\$48	-\$21	\$2,758
27	-\$65	\$5	-\$48	-\$22	\$2,937
28	-\$85	\$6	-\$48	-\$22	\$3,093
29	-\$104	\$7	-\$48	-\$21	\$3,226
30	-\$123	\$8	-\$48	-\$20	\$3,340
31	-\$140	\$8	-\$48	-\$20	\$3,436
32	-\$157	\$9	-\$48	-\$19	\$3,515
33	-\$172	\$10	-\$48	-\$18	\$3,579
34	-\$186	\$10	-\$48	-\$17	\$3,630
35	-\$199	\$11	-\$48	-\$16	\$3,668
36	-\$209	\$12	-\$48	-\$15	\$3,696
37	-\$218	\$12	-\$48	-\$15	\$3,714
38	-\$225	\$12	-\$48	-\$14	\$3,724
39	-\$229	\$13	-\$48	-\$14	\$3,727
40	-\$232	\$13	-\$48	-\$14	\$3,723
41	-\$232	\$13	-\$48	-\$15	\$3,713
42	-\$230	\$13	-\$48	-\$15	\$3,698
43	-\$226	\$13	-\$48	-\$16	\$3,680
44	-\$220	\$13	-\$48	-\$17	\$3,658
45	-\$212	\$13	-\$48	-\$18	\$3,632
47	-\$201	\$12	-\$48	-\$19	\$3,604
:	:	:	:	:	:
Total	-\$69	\$189	-\$2,951	-\$826	\$93,568
Present Value	-\$125	\$78	-\$806	-\$248	\$25,908

These

effects are assumed to offset.⁵² **The total increase in government cost of higher education is \$2,898 per participant in the early childhood education system.** In present value at birth, this is \$1,629. Two thirds of this cost increase is to the state government.

Increased tax revenues. State income taxes paid in adulthood are estimated to increase by \$12,773 per early education participant. Property taxes increase by \$6,973 over the lifetime of each participant. Lifetime sales tax revenues increase by \$5,908 per participant. Thus, **total state and local tax revenues in Maine increase by \$25,654 per child participating in the proposed early education system.** This occurs well into the future, though. In present value at birth using a 3% real discount rate, this amount is \$6,781.

The increase in federal income tax revenues is the largest single undiscounted fiscal benefit from the early childhood education system. **Federal income taxes are estimated to increase by \$32,649 per participant.** In present value this amount is \$7,971, which is less than the present value of the decreases in spending on special education and child protective services. **Federal payroll taxes increase by \$13,038 for each participant** (\$3,555 in present value).

Additional Social Security and Medicare Costs. Estimated Social Security retirement benefits and Medicare are slightly higher for Maine high school dropouts than for high school graduates, because dropouts retire earlier than graduates, and the data do not account for the shorter life expectancies of dropouts. The total additional cost of Social Security and Medicare per early education participant is estimated to be \$2,876, but this is only \$226 in present value.

Savings in public assistance. The early childhood education system is estimated to have a significant impact on the receipt of Medicaid and public assistance. **The lifetime reduction in Medicaid and measured public assistance together is \$17,360 per participant** (\$6,464 in present value). Moreover, this is a conservative estimate because not all public assistance is measured in the data. There is also a significant effect on the receipt of Supplemental Security Income. **The lifetime effect on Supplemental Security Income is \$6,502 per participant in the proposed early education system** (\$1,759 in present value).

Other social insurance programs. The effects on other social insurance programs are small. The estimated effects on disability, unemployment compensation, and worker's compensation (an "off-budget" form of government spending) are negligible.

Savings in corrections. Data presented in Harlow (2003) indicate that, nationally, high school graduates are 28% less likely to be incarcerated than high school dropouts. The incarceration rate of those with at least a high school diploma is 1.39%, compared to 1.91% for those without a diploma. To calculate the fiscal effect in corrections the 0.53 percentage-point difference by the 18.1 percentage-point difference in high school graduation times the cost per prison inmate. Fiscal Year 2011 data in Office of Program Evaluation and Government Accountability (2012) indicate that Maine's annual cost per inmate is \$51,649 (in 2012 dollars). Schmitt et al. (2010) estimate the federal cost per inmate to be \$28,070 (in current dollars). The resulting **lifetime effect of early education on corrections cost is estimated to be \$2,951 per participant** (\$806 in present value). The resulting lifetime effect of early

⁵² Comparing total FTE enrollment in Maine public colleges to freshman FTE enrollment suggests that this is a reasonable assumption.

education on corrections cost is estimated to be \$2,951 per participant (\$806 in present value). Only 4% of this effect is on the federal budget. This fiscal effect errs on the conservative side, because it does not include any savings in police and court costs.

Savings in public health care. Hadley and Holahan (2003) estimate that, nationally, each uninsured person imposes an annual cost of \$980 on public budgets (in current dollars). The difference in the lack of health insurance between high school graduates and dropouts in Maine is estimated using CPS data. The resulting **lifetime fiscal saving from participants in the proposed early education program being more likely to have health insurance is \$826 each**. Most (65%) of this fiscal benefit is at the federal level.

LIFETIME

The cumulative net fiscal effect over an average participant’s lifetime is illustrated in Figure 1. **The initial public investment is fully recovered before age 14.** Even when applying a 3% real discount rate, fiscal break-even is just after age 16. In terms of just the net fiscal effects in Maine, the (undiscounted) public investment is fully recovered before age 35.

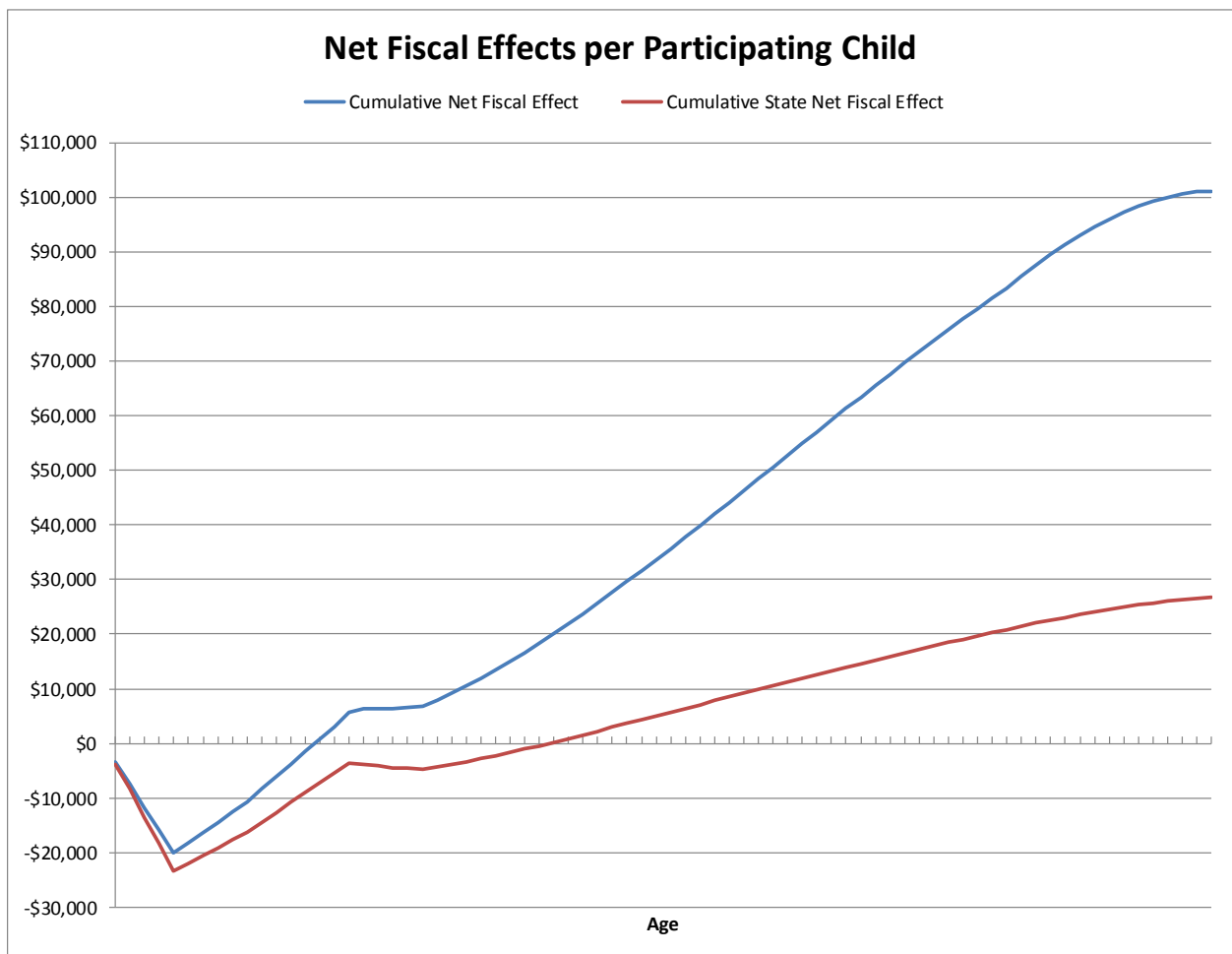


Table 7 summarizes the lifetime fiscal effects per participant in the proposed suggestive early childhood education system. As noted earlier, the gross public cost per child is \$26,215. **The cumulative lifetime effect on government taxes and spending per child program is \$125,371.** Of this, \$53,245 accrues to Maine state and local governments, and \$72,126 goes to the federal government. **The fiscal benefit/cost ratio is, conservatively, 4.78 to 1.** Despite the generously estimated cost of the upfront investment, the return is 4.8 times higher. **The total net fiscal payoff per child is \$98,156.** In present discounted value at birth using a 3% real discount rate, the total fiscal benefit is \$50,380 (\$25,082 to Maine state and local governments). In present value the fiscal benefits are 2.05 times greater than the initial investment. The net fiscal payoff per child in present value is \$25,749. In other words, **even after discounting the benefits, the government makes almost \$26,000 for each child placed into the proposed high-quality early education system.** Even after taking the time value of money into account, even when focusing narrowly on just the fiscal effects, and even with the substantial scale of the proposed system and estimating these costs generously, investment in early childhood education more than pays for itself.

	Initial Cost	Total Fiscal Benefit	State Fiscal Benefit	Net Fiscal Benefit	Net State Fiscal Benefit
Total	\$26,215	\$125,371	\$53,245	\$99,156	\$27,030
Present Value	\$24,630	\$50,380	\$25,082	\$25,749	\$452
Undiscounted Benefit/Cost		4.78	2.03		
Discounted Benefit/Cost		2.05	1.02		
Internal Rate of Return		7.49%	3.11%		

The real fiscal internal rate of return (i.e., the discount rate that makes the net present value equal to zero) on investment in early childhood education is estimated to be 7.49% in the long run. The real internal rate of return to Maine exclusively is 3.11%.

It is worth keeping in mind that these are not the estimated effects for a specific policy recommendation. They are long-run estimates for a suggestive generic system of early childhood education and care targeted toward children from families with relatively low incomes. A specific proposal will have to deal with several important issues neglected in this analysis. For instance, it is very likely that a major policy change would have to be implemented gradually over time. If nothing else, the qualified workforce and infrastructure required to achieve a substantial increase in early childhood education would have to be developed and could not happen immediately. The long-run estimates

presented above are for a fully phased-in program. Similarly, the suggestive comparison case examined in this study does not go into the specifics about the form of the increased investment in early childhood development. This will clearly involve some difficult, and possibly contentious, decisions. Several particularly difficult decisions about how to best target the program toward at-risk children will have to be addressed (indeed, the first of these difficult decisions is if targeting is actually desirable, all things considered). This study also does not address how the initial investment will be financed, which is obviously a huge hurdle in the current budgetary climate. Overcoming this obstacle may require some sort of partnership between state government, local governments, philanthropic organizations, and businesses. The “public cost” calculated above does not necessarily have to be financed exclusively by taxpayers. Hopefully this report examining the effects of a suggestive high-quality early education system will contribute to the development of a specific proposal for Maine that successfully addresses these and other issues.

VIII. OTHER IMPORTANT BENEFITS OF HIGH-QUALITY EARLY EDUCATION

An investment with a 7.5% real rate of return is a great deal. Indeed, an investment with a 3.1% real rate of return to the state is a very good deal. But neither of these estimates is the payoff to Maine from investing in high-quality early childhood education. The fiscal payoff is only a small part of the total payoff. The primary reason for public support of early childhood development is to provide opportunities for success in life for the children in our communities. Presumably this is why Maine taxpayers already spend more than \$2 billion annually on public K-12 education. Doing the most that we can to put our children on paths to successful, healthy, and fulfilling lives is a moral duty gladly accepted by adults who care about our world. That it also makes fiscal sense is just icing on the cake. This study estimated just the cake icing from investing in early care and education. The total payoff to the early education cake is several times larger than just the icing reported here.

This report focused narrowly on the fiscal effects from investment in early childhood development for two reasons. First, estimating the total return is a much more ambitious undertaking. Just the narrow focus is probably more than sufficiently difficult. Second, and more importantly, the fiscal focus allows us to squarely address the popular notion that investment in high-quality early childhood education is too costly for Maine right now. This report shows that this notion is short-sighted. *Not investing* in early education is what is truly costly.

This report would be incomplete, however, if it did not at least briefly summarize many of the other important payoffs of high-quality early education. These non-fiscal returns fall into two categories: benefits to the participants and their families (i.e., private benefits), and benefits to everyone else (i.e., external benefits).⁵³

PRIVATE BENEFITS

Increased income for parents. As noted earlier, the proposed system is expected to reduce the cost of childcare for low-income Maine parents by about 48%. In addition to the direct value to parents, this allows many of them to work and earn more (which also increases the workforce available to businesses

⁵³ See Karoly et al. (2005) for a good summary of these effects.

in Maine). Using the approach discussed earlier, **the average increase in income for eligible Maine parents is estimated to be \$782 per year.**

Reduced parenting stress. Parents benefit when their children have fewer academic troubles (such as being placed in special education) and engage in fewer dangerous, unhealthy, and illegal behaviors (and sometimes ending up in juvenile court). Although this report cannot assign a dollar value to these benefits to parents, they are almost certainly much more important than the value of the childcare received.

This report also cannot assign a dollar value to the impact that high-quality early education has on the lives of the participants. Putting more children on a trajectory toward happier, healthier, even longer lives⁵⁴ is the *raison d'être* for early childhood education. Some of the benefits to the participants can be measured, though.

Increased academic benefits for participants. Children participating in high-quality preschool programs are better prepared to start school, and thus get more out of their schooling experiences. The brain stimulation in formative years evidently causes participants to begin education with significantly higher cognitive abilities (typically measured by IQ scores and/or scores on similar tests), although much of this effect appears to “fade out” within a few years.⁵⁵ This fade-out effect initially led many to believe that programs such as Head Start are ineffective, but the issue appears to be more nuanced than first thought. Although the effect on IQ scores appears to fade out over time, the effects on academic tests and performance evidently do not. For example, participation in high-quality preschool leads to significantly better performance on math and reading tests in adolescence⁵⁶ and problem-solving tests in adulthood.⁵⁷ The apparent inconsistency in these effects has led scholars to conclude that a crucial aspect of early childhood education is the development of non-cognitive abilities such as motivation, perseverance, responsibility, social skills, and so forth.⁵⁸

Reduced involvement in the child welfare and justice systems. Disadvantaged children participating in high-quality early education programs with parental interaction benefit from fewer placements in foster care and adoption.⁵⁹ On average, participants also have less trouble with the law as juveniles and as adults.⁶⁰ The estimated fiscal savings from these effects estimated are large, but they are probably almost trivial in comparison to the value of the reduction in emotional (and sometimes physical) suffering.

Reduced harmful behaviors. Children participating in high-quality preschool programs are less likely to engage in dangerous and harmful behaviors such as underage drinking, drug abuse, smoking, crime, and unprotected sex.⁶¹ On average, participants also have healthier lives (including mental health)

⁵⁴ For evidence that participation in high-quality early education significantly increases life expectancy see, e.g., Nores et al. (2005) or Belfield et al. (2006).

⁵⁵ See, for example, Barnett (1995).

⁵⁶ Campbell et al. (2002) and Reynolds et al. (2002).

⁵⁷ Schweinhart et al. (2005).

⁵⁸ See, e.g., Heckman (2000) and Cunha and Heckman (2007).

⁵⁹ Reynolds et al. (2007).

⁶⁰ Reynolds et al. (2007).

⁶¹ Nores et al. (2005), Barnett and Masse (2007), and Reynolds et al. (2007).

during childhood and adulthood.⁶² These are reasons why high-quality early education for at-risk children increases their life expectancies.

Increased educational attainment and income. As discussed earlier at length, participation in high-quality early education increases ultimate education attainment (i.e., the high school graduation among participating Maine children is estimated to increase by 18.1 percentage points). In addition to the direct value of more education, this also leads to substantially greater income. Following the approach used earlier, lifetime income (cash income from all sources, including cash welfare benefits, Social Security, etc.) for Maine high school graduates is estimated to be twice that of Maine high school dropouts (\$2.30 million versus \$1.14 million). Thus, **the increase in lifetime earnings per early education participant is \$210,163.** The present value of the estimated increase in lifetime earnings per participating child (at birth, using a 3% discount rate) is \$53,648, which is 2.2 times larger than the initial gross public cost. The income payoff to participants in the proposed early education system, by itself, is 1.7 times greater than the total fiscal benefit estimated earlier, and 8.0 times greater than the gross public cost of the program. **The real internal rate of return on the initial gross public investment of \$24,630 per child, just in terms of the effect on lifetime income of the participants, is 5.1%.**⁶³ In other words, even if our only rationale for providing high-quality early education was to increase the incomes of the children when they grow up, it is a very good investment.

Higher employment. Part of the participants' additional earnings in adulthood comes from increased participation in the labor market. Maine high school dropouts are estimated to be twice as likely to be out of the work force as high school graduates (45.8% compared to 22.6%). **Participation in the high-quality early childhood education system is estimated to reduce nonparticipation in the labor force by 4.2 percentage points** in the long run. Similarly, the unemployment rate of Maine high school dropouts was 3.1 times higher than the rate for high school graduates in 2008 through 2010. Because of this, **the unemployment rate of participants is estimated to be 3.0 percentage points lower because of the change in their trajectories before kindergarten.**

Improved health. Maine high school graduates are healthier than high school dropouts. Among Mainers in the 2008-2010 CPS from age of 19 to 66, 63.3% of high school graduates report their health to be very good or excellent, twice the 36.2% proportion for high school dropouts. This suggests that **participation in the proposed high-quality early education program will raise the likelihood of reporting health to be at least very good by 4.9 percentage points.** Moreover, the effect on disabilities appears to be even more pronounced. Among Maine high school dropouts, 31.9% report that health or disability limits their ability to work, which is almost three times higher than the 11.2% reported by high

⁶² Nores et al. (2005) and Reynolds, et al. (2011).

⁶³ It might be tempting to infer a rough idea of the total return to investment in early childhood education by adding the fiscal internal rate of return estimated earlier (7.5%) to this internal rate of return from the participants' income, but rates of return cannot be added in this way. Although benefit/cost ratios are additive, rates of return are not. Adding the additional income of about \$210,000 to the total fiscal benefit of about \$125,000 would yield a combined benefit/cost ratio of 12.8 (= 4.8 + 8.0), but the combined internal rate of return would be 10.1% (< 7.5% + 5.1%). Moreover, these fiscal and private benefits should not really be added because they are not independent of each other. That is, the greater income is what creates the greater tax revenues, so adding these benefits would create some double counting. But on the other hand, public-assistance and social-insurance benefits are included in income, so adding the estimated fiscal benefits to the estimated income benefits would also create some counter counting. Thus, without further investigation, it is unclear if the sum of the two benefits is overstated or understated.

school graduates. **Participation in the early childhood education program is estimated to reduce the long-run probability of reporting a work disability by 3.8 percentage points.**

Increased likelihood of having health insurance. In addition to being healthier as adults, participants in the early education system will be more likely to have health insurance when they grow up. To be specific, **participation in the proposed high-quality system is estimated to increase the likelihood of having health insurance as adult by 1.6 percentage points.**

Decreased likelihood of incarceration. As reported earlier, participants in the early education system will be likely to end up in jail or prison as adults. Although the estimated effect is only 0.1 percentage point, this is a 13.1% reduction in the likelihood of adult incarceration.

Intergenerational effects. The children of early learning participants will generally perform better in school and have greater education attainment and better life outcomes, on average, than the children of comparable nonparticipants. In other words, the compounding effect discussed earlier continues across generations.

EXTERNAL BENEFITS

Reduced crime. As discussed in the review of the previous research, the value of the reduction in crime is a huge benefit to society from high-quality early childhood education for disadvantaged children. Indirectly reducing the tangible and intangible harm to victims of crime by changing the life trajectories of at-risk children could be worth as much as the total fiscal benefits, possibly even more.⁶⁴

Increased productivity. More productive workers increase the productivity of their co-workers.⁶⁵ Thus, the increase in aggregate productivity and income from investment in high-quality early education is greater than the increase in participants' income estimated earlier.

A final observation, albeit one unquantified by this or any other study, is that communities with less socioeconomic disparities, less poverty, and greater self-sufficiency are simply nicer places to live.

IX. WHAT'S STOPPING US?

Research on the effects of high-quality early care and education for disadvantaged children demonstrates a substantial return on investment. Although more research improving the precision of the estimates would certainly be useful, it is overwhelmingly clear that the investments are more than worthwhile. Changing the development trajectories of at-risk young children not only significantly improves their prospects for successful lives; it creates substantial benefits for the rest of society. **Creating more equal opportunities for successful lives is not only morally right; the overall return to society from investment in early learning is essentially a windfall profit.** If targeted investments in early childhood development were private investments, capitalists would have scooped up these windfall-profit opportunities long ago. Tragically, investments in our most precious asset, our children, frequently do not occur.

⁶⁴ See Belfield et al. (2006) and Reynolds et al. (2011).

⁶⁵ See, for example, Acemoglu and Angrist (2000), Moretti (2004), and Mas and Moretti (2009) for evidence of this effect.

Like all investments, the costs of early childhood programs have to be borne up front, and the benefits accrue later. This initial cost is often seen as the greatest obstacle to doing more to ensure better starts for Maine children. The initial cost, however, is not the primary barrier to taking better advantage of these windfall-profit opportunities. No matter how tight budgets get, we still manage to fund other important investments, such as K-12 and higher education, road maintenance, and so forth. **The real issue is that most people are unaware of the strong link between early childhood experiences and later life outcomes.**

If we do not maintain our roads, for example, we see and feel big potholes to remind us that something needs to be done. Under-investing in high-quality early childhood education also creates figurative big potholes (more spending on special education, more spending on police and corrections, more drug and crime problems, and so on), but the difference is that we are generally unaware that our failure to invest adequately in our young children is a major cause of these “potholes,” and that something needs to be done to prevent them.

Lee Hansen, an economist at the University of Wisconsin, used to joke to his graduate students that “if you can’t measure it, it doesn’t exist.”⁶⁶ Unfortunately, there is more than a grain of truth in that line. We do not readily perceive the benefits of early childhood education, so in some policy discussions they might as well not exist. Consequently, too much of our spending goes to very costly Band-Aids (special education, corrections, welfare, etc.) rather than relatively inexpensive prevention. Given the magnitudes of the costs of remediation programs, prevention needs only to have small effects to produce big savings.

The large net benefits of early childhood education are not readily perceived for two primary reasons. First, **the hazards of inadequate development during early childhood are latent;** they don’t appear until much later in life. If the same hazards (e.g., the increased probabilities of incarceration, drug abuse, unprotected sex, etc.) were immediately apparent—such as say, the effects of providing alcohol to minors—they almost certainly would be illegal.

Second, **there is no explicit exchange of dollars when the latent effects occur.** Thus, the subsequent effects on spending in K-12 education and incarceration, for example, will not show up in an accounting line labeled “effects of investment in early education.” But this does not make the effects any more hypothetical or any less real than if actual dollars were exchanged every time a child is prevented from having to spend a year in special education.

More research quantifying these difficult-to-measure effects would help us to better comprehend the consequences of early childhood experiences, but we typically are preoccupied with easy-to-measure monetary transactions. This preoccupation with easily measurable things leads to all sorts of economically inefficient policies.

It is ironic that the typical argument against devoting more resources to early childhood development is its cost, since it would actually reduce total government spending. The argument that current economic constraints put greater investment in early childhood education out of reach is equally unsatisfying. Budgets are always tight. If we cannot afford to invest in our children now, then when? “Not now” often means “never.” Moreover, if the debate comes down to just cost, then *not* making

⁶⁶ This is a more succinct version of Daniel Yankelovich’s “McNamara’s Fallacy”.

these investments is the more costly option. Failing to seize the windfall-profit opportunities offered by investments in high-quality early childhood education means greater costs for K-12 education, crime prevention, incarceration, welfare spending, etc.; as well as missed opportunities for putting Maine children on paths to success.

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