The Economic Returns to Early Childhood Education

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Summary

One way to assess the value of preschool education programs is to compare their upfront costs with the economic benefits they produce, measured by such outcomes as less need for special education services, improved high school graduation rates, higher earnings and less criminal activity in adulthood, and so on. What do such benefit-cost analyses tell us about the wisdom of investing in greater access to preschool? In this article, Lynn Karoly carefully reviews the evidence.

First, she identifies the biggest challenges in measuring the economic returns from preschool programs. Then she summarizes the range of estimates from various benefit-cost analyses and some of the methodological differences that can account for the differences among them. Last, she explores the implications of the research for using benefit-cost analysis results to make policy decisions about preschool education.

One key challenge: Although many preschool programs have been evaluated for their educational effectiveness, few have been subject to economic evaluations. Most predictive studies of preschool education's long-term economic benefits rely on benefit-cost analyses of programs that were implemented decades ago, when a far smaller proportion of children attended preschool at all, and that followed their subjects well into adult life. Although analyses of those programs suggest returns from preschool as high as $17 for every dollar invested, Karoly concludes that in today's context, it may be more realistic to expect returns in the range of $3 to $4.

In the end, Karoly writes, we need to improve the quality and usefulness of economic evaluations of preschool, particularly by calculating the true economic value of preschool programs' short-term and medium-term effects in areas such as cognitive, social-emotional, and behavioral development. We could then more easily evaluate the economic benefits of a preschool program without having to wait until the participating children grow to adulthood.

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The case for investing in publicly funded preschool programs rests on a foundation of rigorous program evaluations that demonstrate favorable short- and longer-term effects from high-quality early learning programs.[1] That evidence is reinforced by economic evaluations—particularly benefit-cost analyses—that quantify the positive economic returns from such investments to the public sector and to society as a whole.[2] Both types of evidence—program evaluations and economic evaluations—have gained currency in a policy climate that stresses results-based accountability at all levels of government and prioritizes spending for evidence-based programs.[3] Policy makers want evidence that resources invested in early childhood programs and other areas of social policy can produce downstream benefits for students, the public sector, and society as a whole that can pay back the cost of the investment.

As a decision-making tool, benefit-cost analysis allows policy makers in the public and private sectors to compare the economic value of the resources invested in a high-quality preschool program with the economic value associated with that program's effects on children's outcomes. Among these outcomes are school readiness, use of special education, rates of grade repetition, likelihood of high school graduation, employment rates, and earnings. Other outcomes include levels of social and economic problems in adolescence and adulthood, such as delinquency and crime, teenage pregnancy, and dependence on welfare.

Researchers have applied benefit-cost analysis and other related economic evaluation methods (such as cost-effectiveness analysis) to preschool programs for more than 40 years. When the age-19 follow-up results from the Perry Preschool Project were published in 1984, evaluators made a case that the program's two-year price tag—$9,289 per child, measured in 1981 dollars—was more than offset by the $33,058 per child in benefits to society (where future benefits were discounted). Thus, the estimated return to society was nearly $4 for every dollar spent on the program. According to the results, Perry Preschool reduced the cost of K–12 education, raised lifetime earnings, lowered lifetime welfare use, and reduced lifetime costs from crime and delinquency.[4] (See the introductory article in this issue for a description of Perry Preschool and other programs discussed here.)

In reports that support expanded access to high-quality preschool and other early care and education programs, especially for children from low-income backgrounds who otherwise lack access to such programs, leaders in business and the military have cited benefit-cost analyses that suggest returns as high as $17 for every dollar invested.[5] During his 2013 State of the Union address, President Obama called for making high-quality preschool available to every child in the United States, citing an expected return of more than seven to one from his proposed federal investment.[6]

In this article, I focus on evidence from benefit-cost analyses of preschool programs. I define these as part- or full-day early learning programs that serve children in center-based settings, delivered by public or private providers for one or two years before the children enter kindergarten. This scope includes both universal programs and those targeting at-risk children. The programs

may be implemented on a national scale (such as Head Start), within a state or locality (for example, Oklahoma's universal preschool program), or as a small-scale demonstration program like Perry Preschool.

I also consider preschool programs that extend to the elementary grades, known as P–3 programs—for example, the Chicago Child-Parent Centers (CPC) program. And I reference findings from an economic analysis of the Abecedarian program—which was not strictly a preschool program, but rather an early intervention program serving low-income children from birth to age five with full-day year-round care and early learning. In addition to economic evaluations of existing programs, I also consider evidence from *prospective* benefit-cost analyses, which predict future economic returns from implementing targeted or universal programs on a larger scale.

To make this type of economic evidence more useful as part of the preschool policy debate, I set three goals: first, to identify the key challenges in measuring the economic returns from preschool programs; second, to summarize the range of estimates available from various benefit-cost analyses and some of the methodological differences that can account for the differences among them; and third, to explore the implications of the research on preschool-program impacts and economic returns, both for future research and for using benefit-cost analysis results to make policy decisions.

Challenges in Measuring Economic Returns for Preschool Programs

Performing a benefit-cost analysis of a preschool program can be complex. However, some of the requirements are relatively straightforward. We need:

1. A well-defined program and clearly specified counterfactual condition (that is, what the preschool program is being compared to).

2. A comprehensive estimate of the program's cost relative to the counterfactual condition.

3. An evaluation that provides estimates of the program's causal impact, in the short term and possibly in the longer run, on outcomes for the participating children (and perhaps other beneficiaries, such as parents) relative to the counterfactual condition.

4. An economic value—a market price or, if that's not available, a shadow price that captures the economic value—to attach to each affected outcome, representing what society is willing to pay for that outcome.

Several other parameters must be established for a benefit-cost analysis, such as the time period over which costs and benefits will be measured, and the rate for discounting costs and benefits that occur in the future into present-value dollars.[7] The analysis is typically performed from a societal perspective, which means that all costs and benefits are accounted for. That would include costs and benefits that accrue both to the public sector (federal, state, and local government) and to the program participants themselves, as well as any private benefits that flow to the rest of society (for example, the private gains from crime reduction).

With these elements in place, the analyst calculates the present discounted value (PDV) of the program costs and the PDV of the stream of outcomes that occur over time, with outcomes valued in dollars using market or shadow prices. The PDV of the outcomes

(benefits) minus the PDV of the program costs gives us the net present value (NPV). If the NPV exceeds zero, or if the benefit-cost ratio (PDV benefits divided by PDV cost) exceeds one, then the program has a positive return. (The PDV of a stream of dollar values to be realized in the future is calculated using a discount rate to convert future dollars into current dollars, recognizing that a dollar will be worth less in the future than a dollar today. A typical discount rate for benefit-cost analyses of social programs falls in the range of 3 to 4 percent. If, for example, a preschool program delivered in 2016 saves $1,000 in special education costs 10 years in the future, that benefit is valued, using a 3 percent discount rate, at $744 in 2016 dollars. This is the equivalent of compound interest in reverse.)

It's hard to put a price on many of the outcomes we measure.

Researchers face a number of challenges when using benefit-cost analysis to evaluate a preschool program. Four issues stand out. The first is that it's hard to put a price on many of the outcomes we measure. The short-term outcomes typically measured in preschool evaluations capture children's developmental readiness in various domains: pre-reading skills, language and literacy skills, pre-math skills, and social and emotional skills, among others. These outcomes don't have a clear dollar value, a fact that may preclude conducting a benefit-cost analysis of a program that hasn't followed the participants (and nonparticipants) past the point when they entered school.

If the program evaluation does extend the follow-up period into the elementary grades (through surveys or direct observation, or by linking to school records), we can measure other outcomes such as grade repetition and use of special education. These may be valued in the benefit-cost analysis based on their cost to the education system. But again, it's hard to put a dollar value on measured impacts on student achievement (for example, test scores or grades).

Extending the evaluation period beyond the elementary grades may capture outcomes during the adolescent years, such as crime, delinquency, and eventually dropping out of high school versus graduating. It's easier to put a price on those kinds of outcomes. And when we follow participants into the adult years, we can evaluate behavior in the labor market, health behaviors, and other economic and social behaviors (such as financial savings and home ownership, substance use, marriage and childbearing, welfare use, and so on). The bottom line is that benefit-cost analysis for preschool programs, like analyses of other early childhood interventions, works best with long-term follow-up. That way, the evaluators can measure and place dollar values on outcomes in adolescence and beyond.

A second challenge is related to the fact that preschool programs are expected to affect outcomes throughout the life course. Thus a full accounting of potential benefits would require projecting outcomes from preschool participation into the future, beyond the point of the last follow-up. To connect outcomes measured at younger ages with expected outcomes at older ages, we need to make assumptions about the causal relationships through time. As we'll see in the next section, benefit-cost

analyses of preschool programs that make such linkages typically do so to project how educational attainment may affect future earnings, or how crime and delinquency in the adolescent years may affect criminal behavior in adulthood. More recently, benefit-cost analyses of preschool programs have made assumptions about links between achievement test scores at younger ages and educational attainment or future earnings. In essence, connecting early outcomes with later outcomes is one way to place an economic value on an early outcome that would otherwise not be valued in monetary terms.

The third challenge we face is that spillover benefits to other parties—such as parents, siblings, and participants' own children—may not be captured at all by evaluations of preschool programs. Most preschool evaluations to date haven't measured these spillover effects directly. And although such effects have been hypothesized, they generally haven't been incorporated into the benefit-cost analyses I review in the next section. An exception is a benefit-cost analysis for the Abecedarian program, which did incorporate projected benefits for participants' children.[8]

These three challenges together make it hard to capture the full economic value of favorable effects from a high-quality preschool program. Thus, benefit-cost analyses may underestimate a program's benefits. And then there's the fourth problem: it's often impossible to calculate the incremental benefits and costs of a preschool program against a counterfactual condition of the absence of preschool participation. For evaluations of preschool programs conducted in the 1960s and 1970s, the counterfactual condition was effectively no program, because back then relatively few children participated in formal early learning programs. By 2014, however, 52 percent of three- to five-year-olds who weren't in kindergarten were enrolled in some sort of prekindergarten, preschool, or nursery school program.[9]

Today, then, the counterfactual condition to which we must compare any preschool program includes a high proportion of preschool-age children who are enrolled in some other program. For example, in the National Head Start Impact Study, 60 percent of the children in the 2002–03 program year who were randomly assigned to the control group attended an alternative preschool program. For 18 percent of four-year-olds, the alternative was another Head Start program.[10] The fact that most children now attend some sort of preschool program means that we must be careful when comparing benefit-cost analyses conducted in the past with those conducted more recently. In particular, we can expect the impacts and associated economic benefits found in more recent preschool program evaluations to be relatively more modest than those found in programs implemented and evaluated decades ago, when most children didn't attend preschool at all.[11]

The evidence for economic returns from high-quality preschool programs contains few apples-to-apples comparisons.

In the face of these and other challenges, anyone conducting a benefit-cost analysis

for a preschool program must choose such features as which shadow prices to use, which discount rate to employ, and how to project outcomes into the future. Consequently, the findings from a benefit-cost analysis for one preschool program can't necessarily be compared to the findings from another. Even when researchers use the same set of methods—for example, the benefit-cost model developed by the Washington State Institute for Public Policy (WSIPP), which provides economic evidence to guide state legislature investments in such policy areas as early childhood, K–12 education, and crime prevention—the results from the benefit-cost analysis for one preschool program won't necessarily be comparable to the results for another, because the analyses often measure different outcomes and have different follow-up periods.[12] For this reason, the evidence for economic returns from high-quality preschool programs contains few apples-to-apples comparisons.

Evidence of Economic Returns to Preschool Programs

Although numerous high-quality preschool programs have been rigorously evaluated, far fewer have been subjected to a comprehensive benefit-cost analysis, in part because of the challenges I've just outlined. Benefit-cost analyses for the category of preschool programs defined at the outset of this article range from back-of-the-envelope calculations to formal analyses that include a thorough cost analysis, evidence of a program's causal impact, and valuation of the measured outcomes.[13] I'll begin this section by reviewing the approaches and findings of benefit-cost analyses conducted for preschool programs that have already been implemented and evaluated. Then I'll consider findings from several economic evaluations that estimate the potential returns from expanded preschool programs that have yet to be implemented. This group includes prospective estimates of economic returns using a benefit-cost analysis framework, as well as several studies that estimate economy-wide impacts as preschool becomes available to new cohorts of children over time.

Economic Evaluations of Implemented Programs

Table 1 lists preschool programs implemented and evaluated in the United States that have undergone one or more formal benefit-cost analyses. The table includes two targeted part-day programs serving children one or two years before kindergarten entry: one is a demonstration program—Perry Preschool—the other a program operated by the Chicago public school district—Chicago CPC. The third distinct program is Oklahoma's publicly funded universal preschool program serving children part-day or full-day one year before kindergarten entry, with an evaluation of the program as implemented in the Tulsa school district—Tulsa UPK.

The other two entries in table 1 are programs that WSIPP subjected to benefit-cost analyses based on a meta-analysis of program impacts and program costs and valuation of outcomes specific to Washington state (a meta-analysis is a statistical approach for combining findings across multiple studies of the same program or similar programs). The studies included in the WSIPP meta-analysis cover 12 evaluations of the Head Start program and 17 evaluations of publicly funded state- and district-administered preschool programs, including Chicago CPC and Tulsa UPK. The programs in table 1 vary in terms of other features that are markers for preschool program quality,

Table 1. Features of Preschool Program Benefit-Cost Analyses

	Impacts from Single Program Evaluations					Impacts from Meta-Analysis	
	Perry Preschool	**Perry Preschool**	**Perry Preschool**	**Chicago CPC**	**Tulsa UPK**	**Head Start**	**State and district programs**
Follow-up age for BCAs	19, 27, 40	27	40	21, 26	5	Varies	Varies
Outcomes valued							
Child abuse and neglect	–	–	–	O, P	–		
Achievement tests	X	X	X	X	L	L	L
K–12 net savings	O	O	O	O	–	O	O
Postsecondary net savings	O	O	O	O	–	–	–
High school graduation	X	X	X	X	–	L	L
Earnings (and taxes)	O, P	O, P	O, P	O, P	–	–	–
Crime—tangible	O, P	O, P	O, P	O, P	–	O, P	O, P
Crime—intangible	O, P	X	O, P	O, P	–	O, P	O, P
Welfare use	O, P	O, P	O, P	–	–	–	–
Depression	–	–	–	O, P	–	–	–
Smoking	–	–	–	O, P	–	–	–
Substance abuse	–	–	–	O, P	–	–	–
Teen birth	–	–	–	–	–	O	–
Mortality	O	–	–	–	–	–	–

Abbreviations: L = outcome linked to monetizable earnings; O = observed outcomes; P = projected outcomes; X = measured but excluded from valuation; – = not measured or no significant effect.

Sources: For Perry Preschool column one: Berrueta-Clement et al. (1984); Barnett (1996); Barnett, Belfield, and Nores (2005); for Perry Preschool column two: Karoly et al. (1998); for Perry Preschool column three: Heckman et al. (2010); for Chicago CPC: Reynolds et al. (2002, 2011); for Tulsa UPK: Bartik, Gormley, and Adelstein (2012); for Head Start and state and district programs: WSIPP (2014). See endnotes for full citations.

Note: For programs with multiple benefit-cost analyses, outcomes valued are based on the most recent benefit-cost analysis.

such as group size, teacher-child ratio, teacher education and training, curriculum, and the nature of teacher-child interactions.

The programs listed in table 1 were evaluated in one of two ways. The Perry Preschool evaluation and one of the Head Start evaluations in the meta-analysis used an experimental design—that is, one in which children were randomly assigned to the program (treatment) or to no program (control). Other evaluations used quasi-experimental designs, rigorous methods

that are viewed as a valid alternative to an experimental design. The most common quasi-experimental design used to evaluate larger-scale public preschool programs, including those of the Tulsa UPK and most of the state and district programs, is a regression discontinuity design, which is considered to be one of the best methods when an experimental design isn't possible.[14]

The Chicago CPC evaluation uses a nonrandom comparison group with pre-test data collected retrospectively to demonstrate baseline equivalence, an approach that some researchers view as a weaker evaluation design.[15] I nevertheless include the study because it's one of the few with long-term follow-up and a careful benefit-cost analysis. In addition, the findings from Chicago CPC are often used to forecast the potential impacts and economic returns of expanding access to high-quality preschool (for example, by instituting universal preschool).

The years covered by the evaluations range from the early 1960s for Perry Preschool to 2005 for Tulsa UPK. (The meta-analysis findings fall within the same range.) Because of this long time span, the counterfactual condition isn't consistent. Perry Preschool and Chicago CPC were evaluated when few children in the control or comparison group had access to a formal early learning program. For Tulsa UPK and many of the evaluations that underlie the meta-analyses of Head Start and state and district public preschool, up to 60 percent of children in the comparison group participated in some form of center-based preschool program.

These evaluations provide the basis for the benefit-cost analyses, using the methods summarized in table 1. The Perry Preschool program has been the subject of at least five benefit-cost analyses. Three were associated with the evaluation conducted by the HighScope Educational Research Foundation, which implemented the Perry Preschool program, and were based on follow-ups at ages 19, 27, and 40.[16] Scholars from the RAND Corporation conducted a benefit-cost analysis based on the age 27 follow-up findings, and another group of researchers conducted an analysis using the age 40 findings.[17] Likewise, the Chicago CPC has undergone benefit-cost analyses based on follow-up results at ages 21 and 26.[18]

Given the long-term follow-up available with the Perry Preschool and Chicago CPC programs, the benefit-cost analyses have valued a wide range of outcomes. In all cases, the benefit-cost analyses captured observed net savings to the K–12 education system from fewer grade repetitions and less need for special education. They also captured net savings or costs to the higher education and adult education system (these actually turned out to be net costs, because children in the programs tended to complete more years of schooling). All of the benefit-cost analyses value both observed and projected earnings gains, along with observed and projected savings from reduced crime and lower welfare use. The Chicago CPC benefit-cost analysis further incorporated observed and projected benefits from favorable effects on child abuse and neglect, depression, smoking, and substance abuse.

Both Perry Preschool and Chicago CPC produced favorable effects on test scores that continued past the early elementary grades, as well as favorable effects on the rate of high school graduation. But the benefit-cost analyses didn't value these outcomes directly or link them to other

outcomes because the long-term follow-ups provided direct evidence of the programs' impact on such outcomes as earnings, crime, and welfare use. The RAND study (second column, Perry Preschool at age 27) was the only benefit-cost analysis to omit the intangible benefits from reduced crime.

In contrast, the Tulsa UPK benefit-cost analysis was more limited than those of Perry Preschool and Chicago CPC in that it was based on measured impacts on reading and math skills when children entered kindergarten.[19] To estimate partial economic returns in terms of future earnings, the Tulsa UPK study used the findings from an experimental evaluation of Tennessee Project STAR (Student/Teacher Achievement Ratio). That study was designed to test the relationship between class sizes in kindergarten and the early elementary grades and student outcomes. Based on long-term follow-up of the Project STAR treatment and control-group children, Stanford University economist Raj Chetty and colleagues provided a causal estimate of the relationship between early test scores and adult earnings.[20]

In particular, the Project STAR long-term follow-up data indicate that a one percentage-point increase in achievement scores among kindergarteners leads to a $78.71 increase in annual earnings at ages 25–27 in 2009 dollars. Other researchers used this estimate and the age-earnings profile for workers in the Tulsa metro area to estimate that a one percentage point increase in test scores leads to an increase of $1,502 in lifetime earnings (after discounting to present value and converting to 2005–06 dollars). The evaluation of Tulsa UPK showed an increase in test scores, on average, of 8.8 to 20.2 percentage points, depending on the children's family income and whether they attended part-day or full-day preschool.

Combining these estimates indicates a projected increase in present-value lifetime earnings per child from participation in Tulsa UPK of $13,200 to $30,400. Notably, when the Tennessee STAR estimate of the relationship between early test scores and lifetime earnings is used to forecast the future earnings gains for the participants in Perry Preschool and Chicago CPC (two studies with earnings measured in adulthood), the forecast either slightly underpredicts the measured earnings gains (Perry Preschool) or provides a close estimate (Chicago CPC), thus supporting the projection approach.[21]

As a final step, we compare the estimate of the lifetime earnings benefits per child from Tulsa UPK participation in a part-day or full-day program with the associated cost of participation—about $4,400 for a part-day program and $8,800 for a full-day. That gives us an estimate of NPV benefits (that is, PDV benefits minus PDV costs) or a benefit-cost ratio (PDV benefits divided by PDV costs). The WSIPP meta-analysis for Head Start and state and district preschool programs similarly links test scores and earnings; it also values and projects some of the same outcomes captured in the Perry Preschool and Chicago CPC benefit-cost analyses.[22]

The results of the benefit-cost analyses for the programs listed in table 1, all calculated from a societal perspective, are summarized in table 2. The benefit-cost analysis of the Tulsa UPK program produced separate results for children in three income groups: those eligible for free lunches (family income below 130 percent of the federal

Table 2. Benefit-Cost Analysis Results for US Preschool Programs

Program (Follow-Up Age)	Per Child (in 2014 dollars) PDV Costs	PDV Benefits	NPV Benefits	Benefit-Cost Ratio
Perry Preschool (age 19)	24,192	86,095	61,903	3.56
Perry Preschool (age 27)	18,329	75,399	57,070	4.11[a,b,c]
Perry Preschool (age 27)	20,850	182,238	161,389	8.74
Perry Preschool (age 40)	20,850	355,912	335,063	17.07
Perry Preschool (age 40)	–	–	–	7.1–12.2[d]
Chicago CPC (age 21)	9,719	69,364	59,644	7.14[a]
Chicago CPC (age 26)	9,719	105,294	95,575	10.83
Tulsa part-day program (age 5)				
Free lunch students	5,170	21,084	15,914	4.08[e]
Reduced-price lunch students	5,170	15,462	10,291	2.99[e]
Full-price lunch students	5,170	17,775	12,605	3.44[e]
Tulsa full-day program (age 5)				
Free lunch students	10,341	31,990	21,649	3.09[e]
Reduced-price lunch students	10,341	35,703	25,362	3.45[e]
Full-price lunch students	10,341	29,197	18,857	2.82[e]
Head Start (varies)	8,830	23,150	14,320	2.63
State and district preschool programs for low-income 3- and 4-year-olds (varies)	7,191	30,119	22,928	4.20

[a]Excludes value of reduced intangible crime victim costs.

[b]Discount rate is 4 percent.

[c]Discounted to age 0.

[d]Reported range of estimates from Heckman et al. (2010) under alternative assumptions regarding the economic cost of crime.

[e]Discounted to age 4.

Abbreviations: PDV = present discounted value; NPV = net present value.

Sources: Perry Preschool (in order): Berrueta-Clement et al. (1984); Karoly et al. (1998); Barnett (1996); Barnett, Belfield, and Nores (2005); Heckman et al. (2010); Chicago CPC: Reynolds et al. (2002, 2011); Tulsa: Bartik, Gormley, and Adelstein (2012); Head Start and state and district programs: WSIPP (2014). See endnotes for full citations.

Notes: All dollar values were converted to 2014 dollars using the Consumer Price Index for All Urban Consumers. The benefit-cost ratios are the ratio of the present discounted value of total benefits to society as a whole (participants and the rest of society) divided by present discounted value of program costs. The discount rate is 3% and discounting is to age 3 unless otherwise noted. The value of reduced intangible-crime victim costs are included unless otherwise noted. – = not available.

poverty line), those eligible for reduced-price lunches (income between 130 percent and 185 percent of the poverty line), and those not eligible (income greater than 185 percent of the poverty line). For each income group, separate results are shown for the part-day and full-day programs. When available, the table lists the PDV costs and benefits per child for each study, along with the NPV benefits (PDV benefits minus PDV costs), all converted to 2014 dollars. The associated benefit-cost ratio is listed as well.

Several results stand out from this series of economic evaluations:

- Program costs range widely, from about $5,200 per child for the one-year Tulsa UPK program to nearly $21,000 for the two-year Perry Preschool program. These differences reflect the programs' duration and intensity, as well as variations in the type and quality of services provided.

- The level of net benefits varies considerably as well, in part because of the outcomes available in the evaluation that can be valued and their associated magnitudes. The age-40 Perry Preschool benefit-cost analysis, with an array of sizable impacts on high-value outcomes (such as earnings and crime) that are both observed and projected, shows estimated net benefits that exceed $300,000 per child. Tulsa UPK (which values only projected lifetime earnings gains based on test scores) and Head Start (with smaller impact estimates) are at the lower end of the range, with estimated net benefits of $10,000 to $16,000 per child.

- The corresponding benefit-cost ratios extend from about $3 to $17 of benefits for every dollar of cost.[23] The highest benefit-cost ratios are associated with Perry Preschool and Chicago CPC, the two targeted programs with long-term follow-up. Benefits exceed costs by a sizable margin in both the targeted programs in table 2 and in the one universal program (Tulsa UPK). Moreover, favorable returns are found for the Perry Preschool small-scale demonstration program and for the larger-scale programs implemented at the district level or beyond. But the estimated returns are clearly smaller in the scaled-up programs, even when long-term follow-up findings are available to include in the economic evaluation (as in Chicago CPC and Head Start).

- The multiple benefit-cost analyses available for Perry Preschool and Chicago CPC with each successive follow-up evaluation as the participants grew older show an increase in the estimated net benefits and benefit-cost ratio as outcomes are observed at older ages and the associated forecast period declines. This suggests that the forecasts applied at younger ages tended to understate the future benefits for such outcomes as earnings, crime, and welfare use.

- The Tulsa UPK findings indicate that a one-year part-day or full-day universal preschool program is likely to produce favorable returns for children across the income spectrum. The estimated returns are based solely on earnings projections from the program's impact on test scores, and are quite similar for the three income groups. The NPV benefits from participation in a full-day program are higher for each income group. On the other hand, except for the reduced-price lunch group, the benefit-cost ratio from

the full-day program is lower compared with the part-day program.

- The estimated returns shown in table 2 are based on the set of observed or projected outcomes from the preschool program evaluations. Although the evaluations consider a number of key short- and long-term impacts (see table 1), other potentially important benefits aren't accounted for because they typically haven't been measured. These include intermediate-term benefits to school systems from a reduced need for services for children with behavior problems beyond enrollment in special education classes (which is accounted for in several of the benefit-cost analyses), and lower teacher turnover because of fewer behavior problems. Spillover benefits to classroom peers also aren't assessed. If such outcomes could be demonstrated as part of preschool program evaluation, they would provide additional sources of economic benefits.

In sum, table 2 shows strong evidence that both targeted and universal preschool programs produce favorable economic returns, whether they're provided for one or two years before kindergarten. The evidence also shows that such returns can be realized for scaled-up programs. At the same time, although table 2 features multiple estimates from benefit-cost analyses, the findings rely on just a handful of program models and their associated evaluations. Only two preschool programs taken to scale—Chicago CPC and Tulsa UPK—have undergone individual economic evaluations, and Tulsa UPK's evaluation is based on projecting future earnings from age-five test scores. The meta-analysis for Head Start rests on several evaluations, but only one national experimental evaluation and a handful of quasi-experimental evaluations provide estimates of the program's longer-term impacts. Likewise—with the exception of Chicago CPC, one of the included studies—the meta-analysis findings for state and district programs are based mostly on short-term follow-up.

Forecasting Returns from Universal Preschool Programs

The evidence that targeted programs such as Perry Preschool and Chicago CPC produced favorable economic returns sparked an interest in projecting the potential economic returns from universal preschool programs. Motivated by policy proposals to expand preschool access at the state and federal levels, several studies have been conducted to provide such estimates. Table 3 summarizes the key features of five state studies, all conducted in the mid-2000s.

These studies all project the benefits from state-level universal preschool programs—in some cases for a one-year program, in other cases for a two-year program. The studies consider the effect of increasing access to high-quality preschool programs, relative to current enrollment levels. In most cases, they also consider the effect of increasing the quality of current programs. The first two studies, for California and Texas, take a societal perspective. They base their impact estimates on the Chicago CPC age 21 follow-up findings, and they assume that because universal programs serve more children who aren't disadvantaged, their effects will be somewhat more muted than those of targeted programs.[24] The studies that cover programs in Arkansas,

Table 3. Approach and Findings from Prospective Benefit-Cost Analyses of State-Specific Universal Preschool Programs

BCA Study	Preschool Program Type	Counterfactual	Assumed Outcomes and Sources	Perspective	Benefit-Cost Ratio
California	Universal, one-year part-day academic-year	Current enrollment levels	Based on Chicago CPC impacts (attenuated for scale-up)	Societal	2:1 to 4:1
Texas	Universal, two-year full-day academic-year	Current enrollment levels	Based on Chicago CPC impacts (attenuated for scale-up)	Societal	3.4:1
Ohio	Universal, two-year part-day academic-year	Current enrollment levels	Based on Chicago CPC and other study impacts	Government	1.4:1 to 1.9:1
Massachusetts, Ohio, Wisconsin	Universal, one- or two-year part-day academic-year	Current enrollment levels	Based on Chicago CPC and other study impacts	Government	1.2:1 to 1.6:1
Arkansas	Universal, two-year part-day academic-year	Current enrollment levels	Based on Chicago CPC and other study impacts	Government	1.6:1

Sources: California: Karoly and Bigelow (2005); Texas: Aguirre et al. (2006); Ohio: Belfield (2004); Massachusetts, Ohio, and Wisconsin: Belfield (2006); Arkansas: Belfield (2006). See endnotes for full citations.

Massachusetts, Ohio, and Wisconsin focus on savings to government, with impact estimates derived from multiple evaluations, including evaluations of Chicago CPC.[25]

Despite the differences among these studies, the findings are quite similar. From the societal perspective, they estimate that a one- or two-year universal preschool program would generate returns from $2 to $4 for every dollar invested—consistent with the earnings-based impacts for Tulsa UPK. Focusing on savings to government alone, the returns range from just above $1 to nearly $2 dollars in government savings for every dollar of program cost.

Economy-Wide Projections of Preschool Expansion

Other studies have taken a different approach to forecasting the economic benefits to be derived by expanding access to high-quality preschool, but they too rely on narrow evidence. One group of researchers estimated the national-level effect on economic growth (projected to 2080) of a two-year universal preschool program, based on evidence of the known relationship between educational attainment, earnings, and economic growth.[26] They concluded that such a program would add $2 trillion to the US gross domestic product (GDP), measured against $59 billion in program cost (all in

2005 dollars). Another study estimated the societal costs and benefits at the national level, projected to 2050, of a one- or two-year preschool program that is either targeted or universal, with estimated returns of 12-to-1 for the targeted program and 8-to-1 for the universal program.[27] To forecast the impacts, the first study used estimates from evaluations of Perry Preschool, while the second based its estimates on findings from Chicago CPC. Given that both these studies relied on evaluations of the two programs with the highest estimated returns, it's not surprising that they predicted strong economy-wide benefits that would outweigh the costs of either a targeted or a universal program. In fact, the second study's estimated returns are even higher than those produced for the Chicago CPC program itself.

Implications for Preschool Policy

My review demonstrates that although many preschool programs have undergone impact evaluations, few have been subject to economic evaluations. Benefit-cost analyses have been produced for the three programs with evidence of longer-term impact: Perry Preschool, Chicago CPC, and Head Start. Many of the other programs that have been evaluated, such as state-funded preschool programs, have generated estimated impacts on school readiness and perhaps some other outcomes in the early elementary years, but these outcomes are less readily converted to monetary values.

The Tulsa UPK benefit-cost analysis shows that early skills can be linked to long-term earnings, but for now the connection relies on estimates from a single study. The WSIPP model incorporates meta-analysis to link various outcomes such as school-age test scores to later outcomes such as earnings, which may produce more credible findings. Further evidence of links between early and later outcomes will make it easier to perform benefit-cost analyses for preschool programs that haven't yet had time to generate evidence of longer-term impact.

Even if we can make such projections, however, the long-term benefits of preschool programs that have had only short-term follow-up may be underestimated because all the relevant impacts—those measured at older ages, for which linkages can't be made—won't be accounted for. Consider the fact that the benefit-cost analyses of Perry Preschool and Chicago CPC that were based on outcomes observed at younger ages produced smaller estimated returns than did the benefit-cost analyses that were based on outcomes at older ages. That finding suggests that the projections themselves may understate longer-run effects, especially when researchers use conservative assumptions. At the same time, the fact that preschool participants' short-term developmental or achievement test gains may not last (see the article in this issue by Hiro Yoshikawa, Christina Weiland, and Jeanne Brooks-Gunn) raises the question of whether we can use such short-term gains to forecast later outcomes.

My review also shows how benefit-cost analysis and related methods are used to estimate the future benefits—whether for children or for the economy as a whole—of expanding preschool programs to cover either more low-income children or all children. We must acknowledge that these predictive studies rely heavily on impact estimates from Perry Preschool or Chicago CPC, even if they assume some dilution

of impacts because of scale-up or broader population coverage. The multiplicity of such studies makes it appear that the results are replicated across multiple jurisdictions and by using varied methods, but the truth is that most of the studies assume that future programs will produce impacts on the same set of outcomes that Perry Preschool and Chicago CPC affected. Those two programs and their associated evaluations heavily influence any evidence that makes a case for the positive economic returns of investing in preschool.

Of course, findings from one study don't necessarily apply to other existing or proposed preschool programs. Evidence that some early childhood education programs, such as those shown in table 3, generate positive economic returns doesn't mean that all such programs will have benefits that exceed their costs. Programs at scale—even high-quality targeted programs—are unlikely to produce economic returns as large as those measured for Perry Preschool. Universal programs and those of lower quality are likely to produce smaller returns. Different jurisdictions may also see different results, based on demographic factors and the way the programs are implemented.

Pointing to Perry Preschool's $17-to-$1 returns, in fact, may be setting expectations too high. Rather, it may be more realistic to expect returns in the range of $3 to $4 for every dollar invested, which is consistent with the WSIPP estimate for state and district public preschool programs. Given that more recent cohorts of children already have high rates of preschool participation, we must recognize that creating higher-quality programs or expanding access to preschool would represent incremental investments.

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We also need to acknowledge that it may take time for even high-quality targeted programs to reach the break-even point. Depending on the nature of a program's early impacts and whether we can put a price on them, we may not see substantial monetary savings from improved outcomes until preschool participants reach adolescence or even young adulthood. For example, the RAND analysis of Perry Preschool, based on the age 27 follow-up results, found that cumulative benefits didn't exceed cumulative costs until 15 years after the intervention ended. This profile of upfront costs and a long payback period makes it hard to convince public-sector decision makers to commit to further preschool investments. It may also deter private investors who are interested in mechanisms like social impact bonds, whereby the investors fund the upfront costs of a preschool program in return for future payments from the government if the program produces public-sector savings.[28]

Another challenge we face is that the downstream payoff from publicly funded preschool investments may not always accrue to the same level of government or government agency that made the initial investment—the so-called *wrong pocket* problem. Let's say a city raises taxes to pay for universal preschool, but some of the returns flow to the federal government in the form of increased income-tax revenue from higher earnings. Similarly, a preschool investment

might be made through an education department, but the eventual savings from reduced crime would benefit police departments, the courts, and the corrections system. The fact that some returns from high-quality preschool are private gains to the participating children and their families also means that the public sector doesn't realize all of the downstream benefits. This problem has been an impetus for using social impact bonds as an alternative financing mechanism for preschools and other social programs.[29]

The economic evaluations I've reviewed have strongly influenced policy discussions about devoting public resources to preschool programs. Yet the quality and usefulness of such studies could be improved. For example, policy makers often want to know how economic returns vary with preschool policy choices. What are the differences between part-day and full-day programs, a program that serves children for one year before kindergarten versus two years, targeted versus universal programs, or a prekindergarten program as opposed to one that extends into the early elementary grades? Answering these questions would require evaluation evidence that shows how preschool programs' design affects children's outcomes in both the short and long run. For the most part, such evidence is currently lacking.

We should also calculate the economic value of the many short- and medium-term outcomes affected by preschool programs. We need to measure cognitive, social, emotional, and behavioral development when children enter school, and student achievement in the elementary grades. That way, economic evaluations of preschool programs could offer evidence of impacts in the short term, instead of waiting until longer-term impacts could be assessed.

Meanwhile, initiatives are under way to make benefit-cost analysis and other economic evaluation methods more useful for early childhood programs and other areas of social policy. One of these initiatives is a 2016 report from an ad hoc National Academies Committee on the use of Economic Evidence to Inform Investments in Children, Youth, and Families.[30] Such progress indicates that we'll see more advanced research on the relationship between preschool program design features and the impacts of those programs, In addition, we'll have more standardization in the measures included in impact evaluations and in the methods used to conduct economic evaluations. As a result of these changes, decision makers in the public and private sectors will soon have better evidence to guide investments in preschool programs.

ENDNOTES

1. For a recent review, see Hirokazu Yoshikawa et al., *Investing in our Future: The Evidence Base on Preschool Education* (New York: Foundation for Child Development and Ann Arbor, MI: Society for Research in Child Development, 2013).

2. For a recent review, see Lynn A. Karoly, "Toward Standardization of Benefit-Cost Analyses of Early Childhood Interventions," J*ournal of Benefit-Cost Analysis* 3, no. 1 (2012): article 4, doi: 10.1515/2152-2812.1085.

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4. John R. Berrueta-Clement et al., *Changed Lives: The Effects of the Perry Preschool Program on Youths through Age 19*, Monographs of the High/Scope Educational Research Foundation 8 (Ypsilanti, MI: High/Scope Press, 1984).

5. Business Roundtable and Corporate Voices for Working Families, *Why America Needs High-Quality Early Education* (Washington, DC: Business Roundtable, 2009); Committee for Economic Development (CED), *Unfinished Business: Continued Investment in Child Care and Early Education Is Critical to Business and America's Future* (Washington, DC: CED, 2012); Mission: Readiness, *A Commitment to Pre-Kindergarten Is a Commitment to National Security: High-Quality Early Childhood Education Saves Billions while Strengthening Our Military and Our Nation* (Washington, DC: Mission: Readiness, 2013); ReadyNation, *Attracting, Development, and Maintaining Human Capital: A New Model for Economic Development* (Washington, DC: America's Promise Alliance, 2011); Institute for a Competitive Workforce, *Ready, Set, Go! Why Business Should Support Early Childhood Education* (Washington, DC: US Chamber of Commerce, 2010).

6. "Remarks by the President in the State of the Union Address," White House, Office of the Press Secretary, February 12, 2013, https://www.whitehouse.gov/the-press-office/2013/02/12/remarks-president-state-union-address.

7. For additional discussion of the benefit-cost analysis method, see Eugene Steurle and Leigh Miles Jackson, eds., *Advancing the Power of Economic Evidence for Making Informed Investments in Children, Youth, and Families* (Washington, DC: National Academies Press, 2016).

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9. US Department of Education, *The Condition of Education 2016*, NCES 2015-144 (Washington, DC: National Center for Education Statistics, NCES 2016-144, 2016).

10. US Department of Health and Human Services, *Head Start Impact Study: First Year Findings* (Washington, DC: Administration for Children and Families, US Department of Health and Human Services, 2005).

11. This point is made by Greg J. Duncan and Katherine Magnuson, "Investing in Preschool Programs," *Journal of Economic Perspectives* 27, no. 2 (2013): 109–32, doi: 10.1257/jep.27.2.109. They add that home environments in low-income families have also likely improved over time with the increase in maternal education.

12. Washington State Institute for Public Policy, *Early Childhood Education for Low-Income Students: A Review of the Evidence and Benefit-Cost Analysis* (Olympia, WA: Washington State Institute for Public Policy, 2014).

13. For examples of back-of-the-envelope benefit-cost calculations, see Jens Ludwig and Deborah Phillips, "The Benefits and Costs of Head Start," *Social Policy Report* 21, no. 3 (2007): 3–18; and Greg Duncan, Jens Ludwig, and Katherine Magnuson, "Child Development," in *Targeting Investments in Children Fighting Poverty When Resources Are Limited*, eds. Phillip B. Levine and David J. Zimmerman (Chicago: University of Chicago Press, 2010), 27–58.

14. See Mark W. Lipsey, Christina Weiland, Hirokazu Yoshikawa, Sandra Jo Wilson, and Kerry G. Hofer, "The Prekindergarten Age-Cutoff Regression-Discontinuity Design: Methodological Issues and Implications for Application," *Educational Evaluation and Policy Analysis* 37 (2015): 296–313, for more detail on this approach and some of the limitations.

15. Arthur J. Reynolds et al., "Age-26 Cost-Benefit Analysis of the Child-Parent Center Early Education Program," *Child Development* 82 (2011): 379–404, doi: 10.1111/j.1467-8624.2010.01563.x and Arthur J. Reynolds, Judy A. Temple, Suh-Ruu Ou, Irma A. Arteaga, and Barry A.B. White, "School-Based Early Childhood Education and Age-28 Well-Being: Effects by Timing, Dosage, and Subgroups," *Science* 333 (July 15, 2011): 360–64.

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21. See Bartik, Gormley, and Adelstein, "Earnings Benefits."

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23. As a comparison, Barnett and Masse, "Comparative Benefit-Cost Analysis," reports the estimated benefit-cost ratio for the Abecedarian program as 2.49.

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26. William T. Dickens, Isabelle V. Sawhill, and Jeffrey Tebbs, *The Effects of Investing in Early Education on Economic Growth*, policy brief no. 153 (Washington, DC: Brookings Institution, 2006).

27. Robert G. Lynch, *Enriching Children, Enriching the Nation: Public Investment in High-Quality Prekindergarten* (Washington, DC: Economic Policy Institute, 2007).

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