

The Benefits and Costs of Investing in Early Childhood Education

The fiscal, economic, and societal gains of a universal
prekindergarten program in the United States, 2016-2050

December 2015 By Robert Lynch and Kavya Vaghul

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Overview

Research is increasingly demonstrating that investments in education provide significant benefits to children, families, and society as a whole, accelerating economic growth and promoting opportunity over time. This study describes and analyzes the benefits and costs of investing in a public, voluntary, high-quality universal prekindergarten program made available to all 3- and 4-year-olds across the United States.

By breaking down these benefits and costs at the state and national levels, we show how such a program would strengthen the U.S. economy's competitiveness while simultaneously easing a host of fiscal, social, and health problems. Over time, the program would more than pay for itself: By 2050, a universal prekindergarten program would yield \$8.90 in benefits for every dollar invested and \$304.7 billion in total benefits.

If the ultimate aim of public policy is to promote the well-being of individuals, families, communities, and nations, then investment in early childhood education is clearly an effective strategy.

Key takeaways



Investing in high-quality universal prekindergarten improves economic growth, promotes opportunity, and eases a host of social issues.



Investment in high-quality universal prekindergarten pays for itself: **It takes only eight years for its benefits to exceed its costs.**



By 2050, our government and society would **gain \$8.90** in benefits **for every dollar we invest** in a universal prekindergarten program.



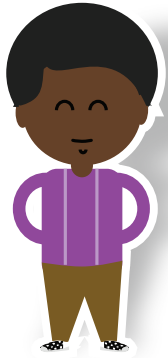
By 2050, a universal prekindergarten program would **yield \$304.7 billion** in benefits. This consists of **\$81.6 billion in government benefits**, **\$108.4 billion in increased compensation**, and **\$114.7 billion in savings to individuals** from less crime and better health.



Children from all socioeconomic backgrounds benefit from high-quality prekindergarten, but **universal prekindergarten reduces inequality because its largest positive effects are on the most disadvantaged children.**



Investing in a high-quality universal prekindergarten program is an **effective public policy strategy to accelerate equitable growth.**



Introduction

A fundamental challenge confronting the United States is how to generate faster and more widely shared economic growth, or equitable growth, now and well into the future. A large body of research across a variety of academic disciplines demonstrates that investments in the education of future workers can improve educational achievement and narrow socioeconomic-based achievement gaps, both of which can accelerate economic growth and promote more equal opportunity over time. Previous research shows that educational achievement and attainment are key determinants of both overall economic growth and individual earnings. This body of research, however, does not always identify how we can raise academic achievement or calculate the costs and benefits of investments that do so.

This study describes and analyzes the costs and benefits of one specific educational initiative: public investment in a voluntary, high-quality universal prekindergarten education program made available to all 3- and 4-year-old children across the United States. Such an investment would boost educational achievement, improve economic growth rates, and raise standards of living across the income spectrum. It also would strengthen the economy's competitiveness long into the future while simultaneously easing a host of fiscal, social, and health problems.

Publicly investing in high-quality prekindergarten provides a wide array of significant benefits to children, families, and society as a whole. Empirical research shows children who participate in high-quality prekindergarten programs score higher on tests when they enter kindergarten than do children who have not attended a high-quality prekindergarten, regardless of whether they are from poor, middle-income, or upper-income families. Children from low- to moderate-income families who attend high-quality prekindergarten require less special education and are less likely to repeat a grade or be victims of child abuse and neglect, thereby reducing the need for child welfare services. When these children become juveniles and adults, they are less likely to engage in criminal activity, reducing criminality overall. They graduate from high school and attend college at higher rates. Once these children enter the labor force, their incomes are higher, and so are the taxes they will pay back to society. As adults, they are likely to be in better health, with lower incidences of depression and reduced consumption of

tobacco. In addition, research shows that quality matters: Higher-quality prekindergarten programs provide greater benefits than lower-quality programs.

High-quality prekindergarten also benefits government budgets by saving government spending on kindergarten through 12th-grade education, child welfare, the criminal justice system, and public health care. Higher tax revenues also flow into government coffers because of increasing taxes paid by participating children and their parents. Thus, investment in high-quality prekindergarten has significant implications for future government budgets, both at the national and the state and local levels, for the economy as a whole, for education, for crime, and for health.

This study breaks down these benefits at the national and state levels. The governmental costs and benefits of a publicly funded prekindergarten program—measured as year-by-year expenditures, budget savings, and revenue impacts—are estimated from program implementation in 2016 through 2050. In addition to the long-term budgetary consequences to governments, the earnings, health, and crime implications for individuals and society are calculated for these same years.

A voluntary, high-quality, publicly funded universal prekindergarten education program serving all 3- and 4-year-old children would generate annual benefits that would surpass the annual costs of the program within eight years. In the year 2050, the annual budgetary, earnings, health, and crime benefits would total \$304.7 billion: \$81.6 billion in government budget benefits, \$108.4 billion in increased compensation of workers, and \$114.7 billion in reduced costs to individuals from better health and less crime and child abuse. These annual benefits would exceed the costs of the program in 2050 by a ratio of 8.9 to 1. (See Figure 1.)

FIGURE 1

Budgetary, Compensation, Health, and Crime Benefits of U.S. Public Investments in Prekindergarten

It would take just 8 years for the total annual benefits of a publicly-funded universal prekindergarten program to exceed the costs for such a program. In 2050, the benefits are even more impactful:

Government budget benefits	\$81.6 billion
Increased compensation	\$108.4 billion
Private savings from improved health and reduced crime and child maltreatment	\$114.7 billion
Total budget, compensation, and private benefits	\$304.7 billion
Ratio of total annual benefits to program costs	8.9 to 1

Note: All monetary values are in 2014 dollars.

Source: Authors' analysis.

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A high-quality prekindergarten program would cost \$5,832 per participant and could be expected to enroll just under 7 million children when it is fully phased in in 2017. The program would initially cost taxpayers about \$40.6 billion a year, but with offsets for current commitments to prekindergarten, this amounts to an additional \$26 billion per year once it is fully phased in. Within 16 years, the net annual effect on government budgets alone would turn positive (for all levels of government combined). That is, starting in the 16th year and every year thereafter, annual government budget benefits due to the program would outweigh annual government costs of the program. Within 35 years, the offsetting budget benefits alone would total \$81.6 billion, more than double the costs of the program. This means that by 2050, every tax dollar spent on the program would be offset by \$2.37 in budget savings and governments collectively would be experiencing \$47.2 billion in surpluses due to the prekindergarten investment. (See Figure 2.)

FIGURE 2
Government Costs and Benefits From a Universal U.S. Prekindergarten Program

It would take just 16 years for the government annual budget benefits to exceed the costs.

Additional taxpayer cost when fully phased in 2017	\$26 billion
Government budget surplus in 2050	\$47.2 billion
Ratio of government budget benefits to costs in 2050	2.37 to 1

Note: All monetary values are in 2014 dollars.

Source: Authors' analysis.

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Even if states paid almost all the costs of the universal program, with the federal government simply maintaining its current commitments to prekindergarten education (holding states harmless from losses of federal funds and distributing prekindergarten commitments equitably among states), the program would be a boon to state budgets, generating budget surpluses in 47 states and the District of Columbia by 2050. When states pay the full cost of the universal program, only Idaho, South Carolina, and Utah do not generate budget surpluses by 2050 because their current commitments to early education are minimal. If we extend the analysis by four years to 2054, however, even these three states break even. Collectively, states would experience net budget savings within 23 years, and by 2050, every dollar spent on the program would be offset by \$1.37 in budgetary savings for state governments.

The returns per state tax dollar spent on universal prekindergarten in 2050 would vary by state, from a low of 94 cents in South Carolina to a high of more than \$7.00

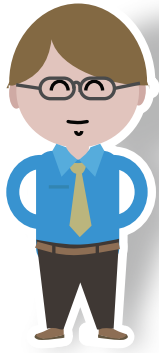
in Vermont and the District of Columbia. And by 2050 the federal government would register a prekindergarten investment-related budget surplus of \$34.8 billion.

Regardless of whether the program is state or federally funded, by the year 2050, a voluntary, high-quality universal prekindergarten education program is estimated to increase the compensation of workers by \$108.4 billion and reduce the costs to individuals from crime, child abuse, depression, and tobacco consumption by \$114.7 billion. Thus, even if states paid almost all the costs, the total state benefits of the program would outstrip the state program costs in every state in 2050 assuming the federal government maintains its current commitments to prekindergarten education. The benefits vary from a minimum of 6.7 to 1 in South Carolina to as much as 36.5 to 1 in the District of Columbia. In other words, when evaluated from the perspective of total costs and benefits, and not just government budget costs and benefits, the program pays for itself in every state several times over.

The increase in worker compensation of \$108.4 billion by the year 2050 is estimated to accrue disproportionately to lower- and middle-income individuals because research shows that these workers of tomorrow benefit the most from higher-quality prekindergarten programs. In addition, a high-quality universal prekindergarten program increases the gross national product of the United States—the total value of all goods and services produced in our economy—by \$234 billion in 2050, or approximately 0.6 percent. Both of these factors indicate that public investment in high-quality prekindergarten will generate faster and more widely shared economic growth.

A nationwide commitment to high-quality early childhood education would cost a significant amount of money upfront—an estimated \$26 billion per year when it is fully phased in. But over time, strikingly, governmental budget benefits alone would outweigh the costs of high-quality prekindergarten education investment.

In short, high-quality prekindergarten pays for itself, and it benefits public balance sheets, children, their families, taxpayers, and society as a whole. Accordingly, policymakers should consider a universal prekindergarten initiative as a sound public investment with long-term returns.



The potential of prekindergarten

The ultimate aim of public policy is to promote the well-being of the nation, including its individuals, families, and communities. When determining whether a particular policy is worth pursuing, it is often useful to weigh the benefits of the policy against its costs. Yet it is not always possible to measure or quantify in dollar terms all the benefits or costs of a particular policy.

The benefits of public investment in early childhood education are difficult to comprehensively and precisely quantify. Research tells us that public investment in effective early childhood education improves educational outcomes, enhances the quality of life of the recipients, and creates a range of external benefits to society over and above those to individual students. But it is not easy to translate all of these improvements into dollar terms. Likewise, while education may be associated with greater levels of life and job satisfaction, it is no simple task to quantify the monetary value of increases in the quality of life. Many of the external benefits to society from early childhood education, such as the future greater productivity of more educated workers, are similarly challenging to quantify.

Still, many (though not all) of the benefits to individuals and society from early childhood education investment can be calculated. The costs of public investment in early childhood education are relatively easier to capture fully and accurately. Hence, we can compare the quantifiable benefits and costs—and even when the benefits are not fully accounted for, such a comparison can inform the public debate on the merits of public investment in early childhood education.

This study analyzes the costs and many, but not all, of the benefits of public investment in the education of children during the early childhood years. Specifically,

this study looks at the costs and the fiscal, earnings, crime, and health benefits of public investment in a voluntary universal prekindergarten education program made available to all 3- and 4-year-olds. The analysis demonstrates that investment in early childhood education, even when its benefits are not fully accounted for, may be an effective public policy strategy for generating growth, raising standards of living, and achieving a multitude of social and economic development objectives.

No single policy can bring about the rapid and simultaneous achievement of all of our economic and social goals, but just as clearly, policies do matter. And at a time of sharp disagreement over solutions to the many social and economic problems we confront, we should take particular notice when a consensus emerges across the political spectrum on an effective policy strategy such as a universal prekindergarten program. There is general agreement that high-quality prekindergarten education in particular has the ability to powerfully impact many of our socioeconomic development goals and positively influence the pace of economic progress.

The consequence of relatively poor educational performance on future economic growth

But first, it is important to provide some context. It may be contentious to state that many American children, whether they come from poor, middle-income, or wealthy families, do not have adequate access to high-quality educational opportunities and, as a result, fall short of achieving their academic potential while in school. But what is not debatable is that American children's academic achievement is poor in comparison to children living in other wealthy countries. The Organisation for Economic Co-operation and Development, comprised of 34 developed or rapidly developing nations, provides data on comparative student achievement across the member nations through its Programme for International Student Assessment, or PISA, ranking countries by the reading, science, and math skills of their 15-year-olds. Several other studies, such as the Trends in International Mathematics and Science Study and the Progress in International Reading Literacy Study, also provide insight into the academic achievement of American children compared to children in other nations. In all of these studies, American children tend to rank at the middle or bottom of the pack. The situation is more dismal when we consider that several of the countries ranked lower than the United States are not direct economic peers; in fact, they are much poorer nations such as Chile, Mexico, and Turkey.

These relatively poor academic achievement rankings have consequences. In a recent study, we calculated the consequences for economic growth, lifetime earnings, and tax revenue of improving educational outcomes and narrowing educational achievement gaps in the United States.¹ Among other results, we found that if the United States were able to raise the math and science PISA test scores of the bottom three quarters of U.S. students so that they matched the test scores of the top quarter of U.S. kids (and thereby raised the overall U.S. academic ranking to third best among the OECD countries), U.S. GDP would be 10 percent larger in 35 years. Simply matching the OECD average math and science PISA scores by narrowing educational achievement gaps between socioeconomically advantaged and disadvantaged American children would raise U.S. GDP by 1.7 percent over 35 years.

Within the discipline of economics, there has long been near-universal agreement that educational achievement and attainment are fundamental elements of success in the labor market. Education provides skills, or human capital, that raise an individual's productivity and future earnings.² Children above and below the poverty line who fail to reach their full academic potential are more likely to enter adulthood without the skills necessary to be highly productive members of society able to compete effectively in a global labor market. Less skilled, less productive, and earning less, these children will be less able to contribute to the growth and development of our economy when they become adults.

But there is hope. Research demonstrates that investment in early childhood education is one of the best ways to improve child well-being and increase the educational achievement and productivity of children and adults. Such investment is also one of the best ways to help us attain numerous other socioeconomic goals. It is interesting to note that economists' conclusions about the effectiveness of investment in early childhood education are buttressed and strongly supported by the findings of scholars in a variety of other fields of inquiry, including medicine, neurobiology, and developmental psychology.

Consider the following from Stanford University neurobiologist Eric Knudsen; Nobel Prize-winning economist James Heckman from the University of Chicago; University of Pittsburgh Professor of Psychiatry, Neuroscience, Obstetrics-Gynecology Reproductive Sciences, and Clinical and Translational Science Judy Cameron; and Harvard University Professor of Child Health and Development Jack Shonkoff:

A cross-disciplinary examination of research in economics, developmental psychology, and neurobiology reveals a striking convergence on a set of com-

mon principles that account for the potent effects of early environment on the capacity for human skill development. Central to these principles are the findings that early experiences have a uniquely powerful influence on the development of cognitive and social skills, as well as on brain architecture and neurochemistry; that both skill development and brain maturation are hierarchical processes in which higher level functions depend on, and build on, lower level functions; and that the capacity for change in the foundations of human skill development and neural circuitry is highest earlier in life and decreases over time. These findings lead to the conclusion that the most efficient strategy for strengthening the future workforce, both economically and neurobiologically, and for improving its quality of life is to invest in the environments of disadvantaged children during the early childhood years.³

Findings from economics and other disciplines are increasingly indicating that “prevention is more effective and less costly than remediation, and earlier is far better than later.”⁴ Appropriately, there is growing consensus that investment in the education of young children, especially disadvantaged children, is one of the most effective strategies to develop the workforce of the future, ameliorate the quality of life, and enhance the well-being of individuals, families, communities, societies, and nations.

Overview of the benefits of early childhood development programs

A strong consensus has developed among experts who have studied high-quality early childhood development programs that these programs have substantial and enduring payoffs. Long-term studies of early childhood development participants, especially prekindergarten participants, consistently find that investing in children has a large number of lasting, important benefits for the participants, their families, and society at large (including taxpayers). These benefits include:

- Higher levels of verbal, mathematical, and general intellectual achievement
- Greater success at school, including less grade retention, less need for special education, and higher graduation rates
- Less welfare dependency
- Better health outcomes
- Higher employment and earnings
- Greater government revenues and lower government expenditures
- Lower crime rates

There is growing consensus that investment in the education of young children is one of the most effective strategies to develop the workforce of the future.

Children who participate in high-quality early childhood development programs tend to have higher scores on math and reading achievement tests and greater language abilities.

More specifically, assessments of well-designed and well-executed programs in early childhood development have established that participating children are more successful in school and in life after school than children who are not enrolled in high-quality programs. In particular, children who participate in high-quality early childhood development programs tend to have higher scores on math and reading achievement tests and greater language abilities. They are better prepared to enter elementary school, experience less grade retention, and have less need for special education and other remedial coursework. They have lower dropout rates, higher high school graduation rates, and higher levels of schooling attainment. They also experience less child abuse and neglect and are less likely to be teenage parents. Additionally, they have better nutrition, improved access to health care services, higher rates of immunization and better health.

As adults, high-quality prekindergarten recipients have higher employment rates, higher earnings, greater self-sufficiency and lower welfare dependency. They exhibit lower rates of drug use and less frequent and less severe delinquent behavior, engaging in fewer criminal acts both as juveniles and as adults and having fewer interactions with the criminal justice system, and lower incarceration rates. They also have better health outcomes such as fewer episodes of depression and less tobacco use. The benefits of early childhood development programs to participating children enable them to enter school “ready to learn,” helping them achieve better outcomes in school and throughout their lives.

Parents and families of children who participate in early childhood development programs also benefit. They benefit both directly from the services they receive in high-quality programs and indirectly from the subsidized child care provided by publicly funded early childhood development programs. In general, parents take advantage of the child care these programs provide by investing in their own health and education and by increasing their employment and earnings. Mothers have fewer additional births, have better nutrition and smoke less during pregnancy, and are less likely to abuse or neglect their children. Parents complete more years of schooling, have higher high school graduation rates, are more likely to be employed, have higher earnings, engage in fewer criminal acts, have lower rates of drug and alcohol abuse, and are less likely to use welfare.

Investments in early childhood development programs pay for themselves over time by generating high rates of return for participants, the non-participating public, and government. Good programs produce \$3 or more in present value benefits for every dollar of investment. Present value estimates are the value in today’s

dollars of future revenues discounted at a specified rate of interest. While participants and their families get part of the total benefits, the benefits to the rest of the public and government can be larger and, on their own, tend to far outweigh the costs of these programs. Thus, it is advantageous even for non-participating taxpayers to help pay for these programs.

Several prominent economists and business leaders have recently issued well-documented reviews of the literature that find very high economic payoffs from early childhood development programs. Nobel Laureate James Heckman concludes that:

Recent studies of early childhood investments have shown remarkable success and indicate that the early years are important for early learning and can be enriched through external channels. Early childhood investments of high quality have lasting effects [...] In the long run, significant improvements in the skill levels of American workers, especially workers not attending college, are unlikely without substantial improvements in the arrangements that foster early learning. We cannot afford to postpone investing in children until they become adults, nor can we wait until they reach school age – a time when it may be too late to intervene. Learning is a dynamic process and is most effective when it begins at a young age and continues through adulthood. The role of the family is crucial to the formation of learning skills, and government interventions at an early age that mend the harm done by dysfunctional families have proven to be highly effective. (Heckman 2000; 22-42)

The former director of research and an economist at the Federal Reserve Bank of Minneapolis, Arthur Rolnick and Rob Grunewald, come to similar conclusions:

[Recent] studies suggest that one critical form of education, early childhood development, or ECD, is grossly under-funded. However, if properly funded and managed, investment in ECD yields an extraordinary return, far exceeding the return on most investments, private or public. [...] In the future any proposed economic development list should have early childhood development at the top. (Rolnick and Grunewald 2003)

Likewise, after reviewing the evidence, the Committee for Economic Development, a nonpartisan research and policy organization of business leaders and educators, finds that:

Society pays in many ways for failing to take full advantage of the learning potential of all of its children, from lost economic productivity and tax revenues

to higher crime rates to diminished participation in the civic and cultural life of the nation. [...] Over a decade ago, CED urged the nation to view education as an investment, not an expense, and to develop a comprehensive and coordinated strategy of human investment. Such a strategy should redefine education as a process that begins at birth and encompasses all aspects of children's early development, including their physical, social emotional, and cognitive growth. In the intervening years the evidence has grown even stronger that investments in early education can have long-term benefits for both children and society. (Committee for Economic Development 2002)

In a follow-up review of the evidence, the Committee for Economic Development further concludes that:

[It] has become generally accepted that preschool programs play an important role in preparing children – both advantaged and disadvantaged – to enter kindergarten. There is also a consensus that children from disadvantaged backgrounds in particular should have access to publicly supported preschool programs that provide an opportunity for an “even start.” (Committee for Economic Development 2006)

The social equity arguments for preschool programs have recently been reinforced by compelling economic evidence that suggests that society at large benefits from investing in these programs. Broadening access to preschool programs for all children is a cost-effective investment that pays dividends for years to come and will help ensure our states' and our nation's future economic productivity.

Estimates of the benefits and costs of prekindergarten investment

Three prekindergarten programs have been the subject of carefully controlled studies of their benefits and costs with long-term follow-up of participants and a control group of non-participants: the Perry Preschool Project, the Abecedarian Early Childhood Intervention, and the Chicago Child-Parent Center Program.⁵ All of these studies have found that enormous payoffs result from investments in early childhood development. Specifically, analyses of the three programs for disadvantaged children have found benefit-cost ratios that varied from a minimum of 3.78 to 1 to a high of 16.14 to 1, expressed in net present value. (See Figure 3.)

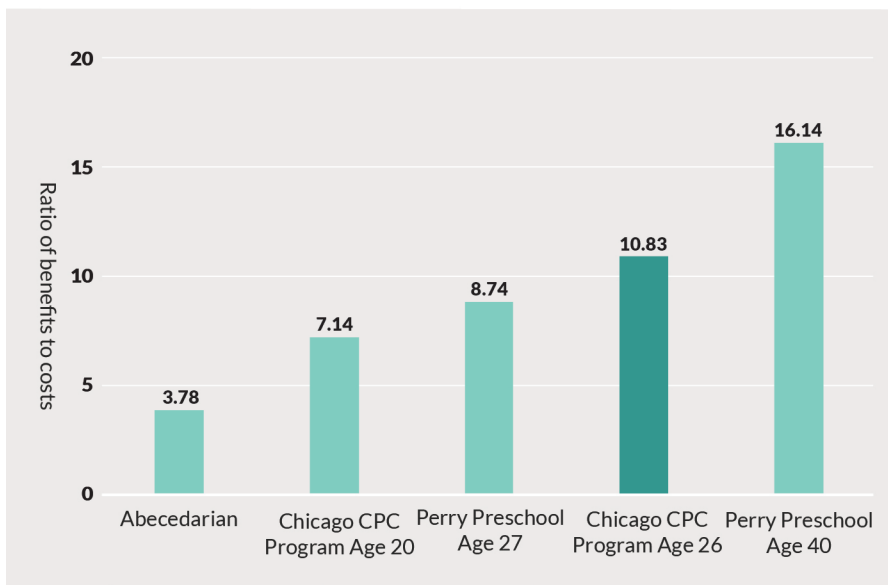
It should be noted that investment in a project is justified if its benefits are greater than its costs or if its benefit-cost ratio exceeds 1 to 1.⁶ Moreover, in the benefit-cost

analyses of all three of these programs, the costs may have been fully described but the benefits were certainly understated.⁷ Thus, the benefits of these prekindergarten programs probably exceed the costs by margins greater than those indicated in Figure 3.

It is interesting to note that the benefit-cost ratios do not fade as the children age and researchers are able to analyze additional data. Compare, for instance, the Chicago results at age 20 (7.14 to 1) with those at age 26 (10.83 to 1) and the Perry results at age 27 (8.74 to 1) with those at age 40 (16.14 to 1) in Figure 3. This suggests that the benefits of prekindergarten are not ephemeral. On the contrary, as noted by others, they are sustained and may grow larger over time.⁸

FIGURE 3
Ratio of Benefits to Costs

This chart compares the ratios of benefits to costs (or the returns for every dollar invested) for preschools that have conducted long-term follow-up studies.



Source: Barnett, W. Steven. 1993. "Benefit-Cost Analysis of Preschool Education: Findings from a 25-Year Follow-Up." *American Journal of Orthopsychiatry* 63 (4): 500-508; Masse, Leonard, and W. Steven Barnett. 2002. "A Benefit Cost Analysis of the Abecedarian Early Childhood Intervention" New Brunswick: National Institute for Early Education Research; Reynolds, Arthur J., and others. 2002. "Age 21 Cost-Benefit Analysis of the Title I Chicago Child-Parent Centers." *Education Evaluation and Policy Analysis* 24 (4): 267-303; Reynolds, Arthur J., and others. 2011. "Age-26 Cost-Benefit Analysis of the Child-Parent Center Early Education Program." *Child Development* 82 (1): 379-404; Belfield, Clive R. and others. 2006. "The High/Scope Perry Preschool Program: Cost-Benefit Analysis using Data from the Age-40 Follow-up." *Journal of Human Resources* 41 (1): 162-190.

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From the perspective of public policy, investments in prekindergarten programs pay for themselves by generating very high rates of return for participants, the non-participating public, and government (in the form of either reduced public service costs or higher tax payments by participants and their families). While participants and their families get part of the total benefits, it is noteworthy that

the benefits to the non-participating public and government are larger and, in and of themselves, tend to outweigh the costs of these programs.

Consider, for example, the benefit-cost analysis of the Chicago Child-Parent Center program when the participants were at age 26. The study found that of the total return of \$10.83 per dollar invested, \$7.20 went to people other than the program participants and their families.⁹ Likewise, a Federal Reserve Bank of Minneapolis study determined that annual real rates of return (after adjusting for inflation) on public investments in the Perry Preschool prekindergarten program were 12 percent for the non-participating public and government, and 4 percent for participants, so that total returns exceeded 16 percent.¹⁰ These analyses suggest that it is advantageous even for non-participating taxpayers to pay for these programs. To comprehend how high these rates of return on prekindergarten investments are, consider that the highly touted real rate of return on the stock market that prevailed between 1801 and 2006 was 6.8 percent.¹¹

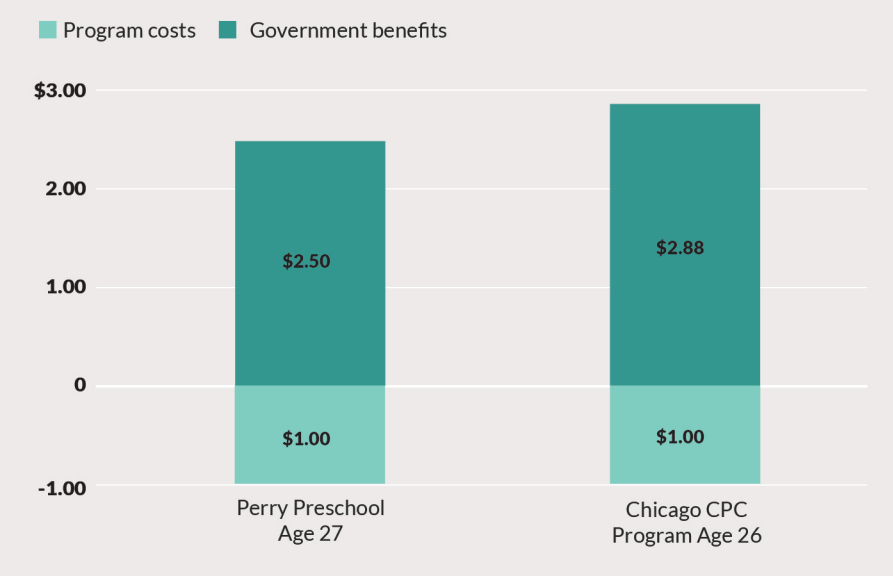
Even from the narrow perspective of budgetary policy, investments in prekindergarten programs pay for themselves because the costs to government are outweighed by the positive budget impacts that the investments eventually produce. Take, for instance, the benefit-cost ratio for two of the three prekindergarten programs described in Figure 1, assuming that all the costs are borne by government and taking into account only the benefits that generate budget gains for government.¹² These ratios vary from 2.5 to 1 for the Perry Preschool program to 2.88 for the Chicago Child-Parent Center program by age 26. (See Figure 4.)

Earlier research has not usually translated these calculations of benefits and costs into estimates of how investments in prekindergarten programs affect future government finances, the economy, health, and crime. This study presents such an analysis based in large part on the outcomes of the Chicago Child-Parent Center Program.¹³ Since the outcomes of this program are used as the basis for the analysis carried out in the third section of this report, in the next section we describe in detail the long-run effects of this high-quality prekindergarten program. The third section describes the budgetary, economic, health, and crime effects of a voluntary, universal, high-quality, publicly financed prekindergarten education program for all 3- and 4-year-old children. Both the national and state-level effects of prekindergarten are discussed. The calculations used to carry out the extrapolations in the third section are explained in the methodology section.

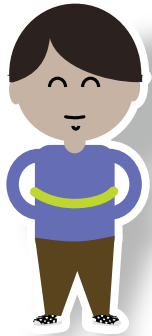
FIGURE 4

Government Benefits for Each Dollar Invested

For every dollar invested, there are more than double the returns on prekindergarten investment in the long-run.



Source: Authors' analysis of Barnett, W. Steven. 1993. "Benefit-Cost Analysis of Preschool Education: Findings from a 25-Year Follow-Up." *American Journal of Orthopsychiatry*, 63 (4): 500-508 and Reynolds, Arthur J., and others. 2011. "Age-26 Cost-Benefit Analysis of the Child-Parent Center Early Education Program." *Child Development* 82 (1): 379-404.
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Characteristics of high-quality prekindergarten and the outcomes of the Chicago Child-Parent Center program

This section begins with a brief description of the general characteristics of high-quality prekindergarten programs. Then, the Chicago Child-Parent Center program is described in particular detail, as it is the basis of the benefit-cost estimates described in the following section. In particular, the outcomes, and the pedagogy and other factors that account for the success of the Chicago Child-Parent Center program will be described.

What makes a prekindergarten program high-quality?

The quality of preschool education is typically measured by two standards: structure and process. Structure is categorized as the tangible characteristics of preschool education programs such as child-to-teacher ratios, teacher pay, teacher qualifications, and class size, while process refers to the social experiences in the classroom such as the nature of teacher-child interactions, the relationships with parents, the diversity and quality of activities and instructional materials, and the health and safety procedures.

A high-quality prekindergarten program boasts low child-to-teacher ratios (10 to 1, or better), small class sizes (20, or less), and highly paid, well-qualified teachers

and staff. Teachers are typically required to have at least a bachelor's degree with a specialization in early childhood education, and classroom assistants usually have at least a child development associate's degree or equivalent. In high-quality preschools, both teachers and assistants are encouraged and given opportunities to continue their professional development, and parental involvement in the education process is cultivated. The nature of teacher-child interactions tends to be warm, positive, supportive, and stimulating.

The activities in the classroom and the instructional materials vary with emphasis placed on quality instruction in a wide range of subjects, among them art, music, science, math, problem-solving, language development, and reasoning. From a programmatic side, high-quality preschools provide meals and offer health services (such as hearing, vision, and psychological health screenings) for their students. All of these aspects of high-quality programs are upheld and improved through rigorous monitoring to ensure that quality standards are being met or exceeded.

High-quality, publicly funded universal preschools in the United States

There are few examples across the country of high-quality and publicly funded universal programs. Generally, the existing publicly funded, large-scale programs vary in quality and audience. Head Start is by far the most well-known and largest early childhood intervention program in the United States. Though Head Start offers early education, development, health, and nutrition services, it is largely targeted at low-income preschool students, and there is substantial variation in how the programs are administered locally, though they must comply with federal standards and quality guidelines. Currently, only five states (Florida, Georgia, Oklahoma, Vermont, and West Virginia) have a publicly funded, universal voluntary prekindergarten program that offers services to all 4-year-olds. The District of Columbia also has a universal prekindergarten program, but unlike the five state programs, it is open to 3-year-olds as well as 4-year-olds.

Perhaps the best example of a high-quality publicly funded prekindergarten program with long-term outcome follow-up studies is Chicago's Child-Parent Centers.

Chicago Child-Parent Centers

Established in 1967, the Child-Parent Center program, or CPC, provides center-based, comprehensive educational and family-support services to economically

disadvantaged preschoolers (children ages 3 and 4) and early elementary students from several of Chicago's poorest neighborhoods. The program was initiated with federal funding from Title I of the Elementary and Secondary Education Act of 1965, and its prekindergarten and kindergarten components are still supported by those federal allocations. After Head Start, CPC is the oldest federally funded prekindergarten program in the nation.

The CPC programs are administered by the Chicago Public School system. To be eligible for enrollment in the CPC, children must live in neighborhoods that receive Title I funding for schools. Eligible children must not be enrolled in another preschool program, and their parents must agree to participate in their child's classroom at least one half-day per week. In practice, however, parent participation tends to be lower.

Children typically enter the program at age 3 for a half-day of prekindergarten (either a morning or afternoon session of three hours) and attend the program for the regular nine-month school year for a total of 540 hours. Generally, the preschoolers are exposed to small peer groups, with classrooms including at most 17 students and at least two staff members. These small classrooms foster an effective learning environment, as children learn basic language, reading, and math skills. Teachers also place importance on the students' social, psychological, and physical development.

Teachers in the CPC program have at least a bachelor's degree along with a certification in early childhood education.¹⁴ Staff compensation is relatively high compared to most preschool staff, mirroring the salary schedule of the Chicago Public School system, which reduces teacher turnover.¹⁵ In addition to teachers and classroom aides, students also are monitored by parent volunteers, home visit representatives, clerks, nurses, speech therapists, and other administrative staff who are associated with the public school program. Similar to other high-quality programs, the Chicago CPC program also provides funds and time for ongoing professional development for teachers, classroom aides, and community representatives alike. (See Figure 5.)

FIGURE 5

What Makes the Chicago Child-Parent Center Program Work?

According to Arthur Reynolds and his associates at the University of Minnesota's Institute of Child Development, who have conducted the most comprehensive longitudinal evaluation of the CPC, there are several critical features that make the CPC a total success.

1. A structured and diverse set of language-based instructional activities
2. Highly qualified and well-compensated teachers with bachelor's degrees and certifications in early childhood education
3. Low child-to-teacher ratios (at most 17 to 2)
4. Parent participation and resources for parental personal development
5. Home visits and other community outreach activities
6. On-going staff development
7. Health and nutrition services (screenings, speech therapy, and free breakfasts and lunches)
8. Comprehensive services to families and children aged 3 through 9 in a school-based setting

Source: Reynolds, Arthur J., and others. 2011. "Age-26 Cost-Benefit Analysis of the Child-Parent Center Early Education Program." *Child Development* 82 (1): 379-404.

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The Chicago Longitudinal Study

The Chicago Longitudinal Study began in 1999 and has been following a cohort of 1,539 low-income students who were born in 1980. The 989 children who completed the Chicago CPC prekindergarten program were compared to a control group of 550 children who did not attend the preschool program but had participated in full-day kindergarten. Of the 550 children in the control group, 161 attended a CPC kindergarten program even though they had not attended the CPC preschool program. Data on both the intervention and control groups are collected periodically by Arthur Reynolds and his colleagues at the University of Minnesota's Institute of Child Development, with the most recent published results for the group by age 26.¹⁶

Figure 6 summarizes some of the statistically significant outcomes of the CPC preschool program as reported by Reynolds and colleagues.¹⁷ The results shown here are only for 3- and 4-year-olds in the prekindergarten program.

FIGURE 6

The Benefits of the Chicago Child-Parent Center Prekindergarten Program

Below are some of the statistically significant longitudinal results for children by age 26 who attended the CPC program 22 years earlier compared to the control group who did not attend the program. Other statistically significant outcomes were observed along with positive impacts that were not statistically significant.

	CPC participants (%)	Control group (%)
High school completion, by age 25	79.7	72.9
College attendance*, by age 25	10.9	7.1
Special education, by age 18	14.4	24.6
Grade retention, by age 15	23.0	38.4
Abuse and neglect victims, age 4 to 17	9.9	17.4
Juvenile arrest, by age 18	16.9	25.1
Adult felony arrest, by age 26	13.3	17.8
Adult major depressive disorder	12.8	17.4

*College attendance is categorized as whether the student completed 0.5 credits at a 4-year college

Source: Reynolds, Arthur J., and others. 2011. "Age-26 Cost-Benefit Analysis of the Child-Parent Center Early Education Program." *Child Development* 82 (1): 379-404.

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The Chicago Longitudinal Study demonstrates that there are significant benefits from attending the CPC program. The study finds that the children who attended the program had significantly higher test scores at ages 5, 6, 9, and 14 than non-center students. CPC participants also spent less time in special education and had lower grade retention rates. Between the ages of 4 and 17, 10 percent of the students experienced child maltreatment in the form of abuse and neglect, while more than 17 percent of non-CPC participants were victims.

Juvenile and adult crime rates were also significantly lower for CPC students. By age 18, roughly 17 percent of participants had been arrested—a stark contrast to a juvenile delinquency rate of 25 percent in non-participants. Similarly, adult crime by age 26 was 13 percent for participants and close to 18 percent for non-participants. Reynolds and his colleagues also observe the long-term health benefits from attending a high-quality prekindergarten program. The prevalence of adult major depressive disorder in participants is lower (13 percent) than it is for non-participants (17 percent). Adult smoking rates also diminish for participants versus non-participants (18 percent versus 22 percent), although the declines were not statistically significant.

Reynolds and his colleagues carry out a benefit-cost analysis of the Chicago Child-Parent Center program. For the prekindergarten program alone, they identified \$92,220 in present value benefits and \$8,512 in present value costs in 2007 dollars—a benefit-cost ratio of 10.83 to 1.¹⁸ The benefits derived mainly from reduced public education expenditures due to lower grade retention and use of special education, reduced costs to the criminal justice system and victims of crime due to lower crime rates, reduced expenditures on child welfare due to less child abuse and neglect, higher projected earnings of center participants, and increased income tax revenue due to projected higher lifetime earnings of center participants.

The benefits of the program, however, underestimate the savings from reduced adult welfare, as welfare usage on the part of center participants was not calculated. In addition, neither the likely benefits to the center participants' offspring nor the value of the likely increase in parental earnings, due to the child care provided by the preschool, were included in the calculations.

In 2012, the CPC prekindergarten program was expanded to four school districts in Illinois and Minnesota. The scaled-up model, known as the Midwest Expansion of the Child-Parent Center Education Program (Midwest CPC), includes a fortified curriculum and a more economically and racially diverse cohort of preschoolers. Early results from these new sites reveal very similar results to the Chicago Longitudinal Study: Participants had higher mean scores for literacy, language, math, cognitive development, socio-emotional development, and physical health compared to non-participants, suggesting that the program has promising benefits for children today.¹⁹ These positive results were consistent across socioeconomic and racial groups, further reinforcing the CPC model's effectiveness in cultivating school readiness skills and potentially other long-term benefits for all children.

We will use the findings detailed in Figure 6 and other results from this latest study as the baseline for treatment effects in our methodology.²⁰ In the next section, we will describe the characteristics of our proposed high-quality universal prekindergarten, explain two of the key assumptions underlying our methodology, and discuss the fiscal, economic, earnings, health, and crime effects of the prekindergarten program.



The effects of universal prekindergarten on future government finances, the economy, crime, and health

The research literature reviewed earlier in our report establishes that high-quality prekindergarten education programs can generate significant long-run benefits for program participants, their families, and other non-participants. In this section, we translate the measured consequences of the Chicago CPC program into estimates of how public investment in a universal, high-quality prekindergarten program would affect future government finances, the economy, crime, and health. The methodology used to arrive at the estimates presented below is explained in detail in the appendix.

In the following subsections, we first describe the characteristics of the proposed high-quality universal prekindergarten program. Next, we discuss two determinations we made about the effects of high-quality prekindergarten on non-low-income children and on children who would, in its absence, attend some other form of preschool. Then, we describe the costs and benefits of the proposed prekindergarten program over the next 35 years through 2050. These include its effects on the economy, government budgets, private savings from reduced crime and better health, and the compensation of workers.

(In the next section of the report, we discuss the costs and benefits that have been omitted in our analysis; as explained there, the benefits that we were not able to quantify in dollar terms are likely to be much greater than the omitted costs. As a

result, the overall benefits and the benefit-cost ratio of a universal pre-K education program are likely to be higher than those we have presented in this paper.)

Characteristics of the proposed high-quality universal prekindergarten program

To estimate the long-run costs and benefits of a universal preschool education program, we must make assumptions about the characteristics of the program. Our study assumes that a prospective universal preschool would take the form of a voluntary, high-quality, publicly funded prekindergarten program that is modeled on the Chicago Child-Parent Center program, described in detail earlier in our report. The proposed program would operate 3 hours per day, 5 days a week, for 36 weeks a year (the traditional school year) or a total of 540 hours.²¹ The program would be available to all 3- and 4-year-old children regardless of family income.²²

Classrooms in this prospective program would be small: Each classroom would contain a maximum of 17 children. Additionally, each classroom would have at least two overseeing staff members, a lead teacher and a teaching assistant, which would permit a low student-to-teacher ratio of 17 to 2. The lead teachers in a classroom would all have bachelor's degrees (or higher) with certification in early childhood education. They would also be encouraged to pursue professional development opportunities. The teaching assistant in each class would have at least an associate's degree. As a further incentive for quality, teacher and staff pay would be high relative to most existing preschool programs. Their compensation would follow the salary schedules of the public schools.

Each classroom's curriculum would have a strong focus on language and pre-reading skills, mathematics such as counting and number recognition, science, social studies, health and physical development, and social and emotional development. The prekindergarten program would also provide several auxiliary services such as health screenings, speech therapy services, and home visitations, allowing for comprehensive monitoring of a child's educational, physical, mental, and social development.

Further, parental involvement in the form of volunteering or classroom engagement would be encouraged. We assume that the prekindergarten education program would be housed in public schools, community centers, or private child care centers that meet quality standards. All costs of the prekindergarten program would be paid for with public funds.

The effects of high-quality prekindergarten on non-low-income children and children who would, in its absence, attend some other form of preschool

Numerous studies have examined the long-term effects of prekindergarten programs on the outcomes of participating children. Yet most of these studies have focused on low-income children and children at high risk for educational failure. Prekindergarten programs that have served children from middle- and upper-income families have generally not been subject to carefully controlled studies with long-term follow-up of participants and a control group of non-participants. Thus, the effects of prekindergarten programs on middle- and upper-income children are not as well understood.

Still, there are good reasons to expect that a universal program would generate significant benefits but not generate the same magnitude of benefits per participant or the same high rate of return as a program targeted to relatively disadvantaged children. There are also reasons to believe that the benefits of a high-quality prekindergarten program like the Chicago Child-Parent Centers, which served high-risk children from low-income families, will not apply fully to medium-risk children (from middle-income families) and low-risk children (from high-income families) who would otherwise attend no prekindergarten.

Finally, there are reasons to believe that the benefits of a high-quality prekindergarten program like the Chicago CPC program—one that compared outcomes for children who attended a high-quality prekindergarten program to outcomes for children who (for the most part) attended no prekindergarten—will not apply fully to children who would otherwise attend some form of preschool education program. Children who are likely to enroll in a public universal program may be somewhat more likely to otherwise attend some form of preschool education in comparison to children who attend targeted programs. This means that the benefits per participant and the overall benefit-to-cost ratio of a universal prekindergarten program are likely to be smaller than those of a more targeted prekindergarten program.

At the same time, the total benefits of a universal program will be larger than those of a targeted program to the extent that benefits of prekindergarten for middle- and upper-income children exist. The ratio of benefits to costs of a universal program, while smaller than that for a targeted program, may still be large enough to justify public investment in a universal program. But to estimate the costs and benefits of a universal prekindergarten program, we have to address the caveats described above. Specifically, we have to make two key determinations:

The total benefits of a universal program will be larger than those of a targeted program to the extent that benefits of prekindergarten for middle- and upper-income children exist.

- To what extent will the benefits of a high-quality, prekindergarten program like the Chicago CPC program, which served high-risk children (from low-income families), apply to medium-risk children from middle-income families and low-risk children from high-income families who would otherwise attend no prekindergarten?
- To what extent will the benefits of a high-quality prekindergarten program, like the Chicago CPC program that compared outcomes for children who attended a high-quality prekindergarten program to outcomes for children who (for the most part) attended no prekindergarten, apply to children who would otherwise attend some form of prekindergarten?

In answer to the first question, as detailed in the appendix, the empirical research shows that all children, regardless of whether they are from poor, middle-income or upper-income families, benefit from high-quality prekindergarten. But studies differ on the degree of impact that prekindergarten has on children from different economic backgrounds. Some studies find that the positive effects of prekindergarten on children from more- and less-advantaged backgrounds are nearly identical. Other studies suggest that children from low-income families gain more from prekindergarten than do children from middle- and high-income families. Finally, some studies suggest that for some skills, lower-middle-income children gain more than poorer or wealthier children.

Differential benefits for children from different socioeconomic backgrounds manifest themselves in at least two ways. First, there is a baseline effect: Different socioeconomic groups have different rates of everything from special education to child abuse to criminal behavior to smoking. These different baselines can be thought of as “room-for-improvement” effects. Second, there may be a differential treatment effect: For reasons not captured fully by the baseline differences, different children may see greater or lesser treatment effects from prekindergarten. Our estimating procedure takes into account both of these factors, using a variable-specific estimate for the first factor based on data for the diverse levels of social and academic problems experienced by children from different family incomes. For the second factor, we use an average estimate of the relative impact of prekindergarten on children from different family incomes.

For the second factor, we also use the available empirical data to calculate a likely range of these possible effects: high (100 percent), low (40 percent), and intermediate or most likely (79 percent) estimates. In the discussion below describing the estimated costs and benefits of the program, we use the intermediate range esti-

mate. But a sensitivity analysis is performed (described later on) to demonstrate what effect different estimates have on the final results. Taking into account both factors—baseline adjustments and treatment effect attenuations—our intermediate estimate assumes that middle- and upper-income children receive on average only 56 percent of the reduction in the need for special education, 28 percent of the decline in grade retention, 16 percent of the reduction in child maltreatment, 55 percent of the drop in juvenile and adult crime, 49 percent of the decrease in smoking, and 34 percent of the lessening of depression experienced by relatively disadvantaged children.

In answer to the second question, again discussed in much greater detail in the appendix, the literature shows that there is evidence that existing prekindergarten programs (private and public) provide important benefits to participants compared to children who attend no prekindergarten. In addition, higher-quality prekindergarten programs provide greater benefits than lower-quality programs. Hence, children moving from low- or medium-quality prekindergarten to high-quality prekindergarten should not gain as much as children moving from no pre-K to high-quality pre-K. We use empirical data to provide a range of estimates: high (100 percent), low (30 percent), and intermediate or most likely (76 percent).²³ In our estimates below of the costs and benefits of a voluntary, high-quality universal prekindergarten program, we use the intermediate estimate but our sensitivity analysis includes the results from the full range of estimates.

Combining baseline adjustments, treatment attenuation effects, and prior preschool attendance attenuation effects, we assume that non-low-income children experience 42 percent of the reduction in the need for special education, 21 percent of the decline in grade retention, 12 percent of the reduction in child maltreatment, 42 percent of the drop in juvenile and adult crime, 26 percent of the lessening of depression, and 37 percent of the decrease in smoking experienced by low-income children.²⁴

Enrollment in universal prekindergarten

Given that the prospective universal prekindergarten program would be both voluntary and available to all 3- and 4-year-olds, we had to estimate its prospective enrollment. As explained in detail in the methodology appendix, based on the enrollment rates for the five states and the District of Columbia that have publicly funded universal pre-K programs, we assume that the enrollment rate would be approximately 86 percent. Below, we translate the measured impacts of

the Chicago CPC program into estimates of how public investment in a universal, high-quality, prekindergarten program would affect future government finances, the economy, earnings, and crime and health, using the attenuations described above for children from middle- and upper-income families, and for children who in its absence would have attended some other preschool.

Total benefits of investment in a universal prekindergarten program

The annual budgetary, earnings, health, and crime benefits of a voluntary, high-quality, publicly funded, universal prekindergarten program would begin to outstrip the annual costs of the program within eight years after full phase-in and would do so by a growing margin every year thereafter. By the year 2050, the annual benefits would total \$304.7 billion: \$81.6 billion in government budget benefits, \$108.4 billion in increased compensation of workers, and \$114.7 billion in reduced costs to individuals from less crime and child maltreatment and better health. These annual benefits in 2050 would exceed the costs of the program in that year by a ratio of 8.9 to 1. Broken down by state, in 2050 the total annual benefits would outstrip the annual costs of the program by a minimum of 6.7 to 1 for residents of South Carolina and by as much as 36.5 to 1 for the residents of the District of Columbia. (See Figure 7.)

The District of Columbia and Vermont stand out with particularly high ratios of total annual benefits to program costs. This can be attributed to the fact that they both already have high levels of prekindergarten enrollment in state-sponsored programs and are investing heavily in them. It would take relatively little investment beyond what is already being provided to support a universal prekindergarten program in either of these places, and both areas would experience significant budgetary benefits from the cost-sharing with the federal government that is proposed in this study. Although neither area would experience significantly greater benefits from universal prekindergarten than would other states, the additional costs of providing universal prekindergarten in the District of Columbia and Vermont would be relatively low, and the ratio of benefits to costs would thus be high. (The annual costs and budgetary, earnings, crime, and health benefits are further detailed below.)

The District of Columbia and Vermont stand out with particularly high ratios of total annual benefits to program costs.

FIGURE 7

The State-By-State Costs and Benefits of a Universal Prekindergarten Program

In 2050, we can estimate the following benefits from a universal prekindergarten program. All monetary values are in millions of 2014 dollars.

State	Government benefits (\$)	Increased compensation (\$)	Savings to individuals (\$)	Total benefits (\$)	Ratio of total annual benefits to program costs
NATIONAL	81,589	108,400	114,732	304,722	8.9
Alabama	1,068	1,384	1,501	3,953	7.1
Alaska	279	372	509	1,160	10.4
Arizona	2,098	2,764	3,116	7,977	8.9
Arkansas	676	799	1,015	2,490	10
California	11,480	15,887	18,957	46,324	8
Colorado	1,541	2,338	2,120	5,999	9.8
Connecticut	932	1,256	988	3,176	10.4
Delaware	242	340	418	1,000	9.4
District of Columbia	145	134	200	479	36.5
Florida	4,360	6,045	6,416	16,821	8.7
Georgia	2,710	3,507	3,881	10,098	7
Hawaii	376	526	449	1,351	7.3
Idaho	444	692	667	1,804	7.2
Illinois	3,053	4,243	3,573	10,868	9.9
Indiana	1,611	2,254	1,886	5,751	7.5
Iowa	666	933	845	2,443	9.3
Kansas	769	1,056	895	2,720	9.8
Kentucky	1,003	1,187	1,257	3,447	11.5
Louisiana	1,089	1,217	1,868	4,174	9.5
Maine	223	310	284	817	15.2
Maryland	1,621	2,278	2,023	5,922	8.8
Massachusetts	1,438	2,238	1,435	5,111	7.8
Michigan	2,066	2,817	3,246	8,129	9.7
Minnesota	1,458	2,142	1,667	5,267	8.5
Mississippi	684	865	1,061	2,609	9.1
Missouri	1,435	2,041	1,675	5,151	8.2
Montana	230	293	398	921	9.6
Nebraska	501	655	617	1,773	9.5

Nevada	847	1,178	1,500	3,525	7.4
New Hampshire	268	488	257	1,013	11.2
New Jersey	2,116	3,022	2,364	7,501	9.5
New Mexico	568	646	1,063	2,277	10.8
New York	5,699	5,634	8,145	19,478	12.8
North Carolina	2,369	3,091	3,252	8,712	7.2
North Dakota	169	236	257	663	10.6
Ohio	2,651	3,280	3,753	9,684	8.5
Oklahoma	818	1,118	1,295	3,231	11.1
Oregon	1,030	1,437	1,543	4,010	12.4
Pennsylvania	3,147	3,727	4,031	10,905	10.4
Rhode Island	245	310	254	809	10.6
South Carolina	991	1,467	1,355	3,814	6.7
South Dakota	217	325	308	850	11.9
Tennessee	1,570	1,985	2,273	5,827	7.9
Texas	7,694	11,627	10,987	30,308	8.2
Utah	1,029	1,767	1,591	4,387	7.8
Vermont	135	166	139	439	35.6
Virginia	2,225	3,615	2,350	8,189	9.1
Washington	1,933	2,880	2,320	7,133	7.8
West Virginia	333	374	439	1,145	16.4
Wisconsin	1,445	1,778	2,246	5,468	17.9
Wyoming	161	221	293	675	8.1

Notes: All monetary values are in millions of 2014 dollars.

Source: Authors' analysis.

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Budget effects of investments in a universal prekindergarten program

We examine the budget effects through the year 2050 of launching a voluntary, high-quality universal prekindergarten program in 2016 for all 3- and 4-year-old children in America. For illustration purposes, we assume that the program would be fully phased in by 2017. We consider budget effects on the federal government and the combination of state and local governments. We also examine the budget effects on a state-by-state basis. Although responsibilities have shifted in the past and will continue to do so in the future over the 35-year timeframe used in this study, we assume that all levels of government will share in the costs of education, child welfare, criminal justice, and health care in the future in the same propor-

tions as they do today. Likewise, we assume that federal, state, and local tax rates will remain constant over the time period analyzed in this study. All the costs and benefits are expressed in real (inflation-adjusted) 2014 dollars.

We initially assume that the costs of the prekindergarten program will be evenly split between the federal and state governments. We will then examine the scenario where state governments pick up the full cost of the prekindergarten program.

A high-quality universal pre-K program would cost a little over \$5,800 per participant and could be expected to enroll nearly 7 million children in 2017 when it is fully phased in. As a result, the program would cost taxpayers about \$40.6 billion in 2017. Some of this money, however, is already being spent on related programs. Case in point: Forty states and the District of Columbia have publicly financed prekindergarten programs for children, some of whom would be enrolled in our proposed program. Similarly, states and the federal government pay for special education and Head Start services for young children, some of whom would attend our proposed program instead.

Hence, some of the current expenditures on state prekindergarten programs and some of the current expenditures on special education and Head Start services are for children who will be attending the proposed universal prekindergarten program. We assume that these expenditures would be used to pay for part of the proposed program. The bottom line is that our proposed high-quality universal prekindergarten program would require approximately \$26 billion in additional government outlays in 2017, once it is fully phased in.

Government costs initially reflect only the actual expenditures on the prekindergarten program. Eventually there will be some additional government expenditures due to the increased educational attainment of the preschool participants: Prekindergarten participants spend more time in high school and college because they are less likely to drop out of high school and more likely to go on college. Increased public costs at the high school level appear when the first cohort of participants turns 17, and increased higher education costs appear when the first cohort turns 18.

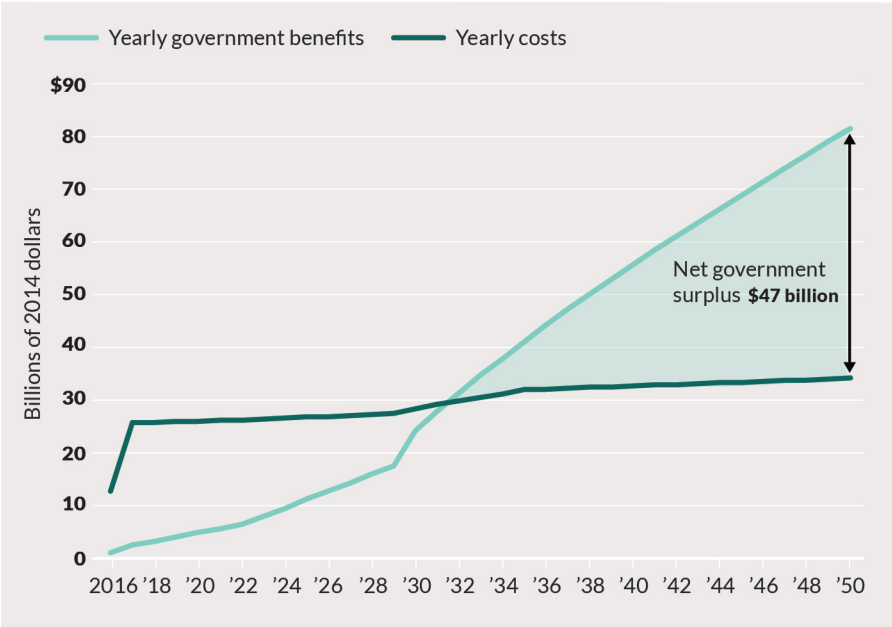
The offsetting budget savings begin small but grow rapidly over time, eventually outstripping the costs. Budget savings in the first year of the program will manifest themselves as reductions in child welfare expenditures as fewer children will be the victims of child abuse and neglect. In addition, some parents will take advantage of the universal prekindergarten program for some of their child care needs,

allowing them to work more and, thus, pay more in taxes. When the prekindergarten participants enter the K-12 public school system, additional budget savings will begin to appear, as these children will be less likely to repeat a grade or need expensive special education services. When the first cohort of children turns 10, further budget savings will begin to be realized as lower juvenile crime rates will require less expenditure on the juvenile justice system. As adults, the prekindergarten participants will be less engaged in crime and working and earning more. Thus, there will eventually be savings to the adult criminal justice system and increased tax revenue derived from the labor of prekindergarten participants. In addition, as adults, the pre-K participants will experience fewer episodes of depression and reduced rates of smoking, which will reduce public health care system expenditures.

For the first 15 years of a fully phased-in national universal prekindergarten program, costs exceed offsetting budget benefits, but by a declining margin. Starting in 2032, offsetting budget benefits exceed costs by a growing margin each year. Annual revenue impacts and costs are portrayed in real terms in Figure 8. Figure 9 shows the annual net budget impact in real terms.

FIGURE 8
Budget Costs and Benefits of a Universal Prekindergarten Program

It takes 16 years of a fully phased in universal prekindergarten program for the budget benefits to offset the program's costs.



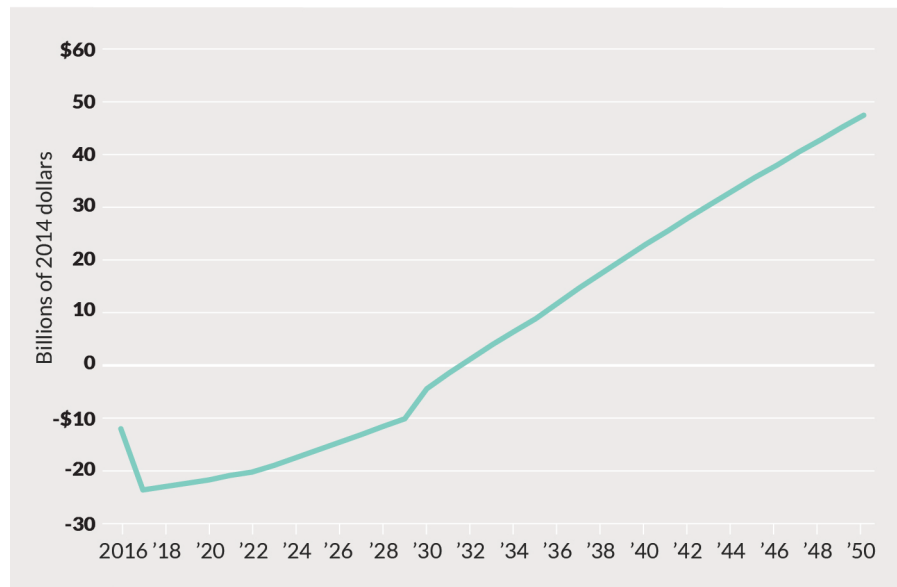
Source: Authors' analysis.
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In the second year of the program, 2017, when the program is fully phased in, government outlays exceed offsetting budget benefits by \$23 billion. The universal pre-K program-related deficit shrinks for the next 14 years. By the 16th year of the program, in 2032, the deficit turns into a surplus that grows every year thereafter culminating in a net budgetary surplus of some \$47.2 billion in 2050, the last year estimated, as illustrated in Figure 9. Thus, by 2050, every dollar spent on the program by taxpayers is offset by \$2.37 in budget savings in that year.

FIGURE 9

Net Benefits to Government Budget from a Universal Prekindergarten Program

By 2050, the net benefits to government exceed \$47 billion.



Source: Authors' analysis.
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The reason for the fiscal pattern seen in Figure 9 is because the costs of the program grow fairly slowly for the first decade and a half, in tandem with inflation and modest growth in the population of 3- and 4-year-old participants. But as the first and subsequent cohorts of participant children begin to use more high school and public higher education services, the costs grow at a somewhat faster pace for a few years. Budget benefits during the first two years result from reductions in child welfare spending due to lower rates of child maltreatment and from increased taxes on the earnings of parents due to subsidized child care. After the first two years, when the

first cohort of children starts entering the public school system, public education expenditures begin to diminish due to less grade retention and need for special education. After a decade and a half, the first cohort of children begins entering the workforce, resulting in increased earnings and thus higher tax revenues.

In addition, governments eventually experience lower judicial system costs due to less juvenile and, later, adult crime, starting when the first cohort of prekindergarten participants reaches age 10. Governments also experience lower public health care costs starting when the first cohort reaches age 18 as they have fewer episodes of depression and lower tobacco usage.

If the federal government did not share in the costs of the universal preschool program, the program would still be a worthwhile investment from the narrow perspective of state budgetary savings for most states.²⁵ States as a whole would experience net government budget savings within 23 years (2039), and by 2050, every tax dollar spent on the program would be offset by \$1.37 in budgetary savings for state governments. And in this scenario the federal government would be enjoying \$34.8 billion in surpluses in 2050.

State-by-state budget effects of a universal prekindergarten program

Our state-by-state estimates capture variation in costs and benefits due to factors such as population, income distribution, teacher salaries, crime rates, health care costs, tax burdens, and current expenditures on all levels of education, child welfare, criminal justice, and health care. If the cost of the universal prekindergarten program is shared evenly by the federal and state governments, then all states eventually realize budget benefits from a universal prekindergarten investment, but the timing and size of the benefits varies.

In 2017, a high-quality universal prekindergarten program enrolling nearly 7 million children nationwide would enroll as few as 11,800 children in the small state of Vermont and more than 891,000 children in the large state of California when it is fully phased in. Given offsets for expenditures on Head Start, special education, and existing state prekindergarten, the program (which would cost \$26 billion nationwide) would cost from as little as an additional \$6.7 million in Vermont to as much as an additional \$4.1 billion in California in 2017. (See Figure 10.)

FIGURE 10

Government Budget Effects of a Universal Prekindergarten by State

For a program that costs \$26 billion, a universal prekindergarten will generate net budget benefits in only 16 years. All monetary values in are millions of 2014 dollars.

State	Additional taxpayer costs in 2017 (\$)	Years before annual government benefits exceed costs	Government surplus in 2050 (\$)	Ratio of government benefits to costs in 2050
NATIONAL	25,983	16	47,172	2.37
Alabama	440	19	515	1.93
Alaska	67	14	167	2.50
Arizona	605	16	1,203	2.34
Arkansas	184	15	427	2.72
California	4,074	18	5,722	1.99
Colorado	428	16	931	2.53
Connecticut	242	14	627	3.06
Delaware	78	15	135	2.27
District of Columbia	9	2	132	11.05
Florida	1,301	17	2,419	2.25
Georgia	939	19	1,259	1.87
Hawaii	133	18	191	2.03
Idaho	176	20	194	1.77
Illinois	886	15	1,956	2.78
Indiana	629	18	841	2.09
Iowa	244	15	403	2.53
Kansas	224	14	492	2.77
Kentucky	232	14	704	3.35
Louisiana	389	15	651	2.49
Maine	42	11	169	4.14
Maryland	502	16	949	2.41
Massachusetts	571	17	787	2.21
Michigan	758	16	1,230	2.47
Minnesota	508	16	836	2.34
Mississippi	226	17	397	2.39
Missouri	534	17	809	2.29
Montana	77	14	134	2.39
Nebraska	149	14	314	2.68

Nevada	285	20	368	1.77
New Hampshire	77	15	178	2.96
New Jersey	615	15	1,323	2.67
New Mexico	145	15	358	2.70
New York	1,254	11	4,183	3.76
North Carolina	779	19	1,154	1.95
North Dakota	55	14	106	2.69
Ohio	1,041	16	1,508	2.32
Oklahoma	214	15	527	2.81
Oregon	239	13	707	3.19
Pennsylvania	965	14	2,098	3.00
Rhode Island	68	13	169	3.21
South Carolina	421	21	425	1.75
South Dakota	59	14	146	3.04
Tennessee	538	17	834	2.13
Texas	2,365	18	4,004	2.09
Utah	390	20	468	1.83
Vermont	7	2	122	10.93
Virginia	669	17	1,322	2.47
Washington	632	18	1,020	2.12
West Virginia	60	9	263	4.78
Wisconsin	234	10	1,140	4.73
Wyoming	65	17	78	1.94

Notes: All monetary values are in millions of 2014 dollars.

Source: Authors' analysis.

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Offsetting budget benefits (federal and state combined) outstrip costs nationwide within 16 years, but at the state level timing varies substantially. The total (federal and state) offsetting budget benefits exceed costs by state in as little as two years (2018) in the District of Columbia and Vermont and in as many as 21 years (2037) in South Carolina.

These differences in state budget benefits are driven by a multitude of factors. In general, states with greater current relative commitments to prekindergarten and other education programs, child welfare programs, criminal justice programs, and health care and those with higher tax burdens experience greater offsetting budget benefits than do other states. States with greater current commitments to

state prekindergarten programs need less additional public expenditure to finance the proposed high-quality prekindergarten program than do states with smaller current commitments to state pre-K programs. Since the proposed prekindergarten program generates budget savings in special education, K-12 education, child welfare, juvenile and adult criminal justice, and health care, states who are making larger financial commitments in these areas save more money than states who are making smaller financial commitments in these areas. Likewise, since the prospective prekindergarten program increases the future earnings of participants and their guardians, states with higher average pay and higher tax burdens will experience greater revenue increases than will states with lower average pay and lower tax burdens.

As noted above, by 2050, the last year estimated, the net nationwide budgetary surplus (federal and state combined) totals \$47.2 billion. The corresponding state-level surpluses due to the program vary from \$78 million in Wyoming to \$5.7 billion in California. Also previously noted, this yields a return to taxpayers averaging \$2.37 in offsetting budget benefits for every dollar spent on the program nationwide in 2050. The total return to state-level implementation is also favorable for every state. By 2050, for example, for every dollar being spent on the program in that year, a program in South Carolina will create \$1.75 in budget savings, and every dollar invested in the program in Vermont, West Virginia, and the District of Columbia would return to taxpayers more than \$10 in budget savings.

If the federal government does not share in the costs of the prekindergarten program and only maintains its current investments, the program generates budget surpluses in 47 states and the District of Columbia by 2050.²⁶ The three outlier states—Idaho, South Carolina, and Utah—also would generate budget surpluses but not until three or four years after 2050. Collectively, states experience net budget savings in 23 years (2039) with an average return per state tax dollar expended on the program of \$1.37 in 2050, but the returns per state tax dollar vary from a low of \$0.94 in South Carolina to a high of more than \$7 in Vermont and the District of Columbia in 2050. And in 2050, the federal government would be enjoying \$34.8 billion in budget surplus due to the prekindergarten investment made largely by states. (See Figure 11.)

FIGURE 11

State-by-state government budget effects of a state-funded universal prekindergarten program with federal maintenance of effort

Even when just state governments pay, almost all states would break even by 2050. All monetary values are in millions of 2014 dollars.

State	Years before annual budget benefits exceed annual costs	State government surplus in 2050 (\$)	Ratio of state government benefits to costs	Ratio of total state benefits to costs	Federal government surplus in 2050 (\$)
NATIONAL	23	12,400	1.37	7.96	34,772
Alabama	30	50	1.09	6.42	465
Alaska	19	50	1.46	9.54	117
Arizona	24	273	1.31	7.96	930
Arkansas	21	142	1.59	9.07	285
California	29	681	1.12	7.26	5,041
Colorado	21	258	1.44	8.96	673
Connecticut	16	237	1.79	9.22	390
Delaware	21	37	1.35	8.66	99
District of Columbia	3	80	7.17	33.06	52
Florida	25	486	1.25	7.76	1,933
Georgia	31	112	1.08	6.25	1,147
Hawaii	27	39	1.22	6.69	153
Idaho	*	*	0.95	6.45	205
Illinois	20	621	1.57	8.80	1,335
Indiana	28	133	1.18	6.64	709
Iowa	22	113	1.44	8.34	290
Kansas	19	166	1.61	8.80	326
Kentucky	16	281	1.97	10.37	423
Louisiana	21	208	1.48	8.67	443
Maine	14	74	2.40	13.68	95
Maryland	22	281	1.43	7.97	668
Massachusetts	26	159	1.25	6.94	627
Michigan	24	296	1.36	8.82	934
Minnesota	23	215	1.35	7.55	621
Mississippi	24	99	1.35	8.28	299
Missouri	26	150	1.24	7.23	659
Montana	19	38	1.41	8.88	96

Nebraska	17	113	1.62	8.58	202
Nevada	34	1	1.00	6.66	367
New Hampshire	20	48	1.54	9.87	130
New Jersey	19	442	1.56	8.45	881
New Mexico	19	133	1.65	10.05	225
New York	14	2,124	2.42	11.60	2,059
North Carolina	29	129	1.11	6.42	1,025
North Dakota	19	31	1.50	9.67	76
Ohio	23	410	1.36	7.60	1,097
Oklahoma	21	146	1.51	9.95	381
Oregon	17	236	1.76	11.32	471
Pennsylvania	15	881	1.86	9.40	1,216
Rhode Island	14	70	1.93	9.46	99
South Carolina	*	*	0.94	6.01	461
South Dakota	17	47	1.68	10.81	99
Tennessee	26	142	1.19	7.05	692
Texas	28	536	1.15	7.38	3,468
Utah	*	*	0.97	7.05	483
Vermont	5	65	7.04	35.52	58
Virginia	23	319	1.36	8.08	1,003
Washington	27	180	1.20	7.09	840
West Virginia	14	113	2.66	14.60	150
Wisconsin	12	570	2.94	16.65	569
Wyoming	27	11	1.13	7.40	67

*Program budget benefits do not exceed costs by 2050

Notes: All monetary values are in millions of 2014 dollars.

Source: Authors' analysis.

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It is important to understand that the ratio of government budget benefits to program costs in 2050 is a cash analysis that compares the impact on net government expenditures from the program to the additional taxpayer costs engendered by the program in 2050. Thus, for a publicly financed prekindergarten program, the government budget-to-cost ratio considers all the additional costs due to the program—but only the additional government budgetary benefits of the program—thereby ignoring the compensation, crime, and other benefits. Hence, the individual state government budget-to-cost ratios in Figure 11 indicate that from the taxpayers' perspective alone, the program fully pays for itself in 2050 in 47 states. This is an extraordinary finding as it may be rare to find government expenditures on a program creating offsetting budget savings such that the public

program pays for itself at the budgetary level. And looking just three or four years further out, the three states where the budget benefits alone do not cover the costs of the program in 2050 would do so if we extended the window of analysis.

Of course, once we add in the other benefits of the program, the universal prekindergarten program more than pays for itself in all 50 states. Indeed, the ratio of total state benefits to state program costs in 2050, when states pay for the universal program and the federal government simply maintains its current efforts in prekindergarten, varies from a minimum ratio of 6.01 to 1 in South Carolina to 35.53 to 1 in Vermont. In fact, the non-budgetary benefits of the prekindergarten program are by themselves much greater than the costs of the program in all 50 states. Consequently, the budget benefits, even those in the few states where the budget benefits do not exceed the additional costs of the program in 2050 when states pay for most of the program, should be seen as bonuses that are in addition to the other non-budgetary benefits.

Economic effects of investment in a universal prekindergarten program

It would be unwise to judge the merits of investments in prekindergarten solely in terms of its budgetary effects. Government investments can affect the quality of life of citizens, justifying their expense even if their net costs are very large. Our national defense program, for example, generates hundreds of billions of dollars annually in budget deficits that may be justified by the collective national security those fiscal outlays provide.

The benefits of prekindergarten include the health and well-being of citizens, the earnings of workers, crime rates, global competitiveness, and numerous other factors. Many of these other benefits may not be easily defined or measured in financial terms, just as the value of collective national security may be difficult to monetize. But these other benefits still exist. Some of the non-budgetary benefits of prekindergarten, however, are measurable in dollar terms. Indeed, benefits that did not accrue to government finances but were measurable represented a sizeable portion of the total benefits found in studies of high-quality prekindergarten programs. In fact, 73 percent of the estimated total benefits found for the Chicago Child-Parent Centers program and 81.4 percent of the total benefits of the Perry Preschool program went to groups aside from government.²⁷

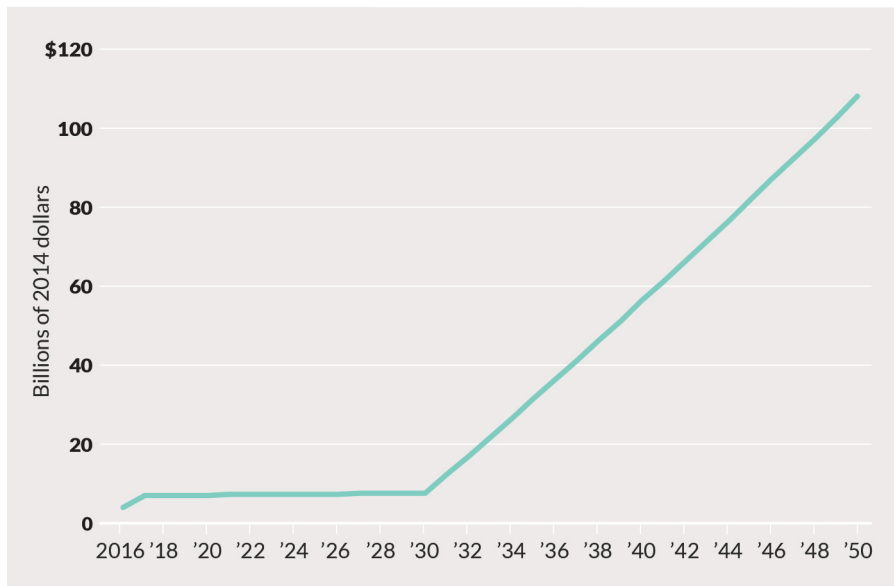
Among the other quantifiable benefits of prekindergarten investment are its impact on the future economy and the earnings of participants and the guardians

of participants. Our research shows that the impact of a universal pre-K program on the economy increases the compensation (wages plus fringe benefits) of participants who attend prekindergarten and their parents. The initial increase in earnings and compensation occurs in 2016 when some of the guardians of prekindergarten participants take advantage of the subsidized child care provided by the pre-K program and enter the labor force or increase the hours they work. Later, in 2031, when the first cohort of participating children turns 18 and enters the labor market, there is a sharp increase in earnings and compensation. By 2050, the increase in post-tax compensation due to prekindergarten investment amounts to \$108.4 billion and results in an economy that is \$234 billion or 0.6 percent larger in 2050 than it otherwise would have been. This averages to an increase in compensation of \$1,832 (in 2014 dollars) for each pre-K participant plus an increase in average compensation of \$1,202 (in 2014 dollars) for the guardians of each prekindergarten participant prior to taxes. (See Figure 12.)

FIGURE 12

Annual Increases in Post-Tax Compensation from Universal Program

By 2050, a universal prekindergarten program will increase worker compensation by \$108.4 billion.



Source: Authors' analysis.
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The increased compensation for guardians estimated here is likely to be conservative, as we assume that guardians gain only during the two years in which their child is enrolled. In reality, two additional years of labor force participation early

in a career are likely to generate beneficial earnings effects for the rest of a worker's life. These increased earnings are not captured in the above estimates.

In addition, and more importantly, our estimated increase in earnings and GDP growth is likely to be understated because we assume no feedback effects on the economy from the increased earnings. In other words, we do not take into account the fact that prekindergarten participants and their guardians are likely to spend a significant part of their increased earnings, thereby stimulating demand, business sales, production, job creation, and economic growth.

State-by-state compensation gains from universal prekindergarten investment

By 2050, the post-tax increase in compensation due to universal prekindergarten investment is estimated to vary from \$134 million in the District of Columbia and \$166 million in Vermont to more than \$15.9 billion in California. (See Figure 7 on page 34.) The average increase in pre-tax compensation per each pre-K participant varies from less than \$1,500 (in 2014 dollars) in West Virginia, Oklahoma, Louisiana, and the District of Columbia to \$2,462 in New Hampshire. The increase in the average compensation of the guardians of pre-K participants varies from less than \$600 in the District of Columbia, Vermont, and West Virginia to more than \$1,700 in Alaska (both expressed in 2014 dollars).

Total state-by-state differences in compensation gains are largely due to differences in population, with more-populated states experiencing greater total compensation gains than less-populated states. But state-by-state variations in compensation gains also are due in part to the fact that state-by-state earnings were adjusted to reflect average annual pay variation by state. As a result, states with relatively high average annual pay experience larger compensation gains per pre-K participant and their guardians than do states with relatively low average annual pay.

Crime and health effects of universal prekindergarten investment

Investments in a universal prekindergarten program would reduce crime rates and improve health outcomes, thereby reducing the extraordinary costs to society of criminality and health care. Some of these reduced costs are savings to govern-

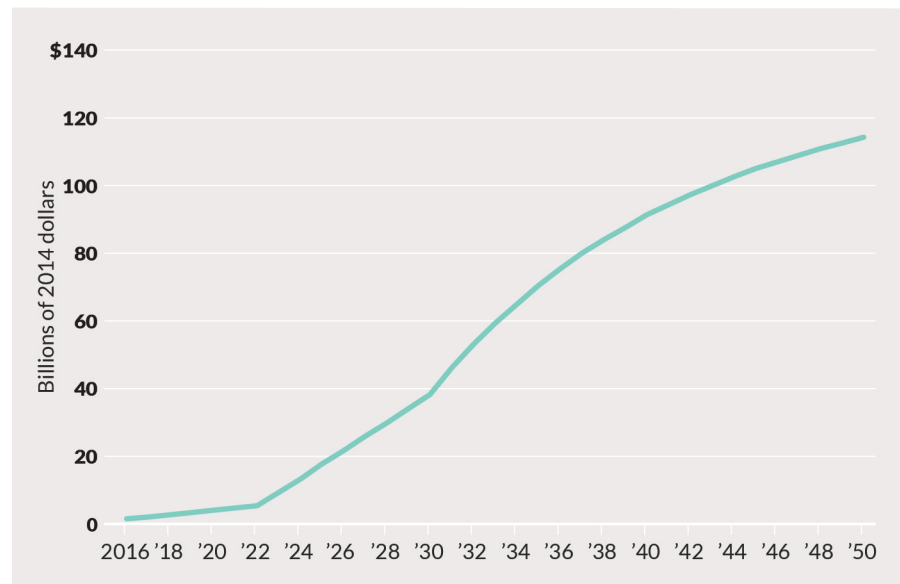
ment in the form of lower criminal justice system costs and public health care spending. These savings to government would total about \$26.7 billion in 2050 and were included in our earlier discussion of the fiscal effects of universal pre-K investment.

But there are other savings to society from reduced crime and better health. These include the value of material losses and the pain and suffering that would otherwise be experienced by the victims of juvenile crime, adult crime, and child abuse and neglect as well as the reduced private medical expenses to individuals from less smoking and depression. By 2050, these savings to individuals from less crime and better health amount to \$114.7 billion. Including the savings to government, the savings to society from reductions in criminality and better health due to investments in a universal pre-K program total \$141.5 billion. Figure 13 illustrates the benefits to individuals from prekindergarten-induced improvements in health and reductions in crime.

FIGURE 13

Yearly Savings to Individuals Due to Reduced Criminality and Better Health from Universal Program

In 2050, society will save \$114.7 billion more just from reduced crime and better health.



Source: Authors' analysis.
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State-by-state crime and health savings from universal prekindergarten

The public health care and criminal justice savings to state governments in 2050 were included in our earlier discussion of the fiscal effects of universal pre-K investment. But the private individual health care and crime savings, by state, were not. By 2050, the savings to individuals from less child abuse and crime and better health amount to \$138.5 million in Vermont and to \$19 billion in California. (See Figure 7 on page 34.)

Total crime and health savings will tend to be larger in states with large populations than in ones with small populations, where there are fewer total crimes. But variations in state-by-state crime and health savings are also due in part to variations in current state financial commitments to child welfare, criminal justice, and health care. States that are spending relatively more on their child welfare programs, criminal justice system, and health care infrastructure will save relatively more than states that make smaller relative commitments in these areas. Similarly, savings to individuals from less crime and child abuse will tend to be greater in states with relatively high crime and child abuse rates compared to states with relatively low crime and child abuse rates.

Aside from positive budget implications, earnings effects, and crime and health impacts, there are other benefits from a high-quality pre-K program that we have not evaluated. There may have been costs that we have omitted from our analysis as well. Many of these costs and benefits are difficult to measure or monetize. Some of these omitted costs and benefits are described in the next section.

Omitted costs and benefits of targeted and universal prekindergarten

The ultimate costs and benefits of a nationwide universal prekindergarten program enrolling nearly 7 million children per year could turn out to be higher or lower than what we have estimated. For illustration purposes, this analysis assumes the launch of a universal pre-K program on a national scale immediately in 2016, with full phase-in by 2017. But for practical purposes—such as the recruitment and training of teachers and staff, and the finding of appropriate locations—a large-scale pre-K program would have to be phased in over a longer period. There may be start-up costs associated with the scaling up of pre-K investment that have not been considered. Likewise, the quality of teachers and other staff may not be as good, or the teachers and staff may not be as highly motivated, as those in the Chicago CPC program, which would adversely affect the benefits of the program.

Importantly, though, the total benefits of prekindergarten investment are understated in our estimates, with the omitted benefits surely outweighing any omitted costs. For instance, we have not measured the financial savings to families who place their children in the publicly funded program but who, in its absence, would have paid the costs of private preschool.²⁸ Since about one-quarter of all families with 3- and 4-year-old children place their children in private preschool programs, the savings to families from the use of publicly funded prekindergarten are potentially very large, especially for a universal program. If the average private program costs only half what the publicly funded universal program costs and only 60 percent of children in private programs moved to the universal, high-quality, public program, then families who moved their children into the publicly funded prekindergarten program would save more than \$3 billion annually.

A large, nationwide universal prekindergarten program would have a greater potential than smaller programs to improve the subsequent school atmosphere for everyone, not just pre-K participants. Raising the academic performance while lowering the drug and criminal activity of the majority of children who attend high-quality prekindergarten should benefit the other non-participating children who subsequently attend kindergarten through high school with them.

In addition, if most children attend a high-quality pre-K program, then the improvements in academic performance, the reductions in crime and school failure, and the boosts to employment and earnings may be reinforcing and could produce much larger prekindergarten effects than those we have estimated in our analysis. As a consequence, there may be some multiplier effects on the economy from the higher-skilled, more productive, and higher-earning universal pre-K participants.

There is also some evidence that a universal program may increase the effectiveness of prekindergarten education to the extent that a universal program integrates children from different socioeconomic backgrounds. Carlota Schechter of St. Joseph's College and the RAND Corporation's Heather Schwartz both find that low-income children in economically integrated schools and preschools fare better than comparable children in programs that served only low-income children.²⁹

Perhaps most important in terms of omitted benefits, we do not calculate the potentially positive effects on the children born to prekindergarten participants who (as parents) will have higher earnings and employment, lower incarceration rates, and better health. Prekindergarten is an investment in the parents of the future who, as a result of that early childhood education, will be able to provide

better educational opportunities to their own children. Hence, the children of prekindergarten participants may be able to earn more and lead better lives. If this intergenerational effect were properly accounted for, then the benefits of pre-K education may be substantially larger than those we have estimated in this study.

Benefits were further underestimated as we limited ourselves to only benefits for which it was possible to obtain monetary estimates. As a result, we left out benefits such as the value of lower drug use, the value of fewer teenage parents, and the value of greater self-sufficiency and less welfare dependency when participants become adults. Similarly, but perhaps more importantly, we omitted the intrinsic value of the increase in the knowledge, skills, and literacy of students, and the potentially greater levels of happiness and job satisfaction that pre-K participants will experience as adults.

We also left out the value of other likely but difficult-to-quantify benefits of pre-kindergarten. Given the correlation between education attainment and voting, we failed to include the value of the greater involvement of citizens in the democratic process that is likely to result from pre-K participation. In total, the value of the omitted benefits are likely to exceed the value of the omitted costs, and the total benefits and the benefit-cost ratios of both the targeted and the universal programs are likely to be larger than those we have presented in this paper.



Conclusion

If the ultimate aim of public policy is to promote the well-being of individuals, families, communities, and nations, then investment in early childhood education is clearly an effective strategy. Investing in high-quality prekindergarten can help us achieve a multitude of social and economic development objectives including strengthening economic growth, increasing incomes, creating jobs, reducing poverty, tempering inequality, improving education, reducing crime, and ameliorating health. Moreover, high-quality pre-K helps to create the conditions that enable people to achieve their potential, live lives of dignity, and maximize their choices.

A high-quality, nationwide commitment to early childhood development would cost a significant amount of money upfront, but it would have a substantial payoff in the future. Our political system, with its two- and four-year cycles, tends to underinvest in programs with long lags between when investment costs are incurred and when benefits are enjoyed. The fact that state and local governments cannot capture all the benefits of prekindergarten investment may also discourage them from assuming all the costs of pre-K programs. Yet the economic case for public investment in prekindergarten is compelling.

A case for public investment in either a targeted or a universal prekindergarten program can be made with the best policy depending in part on whether a higher value is placed on the ratio of benefits to costs (which are higher for a targeted program) or the total net benefits (which are higher for a universal program). Obviously, however, when policymakers weigh the benefits of investment in a targeted versus a universal program, other criteria should be taken into consideration. If public funds are limited, a targeted program may be more attractive to policymakers as it is less expensive to implement. Likewise, if a larger priority is placed on narrowing the achievement gap between children from low-income and upper-income families than on promoting economic growth, then the targeted program may be more effective.

Although a universal prekindergarten program available to all children may not narrow socioeconomic-based achievement gaps as much as a targeted program, it is likely to generate greater future economic growth. It may also garner greater public support and thus be more likely to achieve the high quality necessary for optimal results. In addition, children who are not eligible for a targeted program can benefit from high-quality pre-K, and targeted programs frequently fail to reach many of the children they are designed to serve. A universal program not only

The economic and social benefits from prekindergarten investment amount to much more than just improvements in public balance sheets.

benefits middle- and upper-income children, but may also have larger effects than a targeted program for the most at-risk children.

The economic and social benefits from prekindergarten investment amount to much more than just improvements in public balance sheets. Investing in young children has positive implications for the current generation of children, for future generations of children, and for earlier generations of children. The current generation of children will benefit from higher earnings, higher material standards of living, and an enhanced quality of life. Future generations will benefit because they will be less likely to grow up in families living in poverty. And earlier generations of children, who are now working or in retirement, will benefit by being supported by higher-earning workers who will be better able to financially sustain our public retirement benefit programs such as Medicaid, Medicare, and Social Security.

In short, strengthening the economic and social conditions of our youth will simultaneously help provide lasting economic security to future generations as well as to all of us, including our elderly.

Investing in young children is likely to have enormous positive effects on the U.S. economy by increasing economic growth, improving the skills of the workforce, reducing poverty, and strengthening U.S. global competitiveness. Crime rates and the heavy costs of criminality to society are likely to be reduced. Health outcomes are likely to improve as well. Additionally, given that the positive impacts of prekindergarten may be larger for at-risk than for more advantaged children, a universal pre-K program may help to reduce achievement gaps between poor and non-poor children, ultimately reducing income inequality nationwide. In other words, investment in high-quality prekindergarten promotes equitable growth.

Clearly, no single public policy can bring about the rapid and simultaneous achievement of all of our development goals. But, just as clearly, policies do matter. At a time of sharp disagreement over solutions to the many social and economic problems we confront, we should take particular notice when there is a consensus across the political spectrum that the policy of investing in high-quality prekindergarten can powerfully affect many of our socioeconomic development goals. Although investment in early childhood education can help us achieve many socioeconomic development goals, such investment has a particularly potent and direct bearing on the well-being of children, the educational achievement and productivity of children and adults, health, and crime. All of these are areas where we have not only failed to achieve our potential, but also fallen short relative to other economically advanced nations.

We know that one of the most effective ways to promote faster and more widely shared economic growth is to raise academic achievement and narrow socioeconomic-based achievement gaps. Investment in universal high-quality prekindergarten does both. By raising academic achievement, it will improve well-being now and for future generations of Americans, and it will encourage long-term economic growth. By narrowing socioeconomic-based achievement gaps, high-quality universal prekindergarten will not only induce faster growth, it will also reduce income inequality. It will promote equitable growth.

Appendix I: Sensitivity analysis



In our discussion of the difficulties of estimating the costs and benefits of a universal program, we noted that we have to make two key determinations. First, we must consider the extent to which the benefits of a high-quality prekindergarten program such as the Chicago CPC program, which served high-risk children from low-income families, would apply to medium-risk children and low-risk children who would otherwise attend no prekindergarten. In simpler words, we must determine how large the treatment effects of pre-K are for non-low-income children. Second, we must take into account the extent to which the benefits of a high-quality pre-K program such as the Chicago CPC program, which compared outcomes for children who attended a high-quality prekindergarten program to outcomes for children who (for the most part) attended no pre-K, would apply to children who would otherwise attend some form of prekindergarten.

Middle- and upper-income children might (or might not) experience smaller positive impacts from prekindergarten than would low-income children. In our estimate of the costs and benefits of a universal program, we assumed based on the limited data that are available that middle-income and upper-income children would experience 79 percent of the impacts of prekindergarten experienced by low-income children. These (and the following) estimates of the impact of high-quality pre-K were then adjusted to account for the different levels of social and academic problems experienced by children from families with different incomes, which cut the effects of pre-K on non-low-income children nearly in half.

In addition, we assumed that participants who would have attended some other preschool program in the absence of the high-quality public program would experience only 76 percent of the impacts experienced by the Chicago CPC participants, unless they attended public prekindergarten, in which case it would average 60 percent. In other words, the attenuation of high-quality pre-K effectiveness to account for current preschool enrollment was assumed to be 24 percent to 40 percent with an average of 27 percent.

In the sensitivity analysis below, we examine the costs and benefits of universal pre-K when we both allow non-low-income children to experience as much as 100 percent and as little as 40 percent of the high-quality pre-K effects experienced by low-income children, and vary attenuation rates for current preschool enrollment

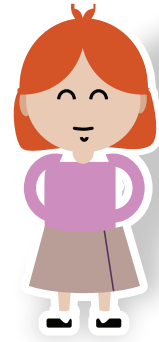
from as much as 70 percent to as little as 0 percent.³⁰ In all scenarios, we further attenuate effects to account for different levels of social and academic problems.

Our most conservative or lowest estimate of the effects of universal pre-K assumes impacts on non-low-income children that are only 40 percent of those for the Chicago CPC participants and attenuation due to current preschool enrollment of 70 percent. Our highest estimate of the effects of universal pre-K assumes impacts on non-low-income children that are 100 percent of those for the Chicago CPC participants and attenuation due to current preschool enrollment of 0 percent.³¹

Our lowest and highest estimates of the effects of universal pre-K investment suggest that this investment would generate a total budgetary surplus of at least \$23 billion and as much as \$67.1 billion in 2050, a return per tax dollar invested in 2050 of at least \$1.70 and as much as \$2.88, an increase in compensation in 2050 of between \$73.5 billion and \$139.1 billion, and savings to individuals from better health and less crime and child abuse that vary from a low of \$78.9 billion to a high of \$143.2 billion in the year 2050. Our sensitivity analysis suggests that the total benefits of the universal program in 2050 would vary from a low of \$208.3 billion to a high of \$385.1 billion, exceeding the total costs by a ratio of at least 6.3 to 1 and by as much as 10.8 to 1.

In other words, even adjusting for a very wide range of estimates for the effects of current preschool participation and the impact of high-quality prekindergarten education on children from different economic backgrounds, high-quality universal prekindergarten delivers substantial long-run benefits for government budgets, the economy, crime reduction, and health outcomes. Pre-K participants, their families, and society at large all benefit from publicly financed prekindergarten. Although the government budget benefit-cost ratio of a national-scale prekindergarten program could be somewhat higher or lower than the preferred estimate presented in this paper, it is improbable that this ratio would be less than the 1-1 ratio necessary for the program to eventually pay for itself.

Appendix II: Methodology



Estimating the benefits of investments in prekindergarten

To estimate the benefits of investments in prekindergarten, we used a five-stage methodology, based on the assumption that a universal pre-K program like the Chicago CPC would be launched across all states in 2016.³²

1. We start with an explanation of the child population estimates through the year 2050 for use in our national and state simulations.
2. Then, we describe government costs and savings and the calculations for private savings from less crime, better health, and increased compensation.
3. Next, we estimate the attenuation of prekindergarten effects for middle- and upper-income children for baseline and treatment effect differences, and for all children to account for prior preschool attendance.
4. Then, we estimate the enrollment rates.
5. Finally, we accrue the adjusted costs and savings through 2050 to understand the long-term benefits and costs of a universal prekindergarten program.

Estimating the child population through 2050

In our methodology, we multiply the annual costs and savings per child by the annual child population estimates (or pre-K participation rates) for both states and the nation through 2050 to show the cumulative impact of a universal prekindergarten program.

As our baseline, we used the U.S. Census Bureau estimates of state and national populations of 3-year-olds in 2013, the latest year available from the Census.³³ To calculate projected preschool participation rates, we first projected the yearly population of 3-year-olds from 2013 to 2050. Because the Census Bureau has discontinued their state-level population projection series, we adjusted state and national Census population projections for years beyond 2013 with data from the University of Virginia's Demographic Research Group. Using the Hamilton-Perry method to extrapolate the 2010 Census population baseline, the center provides projections for five-year age cohorts in 2020, 2030, and 2040 by state.³⁴ We assume that the growth trajectory of the 0-to-4-year-old age group most closely aligns with that of the 3-year-old population. We then calculated the annual population growth rate of this 0-4 group for each decade between 2010 and 2020, 2020 and 2030, and

2030 and 2040. Next, we applied these rates to the 2013 state and national Census population estimate of 3-year-olds.³⁵ To extend these projections to 2050, we continued applying the 2030 to 2040 yearly growth rate through the last 10 years.

Costs and savings

In the second phase of our methodology, we calculate the costs and savings that a high-quality, universal prekindergarten program would yield. For costs, we calculate the per-child costs of the proposed program and the costs of increased high school and higher education usage. Similarly, for savings, we estimate the per-child savings from reduced special education program usage, grade retention, child welfare service needs, juvenile and adult crime, adult depression, and smoking, as well as the increases in the earnings, compensation, and taxes paid by participants and their parents. These costs and savings estimates are later used to evaluate the net costs or net benefits of the proposed program over time and in each of the 50 states and Washington, D.C.

Cost of proposed prekindergarten program

Reynolds and his colleagues estimate that the per-child cost of the Chicago Child-Parent Center program is \$4,400 in 1998 dollars.³⁶ To arrive at this value, they inflate a 1986 estimate of the program's cost using the Consumer Price Index for all Urban Consumers, or CPI-U, the broadest and most comprehensive measure of inflation generated by the U.S. Bureau of Labor Statistics. We recalculated the program costs in the following manner:

First, because the opportunity cost for parent participation is not a cost to government, we subtracted the imputed opportunity cost for parent participation from the program cost. Our parental time cost calculation was based on an assumed 10 hours of parent participation per month at the then-prevailing minimum wage of \$3.35 per hour. Second, we inflated the remaining program costs from 1986 to 2014 with the CPI-U.³⁷ To inflate the costs of the pre-K program from 2015 to 2050, we used projections by the Congressional Budget Office for an inflation rate of 2.4 percent annually through 2039 and 2.5 percent annually thereafter through 2050.³⁸

Based on the assumption that state-by-state variation is primarily due to differences in instructional staff salaries across states, we then varied the portion of the total program cost attributed to staff costs for instruction (47.15 percent) per

Reynolds and his colleagues.³⁹ To create this variation, we constructed a state instructional staff pay index using the 2012-13 average instructional staff salaries by state calculated by the National Education Association.⁴⁰ Because the original program was in Chicago, we used Illinois as the base for the index.

Program cost offsets

State and local governments and the federal government are currently spending money on a variety of early education programs for 3- and 4-year-olds such as prekindergarten education, Head Start, and special education. Our proposed high-quality prekindergarten education program would be a substitute for some of these existing early childhood programs, and we assume that some of the public monies spent on these other programs would be transferred to the funding of the universal program to offset some of its costs.

To avoid double counting these expenditures, we subtracted a portion of current spending on state public pre-K equal to the amount spent on a half-day per public pre-K participants who would be attending the proposed high-quality programs, by state, from the program costs. To determine enrollment in and expenditures on existing public pre-K programs, we used *The State of Preschool 2014* published by the National Institute for Early Education Research.⁴¹ In addition, given that the high-quality prospective pre-K program would attract children who in its absence would otherwise enroll in Head Start, we subtracted a portion of the Head Start expenditures⁴² equal to the amount spent on a half-day of Head Start per proposed prekindergarten participant who would otherwise have attended Head Start, by state, from the program costs to ensure that expenditures were not double counted. We estimated the amount spent on a half-day of Head Start by dividing the total Head Start expenditures by state by one plus the proportion of children enrolled for the full-day, five days a week in Head Start by state as reported by the National Institute for Early Education Research.⁴³

The federal government and state governments currently allocate funds for special education programs for 3- and 4-year-olds. Some 3- and 4-year-olds who require special education services will be enrolled in the proposed prekindergarten program, and we assume that these allocations will continue to fund special education programs for these children.

In order to find the per-recipient federal and state expenditures on special education, we first calculated the total expenditures per special education student. We

divided the federal Individuals with Disabilities Education Act Part B expenditure in 2012 (\$11.5 billion) by the total number of children served (6.4 million) to determine the average national federal expenditure per special education recipient in 2012.⁴⁴ To get the state-by-state federal expenditure in 2012, we varied the average national federal expenditure using a federal spending on special education index that we created from data calculated by the New American Foundation on federal IDEA spending by state.⁴⁵

We then divided the average federal expenditure per special education recipient in 2012 by the share of special education funding from the federal government⁴⁶ to estimate the total national expenditure per special education student in 2012. We subtracted the average national federal expenditure per recipient in 2012 from the total national expenditure per special education student in 2012 to derive the average state expenditure per special education recipient in 2012. Using a state-by-state special education expenditure index,⁴⁷ we varied the average state special education expenditure per recipient in 2012. Finally, we summed the average federal expenditure on special education per student by state with the average state expenditures on special education per student to get the state-by-state total special education expenditures per student in 2012. We inflated the 2012 figure to 2014 using CPI-U.⁴⁸

Once we obtained the state-by-state total expenditures, we could calculate the per-child state and federal cost offsets. Specifically, for each prospective pre-K participant who would require special education services, we apportioned two-thirds of current state-by-state total special education expenditures per recipient for funding the proposed pre-K programs. We assumed that this represented roughly 100 percent of special education monies spent on children who get a half-day or less of special education services and 50 percent of special education monies spent on children who get more than a half-day of special education services. To arrive at the cost offsets from reduced special education services during the pre-K years, we further adjusted these values by the proportion of children enrolled in special education programs during preschool.

Cost of increased high school usage

Reynolds and his colleagues found that Chicago Child-Parent Center participants completed 0.28 years more of education than did non-participants by age 25.⁴⁹ This imposes a cost on governments who must pay for the additional time spent by pre-K participants in public high schools or in publicly subsidized higher education.

We inflated state-by-state estimates of per-pupil expenditures on public K-12 education in 2011-12⁵⁰ to 2014 dollars using the Bureau of Labor Statistics estimate of inflation in the cost of elementary and high school tuition and fees.⁵¹ After 2014, we inflated expenditures using inflation projections of 2.4 percent annually through 2039 and 2.5 percent annually thereafter through 2050.⁵² We divided costs between the federal government and state and local governments using state-by-state estimates of the federal share of K-12 public school revenue.⁵³

A prekindergarten-induced increase in high school attainment can only be experienced by the students who would not graduate in the absence of the prekindergarten intervention. In addition, some of those who would not graduate in the absence of pre-K do graduate if they participate in prekindergarten.⁵⁴ For the latter group, an increase in their educational attainment is likely to be the result of an increase in higher education as well as an increase in high school attendance. We assumed that the increase in average educational attainment (0.28 years) reported by Reynolds and colleagues was spread evenly among the Chicago CPC participants and was divided between more high school and more higher education in proportion to a weighted average of graduates and non-graduates. Accordingly, we multiplied the treatment effect by one minus the average high school graduation rate and by 0.9 to account for the fact that only 90 percent of children attend public high schools. We then multiplied this product by the annual costs of high school to get the state and federal costs of additional high school usage per student.

Cost of increased higher education usage

As noted earlier, the Chicago CPC participants completed 0.28 years more of education than non-participants in the control group.⁵⁵ We assumed that some of the increased educational attainment was the result of participants going on to attend government-subsidized higher education institutions. As a result, a high-quality pre-K program would impose additional costs on governments by increasing the number of children who attend college. We calculated these additional costs as follows:

State-by-state estimates of state and local appropriations for higher education are available for 2014,⁵⁶ while state-by-state data on the distribution of federal higher education expenditures are only available through 2012.⁵⁷

To correct for this mismatch, we first calculated the three-year average state and local appropriation for higher education for 2012, 2013, and 2014.⁵⁸ Next, we

calculated the state-by-state proportion of federal higher education spending in 2012 and applied this distribution to the three-year average national federal higher education expenditure for 2012, 2013, and 2014⁵⁹ to estimate state variations for federal higher education expenditures.

We then divided both the federal and state average three-year expenditures by the total fall 2013 enrollment,⁶⁰ giving the average per-student per-year cost of higher education in 2013. These figures were inflated to 2014 values by the College Tuition and Fees Index.⁶¹ We assumed that the increase in average educational attainment of 0.28 years reported by Reynolds and colleagues was spread evenly among the Chicago CPC participants and was divided between more high school and more higher education in proportion to a weighted average of graduates and non-graduates.⁶² To account for this, we multiplied the treatment effect by the average high school graduation rate and by the inflation-adjusted average per-student per year cost of higher education in 2014, yielding estimates of the cost of increased higher education usage per participant for both the state and federal governments. We spread these per-participant costs in 2014 over a five-year period based on the assumption that people complete their college experience over a five-year timeframe from age 18 to 22.⁶³

Savings from reduced special education

Children who participated in the Chicago CPC program were 41.5 percent less likely to require special education and spent an average of 0.7 fewer years in special education than did children in the comparison group by age 18.⁶⁴

We multiplied our previously calculated state-by-state total expenditures on special education per student in 2014 by the CPC treatment effect on years spent in special education, yielding the per-participant savings due to decreased use of special education. The per-participant savings due to decreased use of special education was weighted to take into account the actual family income distribution of participants within the prospective pre-K program. We further adjusted these values by the proportion of children enrolled in special education programs. These savings were then divided between the state and federal governments using state-by-state estimates of the federal share of special education spending.⁶⁵ Total savings were spread over 13 years to arrive at the yearly savings from kindergarten through 12th grade as a result of less special education usage.

Savings from reduced grade retention

Children who participated in the Chicago CPC program were retained in a grade 40.1 percent less often than non-participants. The per-student per-year cost of K-12 education, calculated earlier, was multiplied by the average reduction in grade repetition for CPC participants, expressed in years (15.4 percent of a year assuming that children were retained in a grade for only one year), yielding the average per-participant reduction in expenditures on additional schooling related to grade retention. We multiplied these savings by a factor reflecting the larger baseline probability that children in the lowest quartile will repeat a grade and by a factor reflecting the smaller probability that children not in the lowest income quartile will repeat a grade,⁶⁶ weighted to reflect the family income distribution of the students in the prospective universal prekindergarten program.

The savings from less grade retention were then divided between federal and state governments according to their shares of the total spending on K-12 education and spread over the 13-year period from age 5 to age 17.

Child welfare savings from decreased maltreatment

Children who participated in the Chicago CPC program were 43 percent less likely to be victims of child abuse or neglect. This reduction in child maltreatment generates savings in child welfare.

The total federal and state (and local) expenditure aimed at addressing child abuse and neglect was estimated at \$28.2 billion in 2012.⁶⁷ This total reflects expenditures for child abuse and neglect in a wide variety of programs such as Title IV-E (foster care and adoption assistance), Title IV-B (child welfare services), Temporary Assistance for Needy Families, the Social Services Block Grant, and Medicaid. These monies were largely spent on child abuse and neglect-related activities such as investigations, foster care services, adoption services, and in-home services for “victims” and “non-victims.”⁶⁸

We divided the total government spending in 2012 on child abuse and neglect by the total child population in 2012 to estimate the per-child cost of child abuse and neglect in 2012. This per child cost was inflated to 2014 using CPI-U.⁶⁹ This cost was then multiplied by the reduction in the likelihood that a child would be the victim of maltreatment as a consequence of participation in the CPC program—

the so-called CPC child welfare treatment effect—yielding per-child government savings from reduced child abuse and neglect.

Children in families whose income is in the bottom quartile of the income distribution account for a disproportionate share of child maltreatment cases. Data from Andrea Sedlak and Dianne Broadhurst suggest that children in the poorest quarter of families account for approximately 57 percent of cases of child maltreatment.⁷⁰ For the universal program, we multiplied the average per-participant savings by a factor reflecting the greater overall usage of child welfare services by children in the bottom quartile of the family income distribution and by a factor reflecting the lower overall usage of child welfare services by children not in the bottom quartile of the family income distribution, weighted to take into account the actual income distribution within the prospective universal program. The resulting per-participant savings were adjusted to factor out savings that could only occur in the first three years of life: the years before a child could attend prekindergarten and experience any pre-K-induced reduction in maltreatment. The resulting adjusted per-participant savings from less maltreatment were divided between the state and federal governments using state-by-state data on the federal share of child welfare spending⁷¹ and spread over the 15 years from age 3 to age 17.

Savings from reduced juvenile crime

Children who participated in the Chicago CPC program were 42.3 percent less likely to be arrested by age 18 than were the children in the comparison group.⁷² This prekindergarten effect generates substantial potential savings in criminal justice system costs for policing, judicial and legal administration, and corrections. For each of these costs, there is a state and federal contribution.

First, we outline the method for calculating the costs for policing. Policing includes a broad range of activities that are not necessarily connected to crime. Thus, to not overestimate the costs of policing that go toward crime prevention, we focus only on the costs of arrests. To calculate the state per-juvenile costs of juvenile arrests, we multiplied the state-by-state violent and non-violent juvenile arrest rates⁷³ by per-arrest costs of violent and non-violent arrests⁷⁴ and summed these products.⁷⁵ There were nine states for which reliable arrest rates data were not available for 2012 because reporting coverage was less than 90 percent in the Federal Bureau of Investigation Arrest Statistics database.⁷⁶ For these states, we applied the national juvenile arrest rate for violent and non-violent crime. Data were also unavailable for the District of Columbia, which has historically experi-

enced a disproportionately high rate of violent crime arrests. To account for this, we calculated the average ratio of the juvenile violent crimes arrest rate in the District to the national rate of juvenile violent crime arrests using data from 1994 and 1995, the most recent years for which reliable Federal Bureau of Investigation data was available. We then multiplied this ratio by the national juvenile violent crime arrest rate in 2012, effectively tripling the juvenile violent crime arrest rate for the District of Columbia compared to the national average.

Unfortunately, there is no state-by-state data on the federal contributions to total per-juvenile cost of juvenile arrests. To best estimate these federal contributions, we used the following method. We multiplied the state per-juvenile cost of juvenile arrests (previously calculated) by the 10-to-17-year-old population⁷⁷ to get the total state costs of juvenile arrests. Next, we divided the national state cost of juvenile arrests by the total state and local policing direct expenditures from the U.S. Department of Justice⁷⁸ to get the share of costs for juvenile arrests. We multiplied this value by the federal policing direct expenditures to estimate the federal expenditure on the arrests of juveniles. This federal expenditure was then distributed, by state, by the state-by-state share of the national state cost of juvenile arrests and divided by the 10-to-17-year-old population to get state-by-state variation for the federal per-juvenile costs of juvenile arrests. Finally, we added the state-by-state costs of juvenile arrests per juvenile to the federal costs of juvenile arrests per juvenile by state to get the total cost of juvenile arrests per juvenile by state.

Second, we calculated the judicial and legal administration expenditures and corrections costs in the following manner. We acquired the state-by-state state and local judicial and legal administration and corrections direct expenditures from the U.S. Department of Justice.⁷⁹ The federal judicial and legal administration and corrections direct expenditures were not available by state, so we multiplied the state-by-state share of the national state and local expenditure by the federal total expenditure⁸⁰ to get state-by-state federal direct expenditure for judicial and legal administration and corrections. We summed the state and federal direct expenditures by state to get the total judicial and legal administration direct expenditure and the total corrections direct expenditure by state.

These expenditures were multiplied by the ratio of juvenile arrests to total arrests by state⁸¹ to get for each state the judicial and legal administration and corrections expenditures on juvenile crime. For the nine states and the District of Columbia where reliable data on juvenile arrests was not available for 2012, we applied the national ratio of juvenile to total arrests. The per-juvenile cost of juvenile judicial and legal administration and corrections were determined by dividing each state's

juvenile judicial and legal and corrections expenditure by their population of 10-to-17-year-olds. The per-juvenile cost of juvenile judicial and legal administration and the per-juvenile cost of juvenile corrections were inflated to 2014 by CPI-U.⁸²

To arrive at the total per-juvenile cost of juvenile crime, we summed the per-juvenile cost of juvenile arrests, the per-juvenile cost of juvenile judicial and legal administration, and the per-juvenile cost of juvenile corrections.

The total per-juvenile cost of juvenile crime was then multiplied by the CPC juvenile crime treatment effect to determine savings in criminal justice system costs due to high-quality prekindergarten. Our estimate of juvenile crime savings was multiplied by a factor reflecting the greater overall criminal justice costs for children in the bottom quartile of the family income distribution and by a factor reflecting the lower overall criminal justice costs for children not in the bottom quartile of the family income distribution, weighted to take into account the actual income distribution within the prospective universal program.⁸³

The savings in juvenile criminal justice system costs were apportioned between federal and state governments based on their shares of total spending on criminal justice in 2012⁸⁴ and spread over the eight-year period from age 10 through age 17.

Savings from reduced adult crime

Children who participated in the Chicago CPC program were 25.3 percent less likely to be arrested for felonies between the ages of 18 and 26 than were the children in the comparison group. This reduction in adult crime generates savings in criminal justice system costs for policing, judicial and legal administration, and corrections. For each of these cost savings there is a state and federal component.

The calculation for the savings from reduced adult crime resembles the methodology used for finding the savings from reduced juvenile crime.

Our first step was to calculate the costs for policing. To calculate the total per-adult cost of adult arrests, we multiplied the state-by-state violent and non-violent adult arrest rates per adult⁸⁵ by the per-arrest costs of violent and non-violent arrests⁸⁶ and summed these products.⁸⁷ For the nine states and the District of Columbia where reliable arrest rates were not available for 2012, we applied the national adult arrest rates for violent and non-violent crime. For the District of

Columbia, however, we tripled the national adult violent arrest rate while holding constant the total national adult arrest rate to reflect the disproportionately high rate of violent crime arrests that prevailed in the most recent years for which reliable data were available for the District. We inflated the per-adult cost of adult arrests to 2014 using the CPI-U.⁸⁸

State-by-state data on the federal contributions to total per-adult costs of adult arrests is unavailable. To estimate these federal costs, we multiplied the state per-adult cost of adult arrest (previously calculated) by the 18 and older population⁸⁹ to get the total state costs of adult arrests. Next, we divided the national state cost of adult arrests by the total state and local policing costs from the U.S. Department of Justice⁹⁰ to get the share of these costs attributable to adult arrests. Then, we multiplied this share by the federal policing direct expenditures to get the federal cost of adult arrests. This federal contribution was distributed, by state, by the state-by-state share of the national state cost of adult arrests and divided by the 18 and older population to get the state-by-state variation for the federal per-adult costs of adult arrests. These state-by-state costs of adult arrests per adult were added to the federal costs of adult arrests per adult by state to get the total cost of adult arrests per adult by state.

Our next step was to calculate the judicial and legal administration expenditures and corrections costs, per adult, attributable to adult crime. The total federal, and state and local, direct expenditure, as well as the state-by-state direct expenditures, on judicial and legal administration and corrections in 2012 was taken from the U.S. Department of Justice.⁹¹ The share of federal expenditures on judicial and legal administration and corrections attributable to adult crime in 2012 was estimated by multiplying the total federal expenditures⁹² by the ratio of adult arrests to total arrests.⁹³ The share of state by-state judicial and legal expenditures and corrections costs attributable to adult crime in 2012 was estimated by multiplying each state's expenditure by the ratio of that state's adult arrests to total arrests.⁹⁴ For the nine states and the District of Columbia where reliable data on adult arrests was not available for 2012, we applied the national ratio of adult to total arrests. The per-adult cost of adult judicial and legal administration was determined by dividing each state's adult judicial and legal expenditure by their 18-and-older population. We used the CPI-U to inflate the per-adult costs of adult judicial and legal administration and corrections to 2014.⁹⁵

To arrive at the total per-adult cost of adult crime, we summed the per-adult cost of arrests due to adult crime, the per-adult cost of judicial and legal administration due to adult crime, and the per-adult cost of corrections due to adult crime.

The total per-adult cost of adult crime was then multiplied by the CPC adult crime treatment effect to determine savings in criminal justice system costs due to high-quality prekindergarten. The savings in adult criminal justice system costs were apportioned between federal and state governments based on their shares of total spending on criminal justice in 2012.⁹⁶ We assumed that adults commit crimes over a 27-year period between the ages of 18 and 44 and thus, spread adult crime savings over the 27-year age period as described in a later section.

Adults in poverty have a higher propensity to commit crime and engage in criminal behavior. Hence, our estimate of adult crime savings was multiplied by a factor reflecting the greater overall criminal justice costs for children in the bottom quartile of the family income distribution and by a factor reflecting the lower overall criminal justice costs for children not in the bottom quartile of the family income distribution, weighted to take into account the actual income distribution within the prospective universal program.⁹⁷

Savings, increased compensation, and revenues from reduced incidence of depression

Children who participated in the Chicago CPC program were 26.4 percent less likely to report symptoms of depression between the ages of 22 and 24 than were the children in the comparison group. This reduction in depression generates savings in public and private health care costs and increases in earnings and tax receipts. For each of these cost savings and benefits, there is a state and federal component.

We used estimates of the workplace and health care costs of depression in 2010 from Paul Greenberg and others,⁹⁸ but excluded the costs attributable to co-morbidities. We divided the total costs of depression by the adult population in 2010 and allocated these costs to each of the 50 states and Washington, D.C. according to each state's prevalence of depression as a percentage of the total national prevalence.⁹⁹

We calculated the health care savings from reduced depression in a series of steps. First, we used estimates from Greenberg and colleagues to determine the share of the total costs, per adult and by state, of depression that is attributable to medical costs in 2010.¹⁰⁰ These per-adult and by-state medical care costs were then allocated to public and private health care according to the national shares of total health care spending from public and private sources.¹⁰¹ We further subdivided the public costs of medical care per adult and by state between state and federal

spending according to the state and federal shares of public health care spending.¹⁰² The average per-participant savings from reduced depression were multiplied by a factor reflecting the greater overall prevalence of depression among children in the bottom quartile of the family income distribution and by a factor reflecting the lower prevalence of depression among children not in the bottom quartile of the family income distribution, weighted to take into account the actual income distribution within the prospective universal program.¹⁰³ We then inflated the public and private medical costs per adult and by state to 2014 dollars by the CPI-U¹⁰⁴ and multiplied these costs by the Chicago CPC treatment effect to determine the state and federal public savings and private savings per adult in health care expenditures due to reductions in depression.

We calculated the increases in compensation and tax receipts from reduction in the incidence of depression due to pre-K in the following manner. We multiplied the previously calculated total costs of depression per adult per state by the percentage of these costs that were a consequence of lost earnings.¹⁰⁵ These 2010 figures were inflated to 2014 dollars by the CPI-U¹⁰⁶ and multiplied by the Chicago CPC treatment effect and state and federal tax rates.¹⁰⁷ We assumed that the reduction in depression starts at age 18 and continues through age 65.

Savings, increased compensation, and revenues from reduced smoking

Children who participated in the Chicago CPC program were 19 percent less likely to be daily tobacco smokers by age 26 than were the children in the comparison group. This reduction in smoking generates savings in public and private health care costs and increases in earnings and tax receipts. For each of these cost savings and benefits, there is a state and federal component.

First, we calculated the health care savings from reduced smoking. We used the Department of Health and Human Services' estimate of the aggregate health care spending due to smoking in 2012.¹⁰⁸ We divided this estimate by the adult population in 2012 and allocated the costs to each of the 50 states and Washington, D.C. according to each state's prevalence of daily smoking as a percentage of the total national prevalence.¹⁰⁹ The average per-adult savings from reduced smoking were multiplied by a factor reflecting the greater overall smoking prevalence among people in the bottom quartile of the family income distribution and by a factor reflecting the lower prevalence of smoking among people not in the bottom quartile of the family income distribution, weighted to take into account the actual income

distribution within the prospective universal program. These per-adult and by-state medical care costs were then allocated to public and private health care according to the national shares of total health care spending from public and private sources.¹¹⁰

We further subdivided the public costs of medical care, per adult and by state, between state and federal spending according to the state and federal shares of public health care spending.¹¹¹ We then inflated the public and private medical costs, per adult and by state, to 2014 dollars using the CPI-U¹¹² and multiplied by the Chicago CPC treatment effect to determine the state and federal public savings and private savings per adult in health care expenditures due to reductions in daily smoking.

Next, we calculated the increases in earnings and tax receipts from a reduction in the incidence of daily smoking due to pre-K using the following method: We inflated both the estimated earnings losses in 2006 from secondhand smoke exposure and the estimated earnings losses in 2007 from smoking to 2014 dollars by the CPI-U.¹¹³ We then summed these totals and divided by the adult population to derive the per-adult earnings losses in 2014 due to smoking. These earnings losses were allocated to each of the 50 states and Washington, D.C. according to each state's prevalence of daily smoking as a percentage of the total national prevalence.¹¹⁴ This procedure provided estimates of the per-adult earnings lost to smoking in 2014 by state. These earning losses were multiplied by the Chicago CPC treatment effect and state and federal tax rates to estimate the per-adult increase in federal and state tax revenues due to a pre-K-induced reduction in smoking.¹¹⁵ We assumed that the reduction in smoking starts at age 18 and continues through age 65.¹¹⁶

Savings from earnings and taxes for parents

A publicly funded prekindergarten program will effectively provide parents of 3- and 4-year-old children with free child care for the time (up to two years) that their children are in pre-K. As a result, parents of participating children will be more likely to enter the labor market, secure a position, earn income, and pay taxes. In addition, parents who are already working may increase their work hours, thereby earning more and paying more in taxes.

The average work year is approximately 1,789 hours,¹¹⁷ and the average commuting hours are about 189 hours per year.¹¹⁸ Considering that the prospective pre-K program lasts 540 hours per year for two years, we can calculate how much time the child care subsidy frees up for work for each of the two years by dividing 540

hours by the sum of the average hours worked and the average commuting time, a subsidy of 27.3 percent.

Parents who currently do not enroll their children in preschool could enroll their children in the prospective program and receive the subsidy. In addition, parents who send their children to a private preschool or private child care program could switch their children to public prekindergarten and benefit from the child care subsidy. Yet there are children who attend some form of public preschool and already receive this child care subsidy. To not overestimate the subsidy for children who would otherwise have publicly financed child care, we reduced the per-participant child subsidy by a factor proportionate to the percent of current public preschool and child care recipients to estimate an effective subsidy rate by state.¹¹⁹

Research suggests that the percentage-point increase in labor force participation for a given reduction in child care costs is about 0.2 or more.¹²⁰ There are data to suggest that this elasticity measure is greater than 0.2 for mothers with children under the age of 6, but to arrive at a conservative estimate of the employment effect of subsidized child care, we use the 0.2 elasticity measure.

The effective child care subsidy rate is multiplied by the 0.2 elasticity measure and the number of pre-K participants to get a rough estimate of the increase in the labor force participation as a result of the publicly funded pre-K program. Following Bartik, we assume nearly a one-third displacement in the job market, so that the increase in employment is only about two-thirds of the increase in labor force participation.¹²¹

The new jobs created by the universal prekindergarten program are multiplied by the 50th percentile of wages¹²² to arrive at an estimate of the increase in earnings due to the program. We multiplied earnings by 1.44 to include non-wage compensation and arrive at an estimate of the increase in total compensation for the guardians of pre-K participants.¹²³

The increase in earnings due to the pre-K program, calculated above, is multiplied by an estimate of the average federal and state and local tax rate (by state) that applies to the middle quintile of income earners.¹²⁴

Savings from greater compensation, earnings, and taxes for program participants

The 6.8 percentage-point increase in the high school graduation rate by age 25 of Chicago CPC participants can be used to estimate the future increases in compensation, earnings, and taxes associated with prekindergarten participation.¹²⁵

We took the median earnings for all people 25 and over for the categories “less than high school,” “high school graduate,” “some college or Associate’s degree,” and “Bachelor’s degree or higher.”¹²⁶ Next, we calculated the weighted average earnings for those without a high school degree in 2014 and subtracted it from the weighted average earnings of those with a high school degree or greater in 2014. We multiplied the estimated earnings differential by the high-quality prekindergarten treatment effect for greater high school graduation to estimate the average increase in earnings per prospective pre-K participant in 2014 dollars.¹²⁷ Earnings were multiplied by 1.44 to include non-wage compensation,¹²⁸ and taxes were subtracted to estimate the after-tax earnings and compensation increase per prospective prekindergarten participant.

Taxes on the increased total earnings were calculated by applying the federal, state, and local average tax rates (by state) for the middle quintile of earners.¹²⁹

The projected gains in compensation, earnings, and taxes associated with prekindergarten participation may have been underestimated. Our approach assumes that prekindergarten participants without a high school degree will earn no more than non-participants without a high school degree, even though the pre-K participants are likely to experience a host of benefits from prekindergarten attendance including a boost in their cognitive skills, less need for education-related remedial services, greater educational attainment, less child maltreatment, better health, and lower involvement in crime. The boost in their cognitive skills, even if unaccompanied by more time spent in school, is likely to increase their future earnings.¹³⁰

Private savings from reduced child maltreatment and crime

Reduced child maltreatment and crime create benefits for society beyond those that accrue to government through reductions in criminal justice system costs and child welfare expenditures. The costs to victims of crime and child abuse and neglect can be divided into “tangible costs” and “intangible costs.” Tangible costs

are costs to victims such as property losses, medical care expenses, lost productivity, and mental health care costs. Intangible costs are reductions in the well-being of victims, such as pain and suffering, which have been monetized so that they might be compared to other costs and benefits.

Tangible and intangible savings from reduced child maltreatment

To calculate the tangible and intangible savings from reduced child maltreatment, we first multiplied the previously calculated proportion of children who will be the victim of child maltreatment by the proportion of victims who are abused and the proportion of victims who are neglected,¹³¹ arriving at the proportion of children who will be abused and the proportion of children who will be neglected. Then, we multiplied each of these proportions by estimates of both the tangible and intangible costs of the relevant type of victimization;¹³² child abuse is estimated to be significantly more costly than neglect. The tangible costs of abuse and the tangible costs of neglect were summed, yielding the tangible costs of child maltreatment. The intangible costs of abuse and neglect were also summed, yielding the intangible costs of child maltreatment.

These cost estimates were inflated from 1993 to 2014 via the CPI-U¹³³ and multiplied by the pre-K child maltreatment treatment effect,¹³⁴ resulting in the per-participant tangible and intangible savings from reduced abuse and neglect.

The average per-participant savings were multiplied by a factor reflecting the greater overall usage of child maltreatment welfare services by children in the bottom quartile of the family income distribution and by a factor reflecting the lower overall usage of child maltreatment welfare services by children not in the bottom quartile of the family income distribution, weighted to take into account the actual income distribution within the prospective universal program.

Tangible and intangible savings from reduced juvenile and adult crime

The tangible and intangible societal effects of crime reduction are estimated to be 4.5 times the governmental savings in criminal justice system costs.¹³⁵ Accordingly, we multiplied the juvenile and adult crime savings for criminal justice by 4.5 to arrive at the tangible and intangible savings from less juvenile and adult crime.

Attenuating the prekindergarten effects for middle- and upper-income children for baseline and treatment effect differences, and for all children for prior preschool enrollment

To calculate the effects of a universal program, we must estimate the extent to which the benefits of a high-quality prekindergarten program like the Chicago CPC program, which serves children from low-income families, would apply to children from middle- and upper-income families who would otherwise attend no preschool. (We will subsequently do a further benefit attenuation for all students attending the proposed public program who would otherwise have attended some other pre-K program). Studies of the Chicago CPC program and of other high-quality programs that targeted children from low-income families have found significant long-run benefits for these children, including greater academic achievement, higher schooling attainment, reduced child abuse and neglect, lower rates of criminal activity, and higher employment and earnings.

These high-quality targeted programs, however, did not usually include children from middle- and upper-income families and thus do not provide evidence of the long-term effects of high-quality prekindergarten participation on more socioeconomically advantaged children. Unfortunately, though there are not many studies that have examined the benefits of high-quality prekindergarten on children from middle- and upper-income families, there are reasons to believe that the effects of pre-K will differ for children from different socioeconomic backgrounds.

Differential pre-K benefits for children with different backgrounds manifest in at least two ways. First, there is a baseline effect: Different socioeconomic populations have different rates of everything from special education to child abuse to criminal behavior to smoking. This different baseline can be thought of as a “room for improvement” effect. Second, there may be a differential treatment effect: For reasons not captured fully by the baseline differences, different children may see greater or lesser treatment effects from prekindergarten.

Attenuation of prekindergarten effects for baseline differences

It is reasonable to suspect that the benefits of high-quality prekindergarten may be more positive for less-advantaged children than they will be for more-advantaged children because there is more room for improvement for poor children. The incidence of academic and social problems is generally higher for children from

low-income families than it is for more advantaged children. Children from middle- and upper-income families use special education at roughly 71 percent the rate of low-income children.¹³⁶ Similarly, middle- and upper-income children are retained in a grade at about 35 percent of the rate of grade retention for low-income children.¹³⁷ Likewise, children who are not in families with low socioeconomic status are only about 20 percent as likely to experience abuse and neglect as are children in families with low socioeconomic status.¹³⁸ This pattern continues to repeat itself with respect to crime, smoking, and depression: Juveniles and adults who are not from low-income families are charged with crimes at less than 70 percent of the rate of low-income adults;¹³⁹ smoking rates for non-poor adults are only about 62 percent of those of poor adults;¹⁴⁰ and middle- and upper-income adults suffer from depression at roughly 43 percent of the rate of low-income adults.¹⁴¹

A similar positive relationship between family income and school readiness was found in The Early Childhood Longitudinal Study, Kindergarten Class of 1998-99.¹⁴² The scores on literacy, math skills, general knowledge, and social skills tests for children who entered kindergarten increased gradually with family income. The shortfalls in scores of poor children relative to middle-income children were similar to the shortfalls in the scores of middle-income children relative to upper-income children. In the most recent study of the Midwest extension of the CPC prekindergarten class of 2012, however, improvements in school readiness were similar across socioeconomic groups.¹⁴³

Collectively, these data suggest that high-quality prekindergarten programs may be able to generate smaller benefits by serving middle- and upper-income kids than by just serving relatively poor children. For example, if a high-quality pre-K program cuts subsequent juvenile crime rates by an equal proportion for all children, the savings in criminal justice costs per pre-K participant will be smaller for kids from upper-income families to the extent that they are less involved in crime than kids from low-income families. For illustration purposes only, assume that the average low-income child commits four crimes while the average upper-income child commits two crimes and that the pre-K program cuts crime rates in half for all children. In this hypothetical example, the criminal justice system will be spared the costs of two crimes per low-income child but only the costs of one crime per high-income child thanks to the pre-K program. This epitomizes the baseline effect that may differ for children from different family backgrounds: A less desirable starting point for poor children leaves more room for absolute improvement.

But these data on the different incidences of social and academic problems of children from different family backgrounds must be interpreted with caution because,

in part, they may reflect that advantaged children are more likely to have attended high-quality prekindergarten than are less advantaged children. With the exceptions of the need for special education and child maltreatment, the indicators above (grade retention, crime, depression, smoking, and school readiness) are all measured after the ages of typical pre-K attendance. As a result, these differences in social and academic problems may exist in part because poor children do not have the same access to high-quality pre-K programs that other children have. In other words, the room for improvement among children from different socioeconomic backgrounds may be more similar than the above data suggest for samples of children who have the same pre-K participation.

Indeed, research suggests that socioeconomic-based gaps in cognitive ability are insignificant among children who are less than 1 year old, are small but measurable between ages 1 and 2, and then grow large between ages 2 and 5, before children typically enter kindergarten. From kindergarten through high school, socioeconomic-based cognitive ability gaps are fairly constant in size. This suggests that the socioeconomic-based gaps in cognitive ability grow significantly over the typical pre-K years of children's lives, ages 3 to 4, and may be due in part to differences in pre-K participation.

In analyses of tests of the cognitive ability of infants aged approximately 9 months, Roland Fryer at Harvard University and Steven Levitt at the University of Chicago found that there were no statistically significant differences in the outcomes of children in the bottom and top quintiles of socioeconomic status. By age 2, however, they found that a cognitive ability gap between the top and bottom quintiles of toddlers had developed that was both substantively (nearly 0.5 standard deviations) and statistically significant.¹⁴⁴

Similarly, Stanford University psychology professors Anne Fernald, Virginia Marchman, and Adriana Weisleder found small differences in the vocabulary and language processing of 18-month-old infants from low- and high-income families that grew rapidly: By age 2, children from low socioeconomic backgrounds were six months behind children from high socioeconomic backgrounds in skills critical to language development and subsequent learning.¹⁴⁵ By age 3, children from low-income families hear 30 million fewer words than children from upper-income families, according to research by Betty Hart and Todd Risely of the University of Kansas.¹⁴⁶

Not surprisingly, Greg Duncan at the University of California-Irvine and Katherine Magnuson at the University of Wisconsin-Madison, found that by the

time children began kindergarten around age 5, the gap on math and reading tests between children in the bottom and top fifth of socioeconomic status had more than doubled in size to over one standard deviation.¹⁴⁷ This means that low-income kids were several years behind in academic skills in comparison to their better-off classmates by age 5, before they had even started kindergarten.

Further, Duncan and Magnuson found no evidence that less-well-off children catch up with their peers once in school, at least through the fifth grade, suggesting that gaps develop early in life and persist through the school years. Consistent with the findings of Duncan and Magnuson, Sean Reardon of Stanford University found wide socioeconomic-based gaps in math and reading achievement test scores that did not narrow as children progressed from kindergarten through 12th grade.¹⁴⁸

Together, these findings indicate that socioeconomic-based gaps may develop primarily after age 1 but before age 5, largely during the pre-K years before children enter kindergarten. This provides a strong theoretical basis for thinking that high-quality pre-K may be crucial to narrowing socioeconomic-based achievement gaps and that these gaps may reflect, at least in part, differences in pre-K attendance.

So, why does it matter if the variations in outcomes by age 5 for children from different socioeconomic backgrounds are due to differences in pre-K participation or other factors? It matters because we attenuate the benefits of pre-K for middle- and upper-income children to take into account both baseline (or “room for improvement”) differences and pre-K participation when pre-K participation may be the cause of some of the baseline differences. Thus, by attenuating benefits for both differences in baseline conditions and pre-K participation we may be exaggerating the degree of benefit reduction and, as a consequence, understating the benefits of pre-K for middle- and upper-income children.¹⁴⁹

Finally, it should be noted that there are also reasons to expect that high-quality pre-K will generate greater benefits for more-advantaged children than it will for less-advantaged children. For a variety of reasons, including family resources and support, peer group support, and community support, children from middle- and upper-income families may be much closer to graduating from high school and attaining a college degree than are children from low-income families. If so, then a high-quality pre-K program may boost the educational attainment of advantaged children in a more critical way than it would for socioeconomically disadvantaged children: The boost in educational attainment may be more likely to enable advantaged children to earn a high school diploma or college degree. These educational

credentials along with along with higher levels of educational attainment, in turn, translate into higher levels of employment, earnings, and taxes paid. This means that the dollar return on an investment in pre-K for advantaged children may be significantly larger than it would be for more disadvantaged children.

Attenuation of treatment effects for children from middle- and upper-income families

Aside from the fact that the room for improvement may differ among children from various socioeconomic backgrounds, the empirical research on the measured impacts of prekindergarten (the treatment effects) shows that lower-, middle-, and upper-income children benefit significantly from high-quality prekindergarten. However, the literature also shows mixed findings on how much each of these groups benefits and which of these groups benefits most.

The short-run treatment effects of pre-K on children from different socioeconomic backgrounds can be summarized succinctly:

1. All children benefit from preschool education; this is the case for children from lower-, middle-, and upper-income families.¹⁵⁰
2. Higher-quality preschool education programs provide greater benefits than lower quality preschool education programs.¹⁵¹
3. Studies differ on the degree of impact that preschool education has on children from different economic backgrounds, although on balance they suggest that children from lower socioeconomic backgrounds gain the most. Some studies find that the positive effects of preschool education on children from more and less advantaged backgrounds are nearly identical.¹⁵² Other studies suggest that children from low-income families gain more from preschool education than children from middle- and high-income families.¹⁵³ Finally, some research suggests that for some skills, lower-middle-income children gain more than poorer children or that upper-income children gain more than other children.¹⁵⁴

Though there is a rich research on the long-run effects of high-quality pre-K for children from disadvantaged families, no studies have looked at the long-term effects for middle- and upper-income children. Rigorous studies of the Perry Preschool, Abecedarian, and Chicago Child-Parent Centers programs followed the effects of pre-K on children from disadvantaged families through ages 40, 21, and 26, respectively, but studies of the effects of pre-K on children from advantaged families have followed children only through kindergarten or elementary

school. Given the limited scope of research, it is not certain what the long-run effects of pre-K will be on advantaged children. Therefore, we must extrapolate the treatment effects of pre-K on a variety of outcomes that are measured after elementary school for middle- and upper-income children based on the best evidence available for the experiences of lower-income children.

Although there are numerous studies, the analyses of the universal pre-K program in Oklahoma are probably the most relevant for this study and have the best evidence on the treatment effects of pre-K on children from different socioeconomic backgrounds. The outcomes of the Oklahoma UPK program are especially relevant to this study because the program is similar, although lower, in quality to the Chicago CPC program, and its estimated effects on the school readiness of low-income children are close (but smaller) in size to those of the Chicago CPC program, which enrolled only low-income children. Thus, the effects on middle- and upper-income children of the Oklahoma UPK program may be a good proxy for the outcomes of middle- and upper-income children in a Chicago CPC-style universal prekindergarten program. In addition, as described in more detail below, analyses of the Oklahoma UPK program use a combination of excellent data sets and high-quality methodology. Hence, we base our estimates of the treatment effects of pre-K on non-poor children on the results of the Oklahoma UPK program.

A series of studies on the outcomes of the Oklahoma UPK program use a methodology called a “discontinuity regression” analysis, which is widely regarded as a highly rigorous and valid approach. Researchers took advantage of the fact that enrollment into the Oklahoma UPK program was subject to a strict birthday cutoff: Children born before September 1 were admitted to the program but those of the same age born on or after September 1 were kept out until the following year. The researchers then analyzed outcomes for the children born on either side of the cutoff date by comparing test results for the incoming kindergarten kids who had just completed one year of pre-K to the incoming pre-K kids who were about to enter the pre-K program.

The family incomes of the children were determined by eligibility for free lunch under federal rules (family income less than 130 percent of federal poverty level income), reduced-price lunch (family income between 130 percent and 185 percent of federal poverty level income), and full-price lunch (family income above 185 percent of federal poverty level income). So, for example, children in a family of four in the study of the 2006 data¹⁵⁵ qualified for free lunch if the family income was less than \$26,000 but paid full price if the family income exceeded \$37,000.

In these studies, free-lunch children are generally from families in the bottom quartile of the income distribution while the more advantaged, full-price-lunch children are mostly from the top three quintiles of the income distribution.

Evaluations of Oklahoma's universal prekindergarten program indicate that children from all economic backgrounds benefit from prekindergarten.¹⁵⁶ But poorer children tend to gain somewhat more than richer children. In the study of children tested in August 2003, the relatively advantaged children (those who paid full price for lunch) experienced improvements of 78 percent on letter identification, 83 percent on spelling, and 64 percent on applied problems, as great as the improvements experienced by the relatively poor children (those who were eligible for free lunch).¹⁵⁷ Across the three tests, lower-middle-income children (those who paid reduced price for lunch) averaged about 93 percent of the test score gains of the relatively poor, free-lunch children.¹⁵⁸

In the more recent study, of students who were tested in August 2006, the test score improvements of full-price-lunch children were 64 percent (letter identification), 63 percent (spelling), and 100 percent (applied problems) as large as they were for the relatively poor, free-lunch children.¹⁵⁹ For the lower-middle-income, reduced-price-lunch children, test scores were 91 percent (letter identification), 75 percent (spelling), and 125 percent (applied problems) as large as they were for the poorest children. In other words, relatively advantaged children appear to experience about 75 percent of the test score gains of relatively poor children, and lower-middle-income children experience roughly 95 percent of the test score gains of the most disadvantaged children.

Based on these findings, we assume that all children benefit from high-quality prekindergarten, but children from lower-middle-income, middle-income, and wealthy families experience somewhat lower benefits from pre-K than did the relatively disadvantaged children attending the Chicago CPC program. Weighting the average relative test score gains of non-poor children by their population, we conservatively estimate that non-poor children, who would otherwise have attended no preschool, experience on average only 78.9 percent of the benefits found in the Chicago CPC program.

This is a conservative estimate because many of the non-poor children in the Oklahoma control group did attend some form of preschool and received benefits from that attendance. Children who attended Oklahoma's universal prekindergarten were compared to children who had not attended the universal prekindergarten,

but who may have attended some other form of preschool such as private preschool or Head Start. This suggests that the gains that were measured for the Oklahoma participants reflect the benefits of attending a relatively high-quality public prekindergarten program compared to the gains of attending, on average, a combination of preschool and no preschool at all. Since we are first trying to measure the impact of a high-quality prekindergarten program on middle-income and high-income children who would otherwise attend no preschool, and given that many of the middle- and high-income children who did not attend the Oklahoma program are likely to have attended some other preschool, basing our estimate on the outcomes of the Oklahoma program may result in an overly conservative estimate of the benefits for middle- and upper-income children. This is especially a problem given that we attenuate for prior preschool attendance later in our analysis.

Our estimate is reasonably consistent with the findings of Magnuson and her colleagues, who provide estimates of the effects of preschool participation relative to non-participation on average children and on children living in poverty.¹⁶⁰ They found that children who attended preschool were better prepared for and performed better in kindergarten than did students who did not attend preschool, regardless of economic background. However, they found that the most socio-economically disadvantaged children achieved the greatest math and reading gains. Yet the reduction in grade retention was roughly the same for disadvantaged and advantaged children. Magnuson and colleagues also provide estimates for the effects on reading and math skills of pre-K participation relative to non-participation for the full sample and a sub-sample of children living in poverty.¹⁶¹ Comparing the coefficients for math and reading scores, their findings suggest that the average child who attends preschool may get anywhere from 60 percent to 95 percent of the benefits of preschool that are received by a child living in poverty.

Our estimate for the effect of pre-K on middle- and upper-income children is more conservative than that used by William Dickens, Isabel Sawhill, and Jeffrey Tebbs when estimating the impact of a high-quality universal prekindergarten program on economic growth.¹⁶² They assumed that the effects of prekindergarten are virtually identical for children of all economic backgrounds; thus, all children in a universal, high-quality prekindergarten program who would otherwise have attended no preschool would get 100 percent of the prekindergarten effects measured for low-income children.

Lynn Karoly and James H. Bigelow assumed that middle- and upper-income children who would attend a prospective high-quality public pre-K program in California but who would have otherwise attended no preschool would receive on

average 50 percent and 25 percent, respectively, of the benefits that high-quality pre-K confers on low-income children.¹⁶³ Given that there are twice as many middle-income children as there are upper-income children, averaging treatment effects across both groups of kids implies that Karoly and Bigelow assumed that non-low-income children would experience approximately 42 percent of the pre-K benefits of low-income children.¹⁶⁴ Our estimate of the average impact of pre-K outcomes for middle- and upper-income children is actually identical (42 percent) once our initial baseline adjustment is taken into account along with our treatment effect attenuation. For example, with the baseline adjustments, we assume that middle- and upper-income children receive on average only 56 percent of the reduction in the need for special education, 28 percent of the decline in grade retention, 16 percent of the reduction in child maltreatment, 55 percent of the drop in juvenile and adult crime, 49 percent of the decrease in smoking, and 34 percent of the lessening of depression experienced by relatively disadvantaged children.

The average reduction in the benefits from prekindergarten for middle-income and upper-income children relative to poor children reflects at least two factors. One is that relatively well-to-do children may have lower baseline involvement and use of a variety of services (such as child welfare or criminal justice services). The other factor is that pre-K may have a smaller impact on improving the academic and social skills of relatively well-to-do children compared to poor children in problem areas (such as special education and grade retention). Our estimating procedure takes into account both of these factors, using a variable-specific estimate for the first factor based on data for the diverse levels of social and academic problems experienced by children from different family incomes, and an average estimate for the second factor, the relative impact of pre-K on children from different family incomes as described above.

Attenuation of prekindergarten effects to account for current preschool enrollment

Roughly 85 percent of the children in the Chicago CPC program control group did not attend any preschool while about 15 percent attended some preschool (mostly Head Start). Thus, to a large extent, but not completely, the Chicago CPC results compare students who attended high-quality prekindergarten to children in the control group who attended no preschool. By contrast, in the United States, a little more than half of 3- and 4-year-olds already attend some form of preschool.¹⁶⁵ So, if the United States were to adopt a publicly funded, high-quality universal prekindergarten,

garten, then it is likely that many of the children who would attend such a program would otherwise attend some other form of public or private preschool in its absence. As discussed earlier, the research on existing preschool programs suggests that many currently existing preschool programs provide benefits to participants relative to children who do not attend preschool. Therefore, to accurately calculate the benefits of universal prekindergarten, we must estimate the extent to which the benefits of a high-quality pre-K program will apply to children who would otherwise have attended some form of preschool.

The attendance of preschool is clearly an important determinant of children's outcomes, but so too is the quality of preschool they attend. Ellen S. Peisner-Feinberg and colleagues found that higher-quality preschool programs had better results for children from all walks of life.¹⁶⁶ Children attending higher-quality child care centers had higher test scores in language and math and higher ratings by teachers in cognitive and attention skills in kindergarten and second grade.¹⁶⁷ Similarly, the National Institute of Child Health and Human Development found that children, regardless of family income, who had experienced higher-quality care, had significantly higher math, memory, and vocabulary skills than children who had experienced lower-quality care.¹⁶⁸ Henry and colleagues also found that the gains across family income were greater as the quality of the preschool program increased.¹⁶⁹ This indicates that children who would otherwise attend low-quality preschools should benefit more from a high-quality public prekindergarten program than children who would otherwise attend a high-quality preschool program.

Barnett compared the average outcomes for special education and grade repetition for high-quality model preschool programs to the average outcomes for relatively lower-quality Head Start and public prekindergarten programs.¹⁷⁰ The comparison suggests that the relatively lower-quality programs achieved about 25 percent of the reduction in special education and 55 percent of the reduction in grade repetition achieved by the higher-quality programs. But as Barnett noted, it may be misleading to compare these results as the higher-quality programs were serving more disadvantaged children.

Dickens, Sawhill, and Tebbs assumed that children who would otherwise be enrolled in private preschool would receive no additional benefit from attending a high-quality publicly funded prekindergarten program while children who would otherwise attend public preschool would get 50 percent of the additional benefits associated with high-quality public prekindergarten.¹⁷¹ Karoly and Bigelow assumed that low-risk (i.e. higher-income) children who would otherwise be enrolled in public or private preschool would receive no additional benefit from attending a

high-quality public prekindergarten program.¹⁷² They also assumed that high- and medium-risk children who would otherwise be enrolled in private preschool would receive no additional benefit from attending a high-quality, publicly funded prekindergarten while high- and medium-risk children who would otherwise attend public preschool would get 50 percent of the benefits associated with high-quality public prekindergarten. Both sets of researchers implicitly assumed that private preschools provide greater educational benefits than public preschools. But are private preschools, in fact, of higher quality than public preschools?

Carol H. Ripple et al., Timothy Smith et al., and David Blau report that public prekindergarten is high-quality relative to other preschools, including private preschools, in terms of a variety of criteria such as class size, child-staff ratios, and teachers' pay and education.¹⁷³ While evaluations of public Head Start programs often rank them low in terms of the teachers' pay and education, Head Start programs rank high in terms of health and nutrition services, social services, and parental involvement.¹⁷⁴ On average, Head Start programs are of higher quality than most other preschool programs.¹⁷⁵

Numerous studies of private preschool programs found their educational quality to be highly variable and lower on average than the quality available in the public programs. Blau and Suzanne Helburn and Barbara Bergmann reported that the average private preschool does not rate highly in terms of staff-to-child ratios and teacher's education.¹⁷⁶ In terms of learning environment and child-caregiver interactions, they found that few private programs are high-quality and quality is low for many others. The Cost, Quality, and Child Outcomes Study (1995) found that less than half the private programs analyzed provided positive child-caregiver interactions, and only 24 percent offered developmentally appropriate care. Karin Schulman and W. Steven Barnett argue that middle-income children from families too rich to qualify for publicly funded programs but too poor to be able to afford expensive private programs are often forced to attend low-cost private programs of low quality.¹⁷⁷ Deborah A. Phillips and colleagues found that most private child care centers for middle-income children had poorer quality ratings than did publicly funded centers that served low-income families.¹⁷⁸ Other studies by Magnuson et al., Henry et al., and Barnett et al. also support the fact that, on average, public prekindergarten programs are of higher quality than private preschools.¹⁷⁹

The bottom line is that there are no data to support the belief that private preschools are better than public preschools as assumed by Karoly and Bigelow and Dickens, Sawhill, and Tebbs.¹⁸⁰ Some researchers have concluded that the quality of private

preschools on average is so poor that they offer little or even no benefit to participants. This reflects the assumption that Barnett and colleagues implicitly make when they calculate that the benefits for children in California who would shift from private preschool to a high-quality public prekindergarten would be the same as for those who would shift from no preschool to a high-quality public prekindergarten.

We take a conservative, middle approach. We assume that, on average, existing private and public preschool education programs are of similar quality. We also assume that existing preschool programs (private and public) provide some important benefits to participants compared to children who attend no preschool. In addition, as suggested by the evidence presented above, we assume that most existing preschool programs, whether private or public, although they may be providing some significant benefits, are not of high quality. Hence, children moving from low- or medium-quality preschool to the prospective high-quality prekindergarten should not gain as much as children moving from no preschool to the high-quality prekindergarten.

We then use data from the Oklahoma UPK program from 2003 and 2006 and compare it to outcomes for Head Start to get a sense of the learning that is achieved in an average quality program compared to a high-quality program.¹⁸¹ Numerous studies have found that the effects of Head Start on children's cognitive outcomes are similar in size to the average pre-K program but smaller than the outcomes of high-quality pre-K programs.¹⁸²

Comparing the effect sizes for tests of letter identification and spelling and applied problem solving, children shifting from an average-quality preschool program like Head Start to our proposed high-quality program may be expected to experience anywhere from roughly 65 percent to 83 percent of the prekindergarten effect experienced by children who attended a high-quality pre-K program.¹⁸³ For the purposes of our simulation, we took the average of these estimates and assumed that children moving from preschool to the proposed high-quality universal program would experience only 75.5 percent of the benefits of high quality pre-K. This implies that we expect the universal program to be of greater quality than existing preschool programs and to generate improvements that are larger than those produced in the average currently existing preschool program. We further adjusted this benefit rate for the 17 percent of children attending a state public prekindergarten program using a three-level program quality score index derived from the State of Preschool's ranking of prekindergarten programs.¹⁸⁴ In particular, we assumed that the existing state public pre-K programs are on average of higher

quality than the non-state preschool programs, but varied in quality such that children attending them who moved to the prospective pre-K program would receive only 40 percent, 60 percent, or 80 percent of the benefits experienced by children who attended a high-quality program.

This 75.5 percent impact is higher than the 50 percent assumption adopted by Karoly and Bigelow for high- and medium-risk children and by Dickens, Sawhill, and Tebbs for all children who would otherwise have attended public preschool.¹⁸⁵ But we note that our estimate may be too conservative because it is based on the results for the Oklahoma Universal Pre-K program, which is a well-above-average-quality program but is not as high-quality as the proposed program, which is modeled on the characteristics of the high-quality Chicago CPC program. In addition, we further attenuate the effects of pre-K on children from non-poor backgrounds for both lower baseline and treatment effects, as described earlier.

With socioeconomic baseline adjustments, treatment effect attenuations, and attenuations for prior preschool participation (other than the generally larger attenuation for participation in a state public pre-K program), we assume that middle- and upper-income children who attend a high-quality pre-K program would receive on average only 42 percent of the reduction in the need for special education, 21 percent of the decline in grade retention, 12 percent of the reduction in child maltreatment, 42 percent of the drop in juvenile and adult crime, 37 percent of the decrease in smoking, and 26 percent of the lessening of depression experienced by relatively disadvantaged children. For those children who attended a public state prekindergarten, the benefits would be about 20 percent lower on average than those described above.

Enrollment rates

The costs and benefits of a prospective high-quality pre-K program will vary with the number of students that it serves. Hence, to estimate the costs and benefits of the program, we must make assumptions about its levels of enrollment.

Percentage of 3- and 4-year-olds who will attend preschool and enroll in the universal prekindergarten program

According to data from the U.S. Department of Education, 42 percent of 3-year-olds and 68 percent of 4-year-olds were enrolled in some form of preprimary

programs in 2013.¹⁸⁶ This means that, on average, roughly 55 percent of all 3- and 4-year-olds were enrolled in preschool, a Head Start program, nursery school, a day care center, kindergarten, or some other preschool program.

Only the District of Columbia and five states (Florida, Georgia, Oklahoma, Vermont, and West Virginia) offer publicly funded, voluntary, universal prekindergarten services. The District of Columbia program extends to both 3- and 4-year-olds while the state programs offer universal prekindergarten to 4-year olds only.

In 2014, 99.8 percent of 4-year-olds and 83.9 percent of 3-year-olds in Washington, D.C. were enrolled in public primary programs (pre-K, Head Start, and preschool special education). The percentage of 4-year-olds enrolled in public pre-K, Head Start, or public special education in the states with universal pre-K were 99.5 percent in Vermont, 94.4 percent in West Virginia, 89.8 percent in Florida, 89.4 percent in Oklahoma, and 68.4 percent in Georgia.¹⁸⁷

Eleven European nations (Belgium, Denmark, France, Germany, Iceland, Italy, the Netherlands, Norway, Spain, Sweden, and the United Kingdom) provide publicly funded, voluntary, universal prekindergarten services for 4-year-olds with enrollment rates in 2013 of more than 94 percent.¹⁸⁸ Their enrollment rates of 3-year-olds are nearly as high, ranging from 86 percent to 98 percent. These publicly funded programs have been in existence longer than the universal programs in the United States and, thus, may indicate the enrollment levels that will be reached here over time.

To arrive at a reasonable estimate for the enrollment rate of 3- and 4-year-olds in the prospective universal pre-K program, we first exclude the high and low outliers of Washington, D.C. and Georgia. We then average the enrollment rate in 2014 of the four other states with a universal pre-K program, and consistent with the District of Columbia's 3- to 4-year-old participation ratio (and similar to the European experience), we assume that the enrollment rate of 3-year-olds in the public universal program will be close to, but somewhat lower than, the enrollment rate of 4-year-olds. As a result, we assume that the enrollment rate of 3- and 4-year-olds will be roughly 86 percent. However, for the four states and the District of Columbia that already exceed an 86 percent enrollment rate of 4-year-olds, we replace our estimated enrollment rate with the actual enrollment rate of 4-year-olds in those jurisdictions.

The enrollment of children in the universal prekindergarten education program is further adjusted to take into account the likely differential enrollment rates

of children from different family income backgrounds. In general, families with young children encounter higher rates of poverty than the typical household;¹⁸⁹ nearly one-third of families with children under the age of 6 have incomes that are 130 percent or less of poverty-level incomes. This suggests that we must adjust the standard distribution of families in the low-, middle-, and upper-income categories to reflect a higher proportion of families with 3- and 4-year-olds who fall into the low-income category.¹⁹⁰ Accordingly, we use a weighting factor to adjust the proportion of participants who are poor, in the middle class, or wealthy.

Specifically, we assume that about 30 percent of children come from low-income households, 47 percent come from the middle class, and 23 percent come from upper-income households. In addition, we adjust the participation rates in our proposed pre-K program to reflect the current weighting of enrollment rates by income distribution in public K-12 schooling. Since current public K-12 enrollment includes about 99 percent of lower-income children, 90 percent of middle-income children, and 80 percent of upper-income children, the outcome of our weighting scheme leads to an over-representation of lower-income children and an under-representation of upper-income children in the universal program. Specifically, about 35 percent and 65 percent of the universal pre-K participants are assumed to come from low-income and non-low-income families, respectively; these groups account for 30 percent and 70 percent of the population.

Our estimated enrollment rate of 86 percent may be conservative because the high-quality prekindergarten program proposed in this study should be more attractive to parents and children than any of the existing state pre-K programs as it is higher in quality.

Accrual of costs and benefits through time

The costs and benefits detailed in this report are estimated as yearly flows over time. This is a relatively complicated endeavor because different benefits and costs accrue at different times in program participants' lives. For each year, the calculations include benefits and costs related to the current year's program participants, and all previous participants, all in the current year's dollars, tracking a changing population. We have included a highly simplified example below.

Consider a one-year program for 5-year-olds, costing the government \$100 in 2016. The parents of these children agree to pay \$200 when the children are 6

years old in 2017. The cost of the program increases due to inflation: In 2017, it costs \$105, \$110 in 2018, and \$115 in 2019. The inflation seen by the parents is the same, raising their payments to \$210 in 2017, \$220 in 2018, and \$230 in 2019. The population affected also increases: In 2016, there are five 5-year-olds, in 2017 there are six, in 2018 there are seven, and in 2019 there are eight. These are the only costs and benefits accrued to the government.

What is the effect of this program on government finances in each year? In each year, the cost is equal to the number of 5-year-olds multiplied by the per child cost. Similarly, in each year, the benefits of the program are equal to the per-child payment multiplied by the number of 6-year-olds, or the number of 5-year-olds from one year earlier (Figure 15). Thus, the program generates a net expenditure of \$500 in 2016, but in 2017 generates net revenue of \$370 (\$1,000-\$630). The net revenue increases in 2018 to \$550 (\$1,320-\$770), and in 2019 increases to \$690 (\$1,610-\$920). (See Figures 14 and 15.)

FIGURE 14
Accruing Costs Over Time

In this example, we demonstrate how to calculate the effects of the universal prekindergarten program on government finances (costs) over time.

Year	Per-child cost		Five-year-olds		Total cost
2016	\$100	x	5	=	\$500
2017	\$105	x	6	=	\$630
2018	\$110	x	7	=	\$770
2019	\$115	x	8	=	\$920

Source: Authors' analysis.
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FIGURE 15
Accruing Benefits Over Time

In this example, we demonstrate how to calculate the benefits from the universal prekindergarten program over time.

Year	Per-child benefit		Five-year-olds		Total benefit
2016	\$0	x	0	=	\$0
2017	\$200	x	5	=	\$1,000
2018	\$220	x	6	=	\$1,320
2019	\$230	x	7	=	\$1,610

Source: Authors' analysis.
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This basic method is used to calculate the yearly net benefit flows provided by prekindergarten programs. The costs calculated above are accrued over differing periods of a participant's life. (See Figure 16.) The program costs are already expressed as per year values. The other costs or benefits are essentially estimates of the sum of the per-year cost/benefit over the period, expressed in 2016 dollars. For example, we have calculated an average per-child savings for special education. Different children will require special education at different points in their educational careers, but over the course of their careers, the participants will, on average, create the estimated savings from reduced special education use.

FIGURE 16

When Do the Costs and Benefits Take Effect?

The different costs and benefits will occur at different stages over a participant's life. Accordingly, when we accrue the costs and benefits, they should only take effect during certain periods of time.

Cost or benefit	Age
Program costs	3-4
Increased high school	17
Increased higher education	18-22
Decreased special education	5-17
Decreased grade retention	17
Child welfare savings	3-17
Juvenile justice savings	10-17
Adult justice savings	18-44
Decreased adult depression	18-65
Decreased smoking	18-65
Increased earnings of guardians	3 to 4
Increased earnings of participants	18-65
Increased taxes	18-65

Source: Authors' analysis of Reynolds, Arthur J., and others. 2002. "Age 21 Cost-Benefit Analysis of the Title I Chicago Child-Parent Centers." *Education Evaluation and Policy Analysis* 24 (4): 267-303 and Reynolds, Arthur J., and others. 2011. "Age-26 Cost-Benefit Analysis of the Child-Parent Center Early Education Program." *Child Development* 82 (1): 379-404.

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They will create these savings sometime between the ages of 5 and 17. It is assumed that the special education savings due to a given child can occur at any point during this period, but that the total special education savings due to a given cohort is spread roughly evenly over these years. So, the initial special education savings estimate is divided by the 13 years in the benefit accrual period, yielding the average per-year per-child savings. The total savings in a given year is calculated by multiplying this per-year per-child savings by the total number of partici-

pants falling within the given age range in the given year, and inflating this savings to current-year dollars. This savings will change each year as the age range encompasses a different cohort, increasing rapidly at first to account for the first cohorts moving progressively further into the age range in question, then more slowly once the range is entirely occupied but the cohorts tracking through continue to grow with population growth. All costs and benefits are assumed to maintain real value, growing each year with projections of the relevant inflation indexes.

The case of adult crime savings is somewhat more complicated than the rest, as criminal activity is not distributed evenly across a criminal career. For the purposes of this model, it is assumed that peak adult criminal activity occurs at age 18, and that criminal activity decreases by 10 percent each year until it ceases at age 45.¹⁹¹ In order to accomplish this, a multiplier stream was applied to the average yearly per-person savings calculated above: A factor was created for each age within the range, using a goal-seeking algorithm, such that the multiplier stream peaks in the first year of the age range, diminishes by 10 percent in each successive year, and sums to the number of years in the age range. The average value of this multiplier is one, so when it is applied to the per-year per-person savings calculated by dividing the per-person savings by the number of years in the age range, the sum of the products of the multiplier and the savings will equal the total estimated per-person savings, but more of the savings will be accrued up front. The savings from reduced adult crime in a given year was thus calculated by summing the products for each age in the age range of the number of program participants of that age in the given year, the per-person per-year savings, and the multiplier for that age.

In brief, the total costs and benefits of the preschool programs were determined by multiplying the number of participants of a particular age by the average value of the cost or benefit for each year the cost or benefit was produced by participants of that age as indicated in Figure 16 above. Thus, for example, the costs of the prekindergarten program were assumed to prevail only when each participant was 3 or 4 years old. The costs of increased high school education attainment were assumed to occur at age 17. The costs of higher education were assumed to start at age 18 and stop at age 22. The reductions in the cost of providing public education per participant, due to less special education, were assumed to kick in when that participant entered the public school system at age 5 and were assumed to cease when that participant turned 18 and left the school system. The savings from less grade retention were assumed to occur when participants were 17. The savings from less child abuse and neglect were assumed to start at age 3 and end at age 17.

Savings from less juvenile crime were assumed to start at age 10 and end at age 17. Savings from less adult crime are assumed to start at age 18 and end at age 44. The benefits of higher earnings and taxes from the increased workforce participation of the guardians of pre-K participants were assumed to occur during the two years the participants were in prekindergarten. The benefits of higher earnings and taxes on the part of pre-K participants were assumed to start at age 18 and cease at age 65. The savings from less depression and lower levels of smoking start at age 18 and end at age 65. Of course, all costs and benefits end in the year 2050, regardless of the age of prekindergarten participants in that year, as 2050 is the last year of our extrapolation. Consequently, the benefits ceased being calculated by age 39 for the oldest participants even though they would have continued accruing for many more years.

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Robert Lynch is a Visiting Fellow at the Washington Center for Equitable Growth and the Everett E. Nuttle Professor of Economics at Washington College. He is also a Senior Fellow at the Center for American Progress and a Research Associate with the Economic Policy Institute. His areas of specialization include human capital, public policy, public finance, and income inequality. Lynch is the author of several works that have quantified the economic and social consequences of public investment in early childhood, assessed the economic effects of immigration reform, evaluated the adequacy and effectiveness of state and local government economic policies in promoting growth and creating jobs, analyzed the efficiency, fairness, and stability of state and local tax systems, and examined the definition and measurement of income inequality. Lynch previously taught at the State University of New York at Cortland. Lynch earned his Ph.D. and Master's in economics from the State University of New York at Stony Brook and his B.A. in International and Development Economics from Georgetown University.



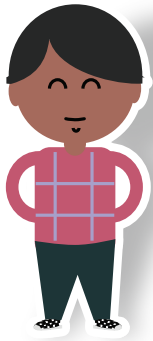
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The errors are, of course, ours alone.



Endnotes

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- 22 The program is voluntary to respect the decisions of parents who would choose not to enroll their children in an education program, to allow for home-schooling or attendance at a religious or other private preschool, and to account for the medical or other special needs of children.
- 23 We further adjusted this benefit rate for the 17 percent of children attending a state public prekindergarten program using a three level program quality score index derived from the State of Preschool's ranking of prekindergarten programs from Barnett, W. Steven and others. 2015. "The State of Preschool 2014." New Brunswick: The National Institute for Early Childhood Education. In particular, we assumed that the existing state public pre-K programs are on average of higher quality than the non-state preschool programs, but varied in quality such that children attending them who moved to the prospective pre-K program would receive only 40 percent, 60 percent or 80 percent of the benefits experienced by children who attended a high-quality program.
- 24 For those children who, in the absence of the universal program, would have attended a public state prekindergarten the benefits would be about 20 percent lower on average than those described above.
- 25 The federal government would simply maintain its efforts in Head Start and special education and allowed states to apply federal savings in Head Start and special education to offset some of the costs of the program (holding states harmless from potential losses of federal funds and distributing federal pre-K commitments equitably among states).
- 26 The federal government would allow states to apply federal savings in Head Start and special education to offset some of the costs of the program (distributing federal preschool commitments equitably among states and holding states harmless from potential losses of federal funds).
- 27 Given our previous calculations in, non-government benefits account for 81.3 percent of the total benefits of the Abecedarian program.
- 28 If some private child care providers do not participate in the proposed universal program, then some of the benefits to families who place their children in alternative publicly funded centers may be offset by losses at the private centers. However, losses at non-participating child care centers may, in turn, be offset by gains experienced by participating centers.
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- 31 For comparison purposes, our most likely estimate of the effect of universal pre-K assumes 27 percent attenuation to account for the effects of current preschool enrollment rates and impacts on middle and upper income children that are 79 percent of those for the Chicago CPC participants. It suggests that universal pre-K investment would generate a net budgetary surplus of \$47.2 billion in 2050 and that every dollar spent in 2050 would return \$2.37 in budget savings in that year. The increase in compensation is estimated to amount to \$108.4 billion per year and the savings to individuals from better health and less crime equal \$114.7 billion in 2050. The total benefits in 2050 are \$304.7 billion and exceed the total costs by 8.9 to one.
- 32 In this way, the transfer of program net costs and net benefits between states as pre-K participants and their families move across state borders is likely to be very small and can be ignored. If states were not to simultaneously launch pre-K programs, then states without public pre-K programs but with in-migration would experience some of the benefits of pre-K paid for by other states. In economic parlance, states without public pre-K would be "free riders," getting the benefits of something they have not paid for. Similarly, states with public pre-K programs and out-migration would lose some of the benefits they had paid for. Complicating matters, in the absence of a simultaneous launch of programs the availability of high quality pre-K, or the lack thereof, could influence migration between states and confer benefits and costs upon states. States with high-quality public pre-K programs might attract families with young children and then experience the economic consequences of in-migration and the added benefits and costs of educating those children. States without public pre-K programs might lose families with young children and suffer the economic consequences of out-migration.
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