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Executive Summary

Kentucky officials are being encouraged to expand the availability of Kentucky's state-funded preschool program. The current program restricts eligibility to three- and four-year-old students with disabilities and four-year-old students with family incomes up to 150 percent of the federal poverty level.

The proposed expansion has two parts:

1. Extend eligibility for the state's preschool program to three-year-old students with family incomes up to 150 percent of poverty.
2. Extend eligibility to three- and four-year-old students with family incomes between 150 and 200 percent of poverty.

Whether it makes sense for Kentucky to expand its existing preschool program depends on the expected costs of and benefits from the proposed expansion. In this report, the Center for Business and Economic Research (CBER) at the University of Kentucky presents estimates of those expected costs and benefits.

A number of findings emerged from this work, but there is one overriding conclusion:

When we consider the combined public and private benefits of pre-k, the total estimated benefit is more than $5 for every $1 the state would invest in an expanded pre-k program.

Beyond the financial return on investment, additional benefits from an expanded pre-k program would include:

- Reduced need for special education
- Lower incidence of crime
- Welfare-related savings
- Lower incidence of grade retention
- Lower incidence of child abuse and neglect
- Higher high school graduation and postsecondary enrollment rates for low-income students

■ ■ ■

The CBER estimates in this report are drawn from studies of other early childhood programs. Since four programs are the most extensively studied, our estimates are largely based on the costs and benefits of these four:

- The Perry Preschool Program, a high-quality, half-day preschool for at-risk students which began in the 1960s in Ypsilanti, Michigan.

- The Carolina Abecedarian Program, a high-quality, full-day child care program for at-risk students, age birth to five. The Chapel Hill, North Carolina, program operated from 1970 to 1985.

- The Chicago Child-Parent Centers (CPC), medium-quality, half-day preschool for children living in high-poverty areas in Chicago that began in the 1960s and remains in operation.

- The Head Start program, a federally funded, medium-quality, half-day preschool program for at-risk students nationwide. Head Start began in the 1960s and remains in operation.

Research on these programs has found that their benefits exceed their costs. However, the differences between costs and benefits, as well as the specific services that appear to produce the largest benefits, vary across the programs. Therefore, when calculating the costs and the benefits of Kentucky's particular program, we focus on the costs and benefits from services that are similar to those offered in Kentucky.

The Perry Preschool and Abecedarian programs provided many more services than Kentucky's state-funded program. As a result, they are of only limited value for estimating the likely costs and benefits of expanding Kentucky's program. We describe these two programs as high quality because they have more desirable characteristics, such as smaller teacher-student ratios and more parental interaction, than Kentucky's program.

In contrast, the CPC and Head Start programs offer services similar to Kentucky's program. We describe these programs, and Kentucky's, as medium quality because they have many desirable features but are noticeably lower quality than programs such as Perry Preschool and Abecedarian. Given the similarity of both CPC and Head Start to Kentucky's program, we primarily use the estimated benefits from CPC and Head Start when estimating the likely costs and benefits of expanding Kentucky's pre-k program.

Throughout the report we separate total benefits into two components:

- Private benefits are those that accrue directly to a child attending a preschool program or to the child's family. For example, if attending preschool leads to higher future wages, these wages are a private benefit.
- Public benefits are those that accrue to everyone in an area (i.e. the general public), regardless of whether they or their children attended a preschool program. An

example of a public benefit is a child's reduced need for special education programs in primary or secondary school because he or she attended a preschool program. Because special education is financed with taxes, the savings are a benefit that accrues to all taxpayers and, therefore, are a public benefit.

In this report, we first calculate the costs and benefits of expanding Kentucky's preschool program to include three-year-olds living in families with incomes up to 150 percent of poverty. We assume that the benefits of expanding Kentucky's program to include three- and four-year-olds living in families with incomes between 150 and 200 percent of poverty are only 75 percent as great as those resulting from the expansion to include three-year-olds at 150 percent of poverty. We make this assumption to ensure that our estimates understate, rather than overstate, the true benefits of the program.

The benefit and cost calculations for the proposed expansion are measured per year of preschool attendance. That way, both costs and benefits are measured similarly for both expansions.

One factor must be taken into account for this work. Although preschool program costs are paid today, in current dollars, the benefits are often received in the future. For example, a teacher is paid today for her work with three- and four-year-old students. But the benefits of the children's education, such as reduced welfare payments or crime rates, occur when the students become adults. Because costs are incurred today while benefits occur in the future, we need to discount the value of future benefits to compare them with current costs. To do this calculation, we assume that money invested today will receive a three percent real return each year, meaning that the three percent is measured after accounting for price increases. This per-year return is called the discount rate.

Our preferred discount rate is three percent as this is the rate used by the federal government when performing analyses similar to that reflected in this report. However, we also calculate benefits using discount rates of five and seven percent to show how our estimates change when we make alternative assumptions and to be as conservative as possible. The results from these additional calculations are provided in the main body of the report.

Our main findings:

- We estimate that the per-student per-year cost of the expanded preschool program in Kentucky will be $5,329.[1] This exceeds the estimated cost of the current program because a 1999 law, which took effect in 2004, requires that all new pre-k teachers have at least an Interdisciplinary Early Childhood Education bachelor's degree. Teachers with bachelor's degrees are paid more than those without the degrees, so teacher salary costs will increase as the program is expanded.

[1] Throughout the report all dollar figures have been adjusted for inflation and are measured in 2007 dollars.

- Using a three percent discount rate, the estimated total lifetime private benefit of expanding the program to include low-income (150 percent of poverty) three-year-olds is $16,576 per student per year of preschool attendance.

- The estimated lifetime public benefit of expanding the program to include low-income three-year-olds is $10,282 per student per year of attendance.

- The total lifetime private benefit of expanding the program to include three- and four-year-old students from families with income between 150 and 200 percent of poverty is an estimated $12,432 per student per year of attendance.

- The total lifetime public benefit from the expansion to include three- and four-year-old students from families with income between 150 and 200 percent of poverty is an estimated $7,712 per student per year of attendance.

- Using a three percent discount rate, we find that the lifetime private and public benefits from both proposed expansions of Kentucky's preschool program exceed the cost of the expansions. For one year of preschool attendance, the public benefit from expanding the program to include low-income three- and four-year-olds is almost twice the cost of the expansion. The public benefit of expanding the program to include three- and four-year-olds from families with incomes between 150 and 200 percent of poverty is almost 1.5 times greater than the expansion cost. When we consider the combined public and private benefits, the total estimated benefit is more than $5 for every $1 invested.

Under reasonable assumptions about the discount rate, our estimates imply that the benefits from the proposed expansion of the early childhood education program in Kentucky exceed the costs by a fairly wide margin. Our only concern about these estimates is that, although many of the previous early childhood education programs included a number of visits to the homes of students by teachers, the Kentucky program includes only two home visits per year. Further, it appears that home visits are one of the services that produced large benefits relative to costs in these early programs (Grunewald and Rolnick, 2006). Therefore, we suggest that Kentucky consider expanding the number of home visits by teachers as part of the expansion of the preschool program.

I. Introduction

State and local governments have made significant investments in the education of their residents since this country was first formed. This investment has been justified because of the significant benefits these investments provide to all residents in a state or locality. These benefits include increased earnings for residents, better health, more informed participants in the political process, reduced crime and faster economic growth in a region.

These educational investments have almost exclusively focused on funding primary, secondary and post-secondary schooling. However, recent research has shown that investment in early childhood education – programs for children under age five – can produce significant economic benefits, benefits that exceed the costs of the programs. This research has led stakeholders to propose an expansion of the early childhood education program in Kentucky.

Of course, whether it makes sense for the Kentucky state government to fund the proposed expansion in the early childhood education program depends on the expected costs and benefits accruing to the citizens of the state of such an expansion. In this study, the Center for Business and Economic Research (CBER) at the University of Kentucky estimates the expected benefits and costs of expanding the early childhood education program in the State. The benefits on which we focus include increased lifetime earnings for participants, decreased welfare payments, decreased K-12 education system expenditures from reduced special education placement and lower rates of grade retention, and the benefits that accrue because participants in early childhood education programs are less likely to commit crimes and become incarcerated. The costs include the total funding provided by state, local, and federal government levels, and we focus on any changes in the costs of the program associated with any expansion of the program.

In the first part of our study we discuss the details of several prominent early childhood education programs. The programs include the High/Scope Perry Preschool Program, the Carolina Abecedarian Program, the Chicago Child-Parent Centers, and the Federal Head Start Program.

In the second part of the report we review the evaluations of the benefits and costs of the programs. We pay particularly close attention to the long-term experimental evaluations of the Perry Preschool Program and the Abecedarian Program since these are some of the most complete evaluations conducted to date and the only ones that follow participants for a number of years after they leave the program. Therefore, these evaluations are able to estimate the lifetime benefits from the programs, and these lifetime benefits appear to be quite substantial.

In the third section of the report we apply the findings reported in the first two sections to Kentucky. This allows us to produce estimates of the expected benefits and costs of expanding the early childhood education program in the State. The results from this report will provide policymakers in Kentucky with a better understanding of the potential benefits of expanding the early childhood education program in Kentucky.

II. Details of Early Childhood Education Programs

Our evaluation of the potential costs and benefits of the proposed expansion of the early childhood program in Kentucky is based on earlier cost-benefit analyses of early childhood programs. In particular, we identified four early childhood education programs that have extensive evaluations of the costs and benefits. In this section, we provide an overview of the following early childhood programs: the Perry Preschool Program, the Carolina Abecedarian Program, the Chicago Child-Parent Centers, and the federal Head Start Program. Several states have instituted universal preschool programs. Because these programs are all fairly new, none of the evaluations of these programs provides reliable estimates of lifetime benefits and costs of universal preschool.

Perry Preschool Program

The Perry Preschool Program began in 1962 in Ypsilanti, Michigan.[2] At that time, the preschool program ran from October through May of each program year. The preschool served three-year old and four-year old children considered to be at risk of failing in school. The preschool consisted of 2.5 hours of center-based preschool each morning for five days a week. Other program components included weekly 1.5-hour in-home visits by program teachers and monthly group meetings of parents. Additionally, the program had a low child-teacher ratio of approximately five or six children per teacher. Because of the large number of hours children were in the preschool program in a week, the low teacher-to-student ratio, and the number of other services offered by the program, the Perry Preschool Program is considered to be a high-quality preschool program. Table 1 contains the details of this program.

Abecedarian Program

The Abecedarian Program provided free, full-day educational childcare to children from infancy to age five in Chapel Hill, North Carolina. The program targeted low-income families where infants were deemed to be at risk of developmental retardation (Campbell and Ramey, 2007). It was in operation from 1972 to 1985. The childcare was center-based and open eight hours a day, five days a week for 50 weeks a year. Transportation to the center was provided if needed, and the center also provided breakfast, lunch, and a snack. The child-teacher ratio remained relatively low, ranging from three infants per teacher to six children per teacher for children age five. Based on the number of contact hours, the low teacher-to-student ratio, and the number of services offered, the Abecedarian Program is also considered to be a high-quality preschool program. The characteristics of this program are also included in Table 1.

Chicago Child-Parent Centers Preschool Program

The Chicago Child-Parent Centers (CPC) are a federally-funded program dating back to 1967. It is operated as part of the Chicago public school system. The CPC provide disadvantaged children at risk of poor academic outcomes with educational and family support

[2] A modified version of the program exists today and is run by the Ypsilanti public school district.

services between the ages of three and nine. Program eligibility is restricted to children residing in low-income areas of Chicago. Additionally, parents must commit to regular participation in the program.

The CPC are a center-based program that provides half-day preschool, half- to full-day kindergarten and full-day schooling from first through third grades. The Centers provide health and nutrition services to children such as health screening and free breakfast and lunch. Child-teacher ratios are 8.5 to 1 for preschool-aged children and 12.5 to 1 for kindergarten and primary-grade children. CPC representatives make in-home visits. Additionally, parents are required to participate in classroom activities or participate in adult education courses for at least one-half day per week.

Table 1 contains details of the program. Because this program is a half-day program, the student-teacher ratio is higher than either the Perry Preschool or Abecedarian Programs, and the number of services offered is smaller, the CPC is viewed as a medium-quality program.

Head Start Program

Head Start is a large-scale, publicly-provided program that started in 1965 as part of President Lyndon Johnson's War on Poverty. The program primarily aims to provide preschool-age children from low-income families with the reading and mathematics skills necessary for success in kindergarten and beyond. In 1995, Head Start was expanded (Early Head Start) to include children three years of age and under.

Children eligible to participate in Head Start usually have family income up to 130 percent of the federal poverty line. As of 2007, Head Start served a racially-diverse mix of over 900,000 children. Thirty percent of the students are African American, and 40 percent are white. Additionally, the majority of children enrolled in Head Start are three- and four-year olds, accounting for 36 percent and 51 percent of all participants, respectively (U.S. Department of Health and Human Services, 2009). Due to funding limitations however, all children eligible for participation are not able to enroll in Head Start.

Head Start provides child and family services in center-based and home-based settings. Programs usually operate about the length of a school year. Additionally, programs range in length from a half to a full day. Although federally funded, Head Start is provided at the local level but subject to federal standards that ensure comprehensive services beyond a child's academic readiness. These services include free meals, preventive health care such as immunizations and early detection of health problems, and screening for children with special learning needs. Again, given the number of contact hours, the student-teacher ratio, and the number of services offered, Head Start is viewed as a medium-quality program.

III. Review of Cost-Benefit Analyses

In this section we provide a critical review of the studies that estimate the benefits and costs of the early childhood education programs described in the previous section. As discussed previously, we focus on the studies of four preschool programs: the Perry Preschool Program, the Carolina Abecedarian Program, the Chicago Child-Parent Centers, and the Head Start Program.

Cost-benefit analyses as presented below should have several features. Before proceeding to the analyses, it is helpful to review these features. In a cost-benefit analysis, the usual first step is to estimate the costs of the program. Program costs include all costs of the resources devoted to the program. These costs are reported as the average dollar cost per program participant for the length of the program. It is important to note that the programs evaluated here have different lengths. The Abecedarian Program runs from infancy through preschool, whereas the other programs are one- or two-year preschool programs.

The next step involves identifying the benefits caused by participation in the program. In order to compare the costs of the program with the benefits of the program benefits need to be expressed in dollar figures. This step in the cost-benefit analysis is the most difficult to undertake as not all benefits are easy to quantify monetarily. For example, one benefit discussed below is that preschool participation is associated with reduced crime, an attribute that is not typically measured in dollar amounts. Belfield et al. (2006) convert reduced crime into dollar amount savings by looking at two aspects of costs associated with crime. First, each convicted crime has costs associated with the arrest and trial of the criminal as well as the costs of housing the criminal in jail or prison. Second, the crime results in a cost to the victim in terms of physical and psychological damage. Belfield et al. (2002) combine these two costs to assign a dollar amount benefit to reduced crime. Once dollar amounts are assigned to all benefits and costs, the total aggregate program cost and benefit are calculated.

The final step involves comparing the aggregate program costs to the aggregate program benefits. To do this, costs and benefits must be transformed to ensure comparability since both likely span more than one year. The transformation involves putting costs and benefits in real dollars to account for inflation, and calculating the present value of costs and benefits to account for the fact that a dollar today is more valuable than a dollar in the future since a dollar today can be invested in an interest-bearing asset such as shares of stocks. The annual rate of return after accounting for inflation of investing such a dollar is called the real discount rate. For example, a real discount rate of three percent assumes that money invested today will increase by three percent each year (after controlling for inflation). All discount rates used throughout the report are real discount rates. Once the appropriate transformations have been carried out, if the total program benefits exceed the total program costs, the investment in the program can be viewed as a positive gain to society.

For the programs discussed below, we measure lifetime benefits of the program and compare them with the total costs incurred. Both costs and benefits are measured per participant.

For example, the CPC offers a two-year preschool program, so the costs of that program are the per-student costs for two years of preschool attendance. The benefits are the lifetime benefits accrued by participants, again measured on a per-student basis.

It is important to understand that benefits can be disaggregated into benefits that accrue directly to program participants and their family, what we call private benefits, and benefits that accrue to the general public, what we call public benefits. Benefits that accrue to society are the sum of private and public benefits. In the analysis that follows, we will discuss benefits in terms of private benefits and public benefits. Additionally, we use the Consumer Price Index (CPI) to convert the authors' estimated costs and benefits into 2007 dollars. We do this for ease of comparability between the various early childhood programs discussed below. We restrict attention to estimates that use a three percent discount rate.

A cost-benefit analysis should also consider the quality of the evaluation. Of particular concern is whether the outcomes of the evaluation were caused by the program or if they were caused by other factors. A random experiment is considered the "gold standard" of program evaluation. In a properly-conducted random experiment, individuals participating in the preschool program are identical in every way to individuals not participating in the preschool program except for receipt of the preschool program. Therefore, researchers can attribute all differences in outcomes between the two groups as causal effects of the preschool program. The evaluations of the Perry Preschool Program and the Abecedarian Program are random experiments.

In evaluations that are not random experiments, researchers are concerned that the group receiving the program and the group not receiving the program are different in ways other than the receipt of the program. For example, we would be concerned about inferring causal effects of a preschool program if all the participants in the preschool program had family incomes above $100,000 but all the individuals who did not participate in the preschool program had family incomes below $50,000. In this hypothetical example, we would be concerned that any positive outcomes for preschool participants were due to higher family income rather than due to preschool participation. Given these potential concerns, evaluations of preschool programs that are not based on random assignment need to demonstrate that, at the time the preschool program begins, the individuals who attend the preschool program are very similar to the individuals who do not attend the preschool program. The CPC evaluation and the Head Start evaluation upon which we rely are not random experiments, and both evaluations compare the characteristics of the individuals who participate in the preschool program and the individuals who do not participate. We discuss these comparisons in our critiques of these evaluations.

Perry Preschool Program

A study was begun in 1962 to evaluate the impact of the Perry Preschool Program on the individuals who participated in the program. This evaluation employed an experimental design. In 1962, four-year old children who were deemed eligible for participating in the preschool program were assigned at random to two groups. In one group, referred to as the treatment group, students were admitted into the Perry Preschool Program and they participated in the

program for one year. In the second group, referred to as the control group, students were not admitted into the preschool program.

New treatment and control groups were formed every year between 1963 and 1965. These subsequent groups were composed of three-year old students, so most individuals in the treatment groups participated in the Perry Preschool Program for two years. Over the four years (1962-1965), 58 children were assigned to the treatment group and 65 children were assigned to the control group.

Information on individuals in both groups has been collected periodically since the start of the evaluation. Belfield et al. (2006) evaluate the efficacy of the high-quality Perry Preschool Program using a cost-benefit analysis that builds on earlier evaluations of the Perry Preschool Program (Barnett 1985; 1996), using the most recently available follow-up data on program participants. In these data, participants in the original study group were at least 40 years old. The data contain information concerning educational outcomes, economic performance, criminal records, family relationships and health.

The study's experimental design and longitudinal nature make evaluations of the Perry Preschool Program a good starting point. Estimates by Belfield et al. (2006) are presented in Table 2. We discuss their estimates below. Unless otherwise noted, all the benefit and cost estimates of the Perry Preschool Program are from Belfield et al. (2006), except that we converted the estimates to 2007 dollars.

We divide the benefits into private benefits and public benefits. Private benefits accrue to individual preschool participants and their immediate family, not to the public as a whole. An example of a private benefit is the higher earnings of preschool participants relative to individuals who did not participate in Perry Preschool. Public benefits are benefits that accrue to the general public, such as reduced K-12 education expenditures or reduced crime.

The largest private benefit associated with the Perry Preschool Program is an increase in lifetime earnings for participants. Belfield et al. (2006) estimate that individuals who participate in the program had lifetime earnings that exceeded the lifetime earnings of nonparticipants by $60,743.[3]

Another private benefit of the Perry Preschool Program is that the parents whose children attended the Perry Preschool Program did not have to pay for private childcare. The estimated value of this benefit is $1,091, which means that for each child they had who participated in the program the family would spend an average of $1,091 less per child on child care over the childhood years.

Participants in the Perry Preschool Program were less likely to receive welfare payments as an adult. However, since this means that participants received less money from the federal government than people who did not participate in Perry Preschool, this decline in welfare payments needs to be viewed as a cost to participants of participating in the program. Belfield et

[3] Belfield et al. (2006) estimate earnings net of taxes.

al. (2006) estimate the cost of reduced welfare benefits over a person's lifetime is $2,414 per participant. Likewise, because participants in the Perry Preschool Program were more likely to enroll in post-secondary schooling, the tuition associated with attending post-secondary schooling also needs to be viewed as a cost to participants of participating in the program since people who do not participate in the program are less likely to pay this tuition.[4] Belfield et al. (2006) estimate the cost of these tuition payments as $193.

Summing over all these benefits, Belfield et al. (2006) estimate that the total lifetime private benefits of participating in the Perry Preschool Program is $59,227 per participant. This means that people who participate in the Perry Preschool Program receive an additional $59,227 over their lifetime compared to otherwise identical individuals who did not participate in the program.

The largest public benefit associated with the Perry Preschool Program is a reduction in the cost of crime, since participants in the Perry Preschool Program are much less likely to commit crimes as an adult. The value of this reduced criminal activity is estimated at $206,467 per participant. This estimated benefit includes substantial amounts for avoided victims' costs (such as pain and suffering) due to a reduction in crime, including the value of lives saved by the reduction in the murder rate. One concern about the benefit from reduced crime is that rate of criminal activity is very high for the sample of low-income individuals living in Ypsilanti, Michigan: 48 percent of the control group had been arrested for a crime compared with 32 percent for the treatment group. Since most parts of the county have crime rates below 32 percent, participants in other early childhood education programs are unlikely to experience this level of criminal activity. Therefore, Belfield et al. (2006) re-estimate the model using more conservative assumptions about the extent of criminal activity.[5] The lower bound estimate of the net benefit to the public is still in excess of $100,000 per participant.

Another public benefit included by Belfield et al. (2006) is decreased K-12 educational costs associated with participating in the program. Participants in the Perry Preschool Program were found to be less likely to need special education services or to be retained in a grade. This leads to a predicted K-12 cost savings of $10,155 per program participant. At the same time, participants in the program were more likely to participate in adult education programs or post-secondary schooling. Because these education programs are paid in part by the government, this additional schooling is a net cost to the public. The estimated cost of additional adult and post-secondary education is $1,362 per participant.

A third public benefit of the Perry Preschool is the reduced administrative costs of the welfare program. Belfield et al. (2006) estimate the public benefits from reduced welfare payments is equal to 138 percent of the reduced welfare payments to former participants in the Perry Preschool Program. For example, if welfare payments were reduced by $100, then their estimated public benefit from this reduced payment is $138. We believe they are double-counting welfare benefits since we do not believe the costs of administering the welfare program

[4] It is important to keep in mind that the benefits from attending post-secondary schooling, such as higher lifetime earnings, will be captured in the earnings differential between participants and nonparticipants discussed above.
[5] The exact assumptions are listed in footnote 23 of Belfield et al. (2006).

are equal to 138 percent of benefits (which is what Belfield et al. (2006) assume). Therefore, our estimate of the reduced administrative costs is equal to 38 percent of the reduction in benefits. In other words, we assume that if welfare benefits were reduced by $100, then the public benefit from this reduced payment is $38. Thus, our estimated public benefit from reduced administrative costs of the welfare program is $762 per participant.

Belfield et al. (2006) include the increase in income taxes paid by participants as a public benefit. However, in our opinion, changes in income taxes paid by individuals should be viewed as a transfer and not as a public benefit. To illustrate how these payments operate as transfers with no overall public benefit, consider the case of welfare benefits. If a single mother receives $100 less in welfare payments, taxpayers are better off because they have not spent $100 on the payments. However, the single mother is worse off because she has $100 less in welfare payments from the government. Society as a whole is no better or worse off because the money was simply transferred from welfare recipients to taxpayers; the net result is no change in overall wealth in the economy. Tax payments represent a similar situation. To accommodate for this, we do not include income taxes or welfare benefits in our estimation of the public benefits of Perry Preschool. Therefore, our estimate of the total public benefit of Perry Preschool is $179,538 per participant over their lifetime.

The total cost of the Perry Preschool Program is estimated at $18,261 per participant. With estimated lifetime private benefits of $59,227 and lifetime public benefits of $179,538 per participant, both the private and public benefits of the program greatly exceed the total per-participant cost of the program.

Abecedarian Program

An evaluation of the Abecedarian Program was begun in 1972. It eventually included children who were eligible to participate in the program between 1972 and 1977. Similar to the evaluation of the Perry Preschool Program, the evaluation of the Abecedarian Program employed an experimental research design in which eligible participants were randomly assigned to either a treatment group and were allowed to participate in the program, or they were randomly assigned to a control group and were not allowed to participate in the program. The evaluation focused exclusively on infants, mostly African-American, between 6 and 12 weeks old. In all, 57 children participated in the Abecedarian program and 54 children were in the control group.

Barnett and Masse (2007) use data on program participants at age 21 to estimate the long-term benefits and costs of the program. Potential benefits identified by the authors include: (1) increased participant earnings; (2) increased earnings of future generations; (3) increased maternal earnings; (4) health benefits; (5) educational cost reductions; (6) higher education costs; and (7) reductions in administrative costs for welfare payments. Estimates of program benefits and costs are given in Table 2. Again, benefits are divided into public and private benefits, and we only discuss benefits estimated under the standard assumption of a three percent rate of discount (i.e. an assumption that the rate of return for investments is three percent a year). All benefits and costs are in 2007 dollars.

As of age 21, preschool participants had completed significantly more years of schooling and were significantly more likely to attend a four-year college than those who did not participate in the Abecedarian Program, whom we call non-participants. Therefore, average lifetime earnings of participants are likely to be higher than that of non-participants. Barnett and Masse (2007) use Census data on demographic characteristics and educational attainment of participants at age 21, along with the probability of higher educational attainment later in life, to estimate the effect of receiving free childcare on lifetime earnings. The benefit amounts to $45,190 per preschool participant, although the amount actually received by participants will be lower because the earnings estimate is pre-tax rather than post-tax earnings.

Several studies find a positive relationship between parental income and their children's income. Thus, estimates of the parent-child income elasticity provide the basis for estimated earnings of future generations. Barnett and Masse (2007) assume that each preschool participant has one child who earns income from age 22 through 65. The estimated pre-tax benefit of the program on earnings of future generations is $6,890 per preschool group member.

As reported by Campbell and Ramey (1994), mothers of the children who participated in the Abecedarian preschool had higher levels of schooling and better-paying jobs when their children were age five. Thus, full-time free childcare provides an important benefit by improving mothers' labor market opportunities. Barnett and Masse (2007) estimate that the pre-tax benefit associated with the availability of free childcare resulted in an increase in maternal earnings from age 26 to age 60 of $82,754 per preschool participant.

Barnett and Masse (2007) assume that more-educated individuals make better healthcare decisions. The authors use data from a previous study to estimate the dollar value associated with reductions in mortality due to smoking. They estimate a benefit of $21,410 per preschool participant from reductions in mortality due to smoking. One caution in interpreting this result is that no statistical differences in smoking rates were found to exist between participants and non-participants. Therefore, we cannot reject the hypothesis that there are no estimated benefits from a reduction in smoking because there are no statistically significant differences in smoking behavior.

The overall private benefit from the Abecedarian Program is estimated at $156,243 per preschool participant, which is the largest private benefit of any program we reviewed. The number is slightly overstated, as it does not include the decrease in benefits due to lower expected welfare receipt or the increased out-of-pocket expenses for higher education (by participants). However, the expected value of these two costs per participant in the Abecedarian Program is likely only a few thousand dollars at most, based on the estimated value of welfare benefits ($2,414) and higher education ($193) in the Perry Preschool evaluation.

The first public benefit estimated by Barnett and Masse (2007) is the cost savings resulting from reductions in special education placement. The authors construct regular/special education placement profiles for 99 of the study's participants for each year and assign the cost of each type of placement to calculate total education costs. They estimated that the program reduced education costs by $10,639 per preschool participant.

At age 21, preschool participants were significantly more likely to attend a four-year college compared to non-participants. Although college attendance benefits individuals through enhanced labor-market opportunities, it also imposes an additional higher-education cost due to government expenditures on higher education. Barnett and Masse (2007) estimate the cost of higher education at $9,787 per preschool participant. This higher education cost is a negative benefit to the general public because it represents an increase in government expenditures on education.

If receiving free childcare reduces welfare payments, then the reduction in payments benefits society by reducing administrative costs associated with providing these programs. The lower benefits themselves are not a public benefit because they are merely transfers from the taxpayers to welfare recipients. Barnett and Masse (2007) infer welfare participation based on reported use of Aid to Families with Dependent Children (AFDC) at age 21. They estimate average total welfare payments at $12,349 per AFDC household. These payments translate into an estimated administrative cost savings of $236 per preschool participant.[6]

By adding the benefits of K-12 education, higher education, and administrative welfare costs, we have an estimate of the total public benefits of the program. Barnett and Masse (2007) found no differences in crime rates at age 21, so they assume that there are no public benefits for lower crime. Therefore, our estimate of the total public benefit of the Abecedarian Program is $1,088 per participant.

The cost of the Abecedarian Program is estimated at $43,183 per participant. Recall that the estimated private benefits were $156,243, and the public benefits were $1,088 per participant. Thus, the private benefits clearly exceed the costs of the program, suggesting that families should participate in the program. However, the public benefits are more than $40,000 lower than the public costs of the program, suggesting that the Abecedarian Program appears to impose net costs on the public rather than provide net benefits.

Chicago Child-Parent Centers Preschool Program

The Chicago Longitudinal Study (CLS) is an on-going evaluation to determine the long-term impact of participation in the preschool component of the Chicago Child-Parent Centers (CPC). The study follows 1,539 individuals who were born in 1980 and who attended kindergarten in 1985-1986. The study compared 989 children who completed the CPC's preschool and kindergarten programs with 550 children who attended an all-day kindergarten program, but did not participate in the CPC preschool program. Ninety-three percent of the children in the study are African-American. CPC offered a two-year preschool program. Individuals in the study were age 20 or 21 in the most recent follow-up survey.

Reynolds et al. (2002) and Temple and Reynolds (2007) evaluate the costs and benefits of the CPC preschool program. Specifically, the analysis calculates the costs and benefits of

[6] However, the incidence of AFDC does not differ significantly between those attending the Abecedarian Program and those not attending the program.

attending two years of the CPC preschool program relative to not attending the CPC preschool program. The preschool program is one of three CPC programs targeting minority children ages three to nine living in high-poverty areas and at risk of school failure.

Unlike the evaluations of the Perry Preschool and Abecedarian Programs, the evaluation of the CPC preschool program is not a random assignment study. Rather, children who did not attend the CPC preschool program were chosen to closely match children who did participate in the CPC preschool program based on age of kindergarten entry, participation in public assistance programs, Title I school area attendance, and eligibility for the subsidized lunch program. Reynolds et al. (2002) document the similarity of treatment and control children over several dimensions. However, the groups differ with respect to some important characteristics such as parental education. Another concern with the study is that attrition may differ between participants and non-participants. The evaluation does not show whether the attrition rate is similar between the two groups, yet the evaluation implicitly assumes that attrition is similar. Therefore, the results from this evaluation need to be interpreted with caution because the study does not guarantee that the participants and non-participants are similar in all aspects at the time of preschool enrollment, like a well-conducted random assignment study (such as the evaluations of Perry Preschool or Abecedarian) does.

Reynolds et al. (2002) identify potential program benefits arising from differences in measured outcomes between the CPC preschool participants and non-participants. They only include benefits that are statistically different from zero, meaning that they do not focus on benefits that are likely to occur "by chance" rather than being attributed to the program. Reynolds et al. (2002) include the following potential benefits: (1) opportunity costs of childcare; (2) participant educational costs; (3) increased earnings of participants; (4) special education and grade retention savings; (5) higher education costs; (6) cost savings due to reduced crime; and (7) cost savings due to reduced child abuse and neglect. Details of the costs and benefits are reported in Table 2 and discussed below. All values are in 2007 dollars, and we assume that the discount rate is three percent.

Each benefit of the CPC preschool program is calculated as the benefit received by CPC preschool participants relative to the benefit received by students who did not participate in the CPC preschool program. The first private benefit calculated by Reynolds et al. (2002) is the savings in child care from the provision of free preschool through the CPC. The estimated value of this benefit is $2,108 per participant.

The additional money spent by participants on education is a private cost (i.e. a negative benefit) of the program. Participants are more likely to attend post-secondary schooling and, therefore, more likely to pay tuition. The estimated cost is $237 per participant. In other words, Reynolds et al. (2002) estimate that each preschool participant spends an average of $237 more on post-secondary education costs such as tuition, books, etc, over their lifetime than individuals that did not participate in the program.

As in the other programs, the largest private benefit in the CPC preschool program is the increased participant earnings. Because participants are only age 20 or 21 at time of the study, future educational attainment and wages are estimated based on educational attainment and

enrollment through age 20 or 21. The projected benefit of increased earnings is estimated at $26,098 per CPC preschool participant.

Reynolds et al. (2002) estimate that the total private benefit received by participants in the CPC preschool program is $27,970 per participant.

The CPC preschool evaluation also considers several public benefits of the preschool program. Preschool participation decreases the likelihood of special education placement and of grade retention compared to individuals who did not participate in the CPC preschool program. According to Reynolds et al. (2002), CPC preschool participation is associated with a 10 percentage-point decline in the likelihood of special education placement and a 15 percentage point decline in the likelihood of grade retention. The estimated public benefit for reduced special education placement is $5,317 per participant, and the estimated benefit for reduced grade retention is $880 per participant. The combined public benefit associated with K-12 education is $6,197 per participant.

As mentioned earlier, participation in the CPC preschool is associated with increased post-secondary educational attainment. Because public post-secondary education is subsidized by the government, this increase in post-secondary education leads to a public cost due to this subsidy. Reynolds et al. (2002) estimate that this public cost is $472 per CPC preschool participant.

Another public benefit is the reduction in costs associated with crime. Participation in CPC preschool is associated with lower levels of juvenile and adult crimes. Reynolds et al. (2002) estimates that the overall public benefit from reduced crime is $16,863. This benefit is much smaller in magnitude than the benefit from the Perry Preschool for two reasons. First, Reynolds et al. (2002) exclude intangible benefits from items such as pain and suffering, as the value of these benefits are very difficult to measure. Second, the rate of crime among the individuals in Perry Preschool evaluation (those who attended preschools and those who did not), especially for violent crimes, is much higher than the crime rates among CPC preschool participants and the nonparticipants. Therefore, the likely reduction in crime among CPC participants is much smaller.

The final public benefit of CPC preschool is the reduction in the need for state child abuse and neglect services, along with the reduction in tangible costs to victims of abuse and neglect.[7] The estimated value of this benefit is $979 per CPC preschool participant.

Overall, the public benefits are estimated at $23,568 per CPC preschool participant. As mentioned previously, the estimated private benefits are even larger at $27,970. The estimated total cost of CPC preschool is $8,512 per participant. Thus, as in Perry Preschool, both the private and public benefits from the CPC preschool program greatly exceed the costs.

[7] It is unclear whether these victims' costs are for the CPC participants themselves or for other children. We include them as public benefits because Reynolds et al. (2002) include them as public benefits as opposed to private benefits.

Head Start Program

Ludwig and Phillips (2008) draw on evidence from a randomized Head Start experiment initiated in 2002. The program randomly assigned 4,700 income-eligible children for participation in Head Start into two groups, those that participate in Head Start and those that were not allowed to participate in Head Start. Because of this randomized design, differences in measured outcomes between the two groups are likely due to the program itself, and not initial differences between the treatment and control groups. The authors find that individuals in the Head Start group have higher scores on tests of cognitive skills than non-participants. Based on these results, they conclude that the long-term benefits to society are predicted to exceed the cost of Head Start. However, they do not observe the long-term benefits; they simply infer these benefits based on the differences in test scores. An additional limitation of their study is that other authors tend to find that differences in test scores dissipate or "fade out" over time (Barnett and Belfield, 2006). Therefore, it is unclear whether the higher test scores observed in Ludwig and Philips (2008) will lead to long-term differences between participants and non-participants.

Barnett and Belfield (2006) provide estimates on the benefits of Head Start even though they do not conduct an explicit cost-benefit analysis. They measure the benefits of Head Start by taking an average of the benefits of Head Start from several different studies examining the impact of Head Start on participants. Although the rigor of these evaluations is not stated, Garces, Thomas, and Duncan (2002) find similar results in their analysis of Head Start. None of these studies are random assignment studies.

Barnett and Belfield (2006) present their results as percentage improvements of Head Start over alternate child care arrangements (including no child care or preschool). In the next section, we will translate these percentages into expected dollar-amount benefits in Kentucky based on education spending patterns. Barnett and Belfield (2006) estimate that Head Start participation leads to lower special education placement (28 percent) and lower likelihoods of grade retention (30 percent).

Garces, Thomas and Duncan (2002) look at the longer-term effects of Head Start participation. Although they do not have data from a random experiment, the authors conduct within-family comparisons of siblings in Head Start with siblings in other child care settings. This within-family comparison provides a good control for most of the pre-Head-Start differences between students in Head Start and students in other programs. These students come from the same families, so they have the same family and neighborhood characteristics, and they likely attend very similar if not the same elementary and secondary schools. The authors find that Head Start participation leads to higher rates of high school completion (20 percentage points) and college attendance (28 percentage points) for whites, but the results for African Americans were not statistically different from zero. In contrast, Garces, Thomas, and Duncan (2002) find that Head Start participation is associated with a 12 percentage point decrease in the likelihood of being charged with a crime for African Americans, but the results for whites were not distinguishable from zero.

Summary of Benefits

The programs reviewed in this section vary greatly in many aspects. The Perry Preschool and the Abecedarian Programs are programs that are of much higher quality than the anticipated expansion in Kentucky's preschool program. Therefore, it is unrealistic to assume that the benefits from these programs can translate into similar benefits for the proposed expansions for Kentucky.

The CPC preschool program and Head Start are similar to Kentucky's pre-school program. The CPC preschool program is a half-day program that runs through the academic year. The CPC preschool program does not require home visits (they are part of outreach services), but it does have parental involvement in the school of one-half day per week. The CPC preschool program also has slightly smaller child-teacher ratios of 8.5 children per teacher compared to 10 for Kentucky. The CPC preschool program is for two years, and we measure the Kentucky expansions in terms of one year of attendance. We believe that the programs are fairly similar, although we assume that the CPC has larger benefits than Kentucky. We make this assumption in order to reflect the longer duration of the CPC preschool program and to produce conservative estimates of the benefits of expanding Kentucky's preschool program.

Head Start is another program that is similar to Kentucky's proposed expansion. Head Start has slightly less stringent teacher requirements than Kentucky's proposed expansion. Head Start has home visits, and they encourage parental participation.

We formalize these assumptions in the next section, where we provide estimates of the benefits and costs of expanding Kentucky's state-funded preschool program.

IV. Expected Costs and Benefits of Kentucky Expansion

This section contains the expected costs and benefits of the proposed expansion to Kentucky's pre-K program. All cost-benefit analyses require several assumptions about the program. We begin this section with a discussion of these assumptions. Next we discuss the estimated costs of the program. Then, we discuss the expected benefits of the program. We conclude with a comparison of the two, along with some closing thoughts.

Assumptions about Kentucky Program

In order to estimate costs and benefits for a proposed expansion of Kentucky's preschool program, a number of assumptions must be made about the proposed expansion. We make the following assumptions about the structure of the program:

- The new program will have the same number of hours per day (2.5 plus meals), days per week (four or five), and weeks per year (academic calendar) as the current preschool program. The current program is similar to many other states, so there is no reason to expect any changes in the hours of the program.

- We also assume that there will be no changes in the instructional setting of the program. Districts currently use either public or private providers.

- Consistent with legislation passed by the Kentucky General Assembly in 1999 that all newly-hired teachers beginning 2004 must have an Interdisciplinary Early Childhood Education bachelor's degree, we assume that each new teacher hired will have at least a bachelor's degree. Because the expansion will substantially increase the number of teachers with at least a bachelor's degree, the percentage of teachers without a bachelor's degree will decrease. Because teachers with bachelor's degrees are paid more than teachers with out bachelor's degrees, hiring new teachers with bachelor's degrees will increase the per-pupil cost of operating a preschool program.

- With respect to assistant teachers, we assume that the current guidelines apply: assistant teachers are required to be high school graduates. The National Institute for Early Education Research (NIEER) (2007) recommends that assistant teachers have at least a Child Development Associate certificate or equivalent, so policymakers may want to consider increasing the education requirements for assistant teachers in the future.

- The teacher-student ratio is assumed to remain constant at 10 students per adult (teacher or teacher associate). The ratio is higher than the Perry Preschool or Abecedarian Programs, but it is consistent with the CPC preschool program and Head Start. Any reduction in the ratio would require a substantial increase in the number of teachers and assistant teachers hired throughout the state.

- We assume that the number of home visits will remain the same at two visits per year.

- We assume that the program includes one meal per day, and transportation is available. These assumptions are consistent with the current program, so the cost estimates are unaffected.

- We assume that the benefits of expanding Kentucky's preschool program to include three and four year olds living in families with incomes between 150 and 200 percent of the poverty line are only 75 percent as large as the benefits from expanding the program to include three year olds living in families with incomes less than 150 percent of the poverty line. We make this assumption to ensure that, if anything, our estimates understate, rather than overstate, the true benefits of the program.

- The costs and benefits of each expansion are measured for one year of preschool attendance. This assumption allows us to compare the two expansions even though they are of different lengths. The first expansion provides one additional year of preschool attendance, at age three, for students with family incomes up to 150 percent of the poverty line. The second expansion provides up to two years of additional preschool attendance for students with family incomes between 150 and 200 percent of the poverty line.

Based on the set of assumptions above, we would characterize our proposed program to expand preschool in Kentucky as a medium-quality program. It has less frequent home visits than high-quality programs, but a comparable number of home visits as other medium quality programs. It has higher student-teacher ratios compared to high-quality programs. The half-day program has roughly the same amount of instructional time as other part-time programs. The instructional settings are similar to other medium-quality programs such as the Chicago Child-Parent Centers. The parental involvement is less than high-quality programs such as Perry Preschool. The requirements for new teachers are similar to high-quality programs, but the fact that it is only applied to new teachers suggests that the overall teacher quality is only slightly above medium-quality programs. Eventually all teachers will have bachelor's degrees, at which point the teacher qualifications will be similar to high-quality programs.

The current Kentucky program is rated highly among state-funded preschool programs. NIEER (2007) ranks Kentucky's program as 10th best in the nation. The program satisfies eight of the 10 benchmarks for quality programs. The two shortcomings are that assistant teachers are not required to have a Child Development Associate certificate or equivalent and that the state does not meet the guideline for on-site monitoring. It is important to note that none of the current state-funded preschool programs would be considered a high-quality program such as Perry Preschool. The parents are much more involved and student-teacher ratios are much lower in Perry Preschool than in any state-funded program.

Expected Costs

During the 2007-2008 school year, the state government allocated $3,304 per student without disabilities in the current pre-K program in Kentucky. However, this cost does not cover the entire cost of preschool. The state allocated approximately $75 million to districts for preschool. However, districts also spent another $15 million in Federal money, and the Kentucky Department of Education estimates that districts spent an additional $15 million from local sources. Thus, the overall cost of the current pre-K program is approximately $105 million. Because these costs cover the entire program, they include students with disabilities and students without disabilities. Therefore, we do not know the exact total expenditures from all sources (state, federal, and local) spent on students without disabilities or students with disabilities. In our calculations we assume that federal and local per-student expenditures are split evenly between students with and without disabilities. Approximately 28 percent of the overall cost is from federal and local sources ($30 million of $105 million). We assume that 28 percent of the overall per-student cost is also from federal and local sources. Under this assumption, the total cost (from all government sources) of providing preschool is $4,229 per student. This assumption likely overstates the per-student cost for students without disabilities. Because the state allocation is higher for students with disabilities, the local and federal allocation is also likely higher for students with disabilities. More generally, our assumptions err on the side of increasing costs and decreasing benefits so that the overall cost-benefit analysis can be viewed as conservative.

Our estimated cost per student will be higher in the expanded program because the proposed program requires that all new teachers have at least a bachelor's degree, whereas in the current program many experienced teachers do not have bachelor's degrees. We assume that the

cost of teachers will increase under the assumption that teachers with bachelor's degrees will be paid more than teachers with less than bachelor's degrees.

According to our calculations from the 2000 Census, early childhood education teachers in Kentucky with bachelor's degrees had earnings that were 25 to 40 percent higher than high school graduates. NIEER (2007) reports similar differences in earnings for Head Start teachers. This does not mean that the costs of the preschool expansions would increase by 25 to 40 percent. Because many teachers already have bachelor's degrees, the current cost of the preschool programs contains costs for employing many teachers with bachelor's degrees. Also, preschools have costs other than teachers' salaries, such as the costs of non-teacher workers and the costs associated with the preschool facility (maintenance, operation, etc.). Given these caveats, we assume that costs will increase by 20 to 32 percent, which is 80 percent of the cost differential between hiring teachers with bachelor's degrees and hiring teachers with high school diplomas. Rather than report a range of cost estimates, we choose the midpoint of this range, which is 26 percent. Thus, we assume that per-student costs increase by 26 percent due to the requirement that all new teachers have bachelor's degrees. A 26 percent increase in costs is equal to $1,100 per student per year.

For all other costs, we assume that the estimated cost per student is the same regardless of the number of students that participate in the program. Such an assumption is reasonable if the market for childcare is competitive. Although we are unable to test this assumption, we believe this is a reasonable assumption.

Based on these assumptions, we estimate that if we expand the current preschool program in Kentucky then per-student costs would increase by $1,100. Adding $1,100 to the current per-student estimate of $4,229 per student results in an estimated total cost (from all government funding sources) of $5,229 per student. As mentioned earlier, this amount is a 26 percent increase over the current funding amount (from all government sources).

In order to estimate the total cost of each expansion, we need to estimate the number of students affected. Under the first expansion, which covers three-year olds with income up to 150 percent of the federal poverty line, we assume that the number of participants equals the number of four-year old participants in 2006-2007 who met the poverty threshold but did not have a disability. According to Kentucky Department of Education (2007), there are approximately 5,500 such students: 8,700 low-income four-year olds received state-provided preschool in December 2007, but 3,200 students were considered dual-eligible because they also had disabilities. Because three-year old students with disabilities are already eligible for state-funded preschool, we do not include students with disabilities in our estimates of the number of additional three-year old students who would participate. Therefore, we predict that expanding preschool to three-year old students with family incomes up to 150 percent of the poverty line would lead to an additional 5,500 students enrolled in the preschool program. The predicted annual cost of this expansion is approximately $23 million per year.[8]

[8] We are assuming that the size of the cohort of three-year olds does not change over time. However, there is suggestive evidence that the number of births has increased in recent years.

For the second expansion—including three- and four-year olds from families with incomes between 150 and 200 percent of poverty—we assume that the number of participating students at each age (three and four) is approximately equal to 2.5 times the increase in participation that occurred in 2006-2007 when the existing program was expanded from 130 percent of the poverty line to 150 percent.[9] According to the Kentucky Department of Education the 2006-2007 increase in the program led to an increase of 904 students, so we are projecting that the proposed expansion will result in an increase in 2,260 additional students at each age, for a total increase of 4,520 students. Based on these projections the estimated total cost of this expansion is slightly more than $19 million per year.

Expected Benefits

In this section, we look at the potential benefits of the two proposed expansions. We consider the benefits of the two expansions separately. The first is expanding access to three-year-old students with family incomes up to 150 percent of the poverty line. The second is expanding access to three-year-old and four-year-old students with family incomes between 150 and 200 percent of the poverty line in addition to expanding access to three-year-old students with family incomes up to 150 percent of the poverty line. It does not make sense to expand access to three-year-old students with family incomes between 150 and 200 percent of the poverty line unless three-year-old students with lower family incomes are also included in the program.

Based on the evaluations of previous preschool programs, we have identified several potential benefits of the proposed preschool expansions. Our estimates of the potential benefits for the two expansions are listed in Table 3. When estimating the size of the benefits from the proposed expansions of the program, we discount future benefits at a rate of three percent per-year. Our assumption of a three-percent discount rate is consistent with assumptions made by the Federal Government when estimating the future costs and benefits of similar programs. However, we also present estimates using a five-percent discount rate in Table 4 and a seven-percent discount rate in Table 5. Again, all dollar amounts are in 2007 dollars.

We distinguish between private benefits, benefits that accrue to the participants, their parents, and their children, from public benefits that accrue to society as a whole. We consider seven potential private benefits: (1) child care costs, (2) education costs, (3) participant earnings, (4) earnings of future generations, (5) participant health, (6) parental earnings, and (7) welfare benefits. We consider seven public benefits: (1) special education placement; (2) grade retention; (3) other K-12 benefits, (4) higher education costs, (5) crime; (6) welfare administrative costs; and (7) child abuse/neglect costs.

We start with the private benefits, the benefits that accrue to participants and their immediate families. Evaluations of the Perry Preschool Program and the CPC preschool

[9] This assumption is based on authors' calculations from the 2000 Census data and the 2005-2007 American Community Survey data. Note that obtaining a more precise estimate of the number of eligible children is very difficult because schools currently have no idea how many students have family incomes up to 200 percent of the poverty line. Schools are more familiar with the cut off for a free or reduced-price lunch, which is 185 percent of the poverty line.

program include foregone child care costs as benefits. To be conservative in our estimate of benefits, we assume that there are no foregone child care costs. In other words, we assume that, in the absence of the program, parents who are currently working would either be forced to leave the labor market to care for their children themselves, or they would provide informal child care – often through friends or relatives – at zero cost.

The second private benefit in Table 3 is the additional cost of education. If preschool attendance increases the likelihood of post-secondary education, then the out-of-pocket education costs (tuition, books, etc.) associated with that increased likelihood are a private cost, which is measured as a negative benefit. We estimate the additional education cost as one third of the cost from the CPC evaluation. We choose one third, rather than one, because the reported CPC costs are for two years of preschool attendance, and our estimated benefit (and cost) is for one year of preschool attendance. In addition, we want to provide a conservative estimate of the benefits. We estimate a private higher education cost of $79 per preschool participant for the first expansion and $59 for the second expansion.

An obvious benefit – to the participant – of preschool is the potential to increase earnings. The evaluation of the Perry Preschool and Abecedarian Programs find large increases in earnings for participants. The evaluation of the CPC preschool program also finds sizable increases, whereas the Head Start evaluation does not identify an increase in earnings. We assume that the earnings differences are half the size of the CPC increase, which is the average of the CPC increase and the Head Start increase. These two programs closely resemble Kentucky's proposed program, and the populations served are also similar. Thus, our estimate of the increase in lifetime earnings is $13,049 per preschool participant for the first expansion and $9,787 for the second expansion. This benefit alone outweighs the cost of the program, suggesting that individuals should choose to participate in the program even if they have to pay the costs of the program.

The Abecedarian evaluation also included small, modest benefits in the form of earnings of future generations under the reasonable assumption that more-educated adults have more educated children. To be conservative in our benefits estimates, we assume that this benefit is equal to 25 percent of the Abecedarian benefit. Such an assumption is made to account for the differences in program quality between the Abecedarian Program and the proposed Kentucky expansion. We chose 25 percent to be consistent with the conservative cost-benefit estimates in Belfield (2006) for potential expansions of preschool in three states. The estimated benefit from the first expansion is $1,649, and the estimated benefit from the second preschool expansion is $1,237.

The evaluation of the Abecedarian Program includes sizable increases in mothers' earnings. This increase in earnings occurs because the mothers of participants in preschool are themselves able to participate in job training and education activities in addition to increasing their labor supply due to the existence of the full-day, full-year child care option. Studies of part-time programs such as Perry Preschool and the CPC do not include such benefits. Following our conservative approach, we assume that there are no benefits for parental earnings as a result of expanding eligibility for the half-time, academic-year preschool program in Kentucky.

Preschool participation also has the potential to increase participant health. Much of that increase occurs because more-educated individuals have better health outcomes independent of the effects of education on other health-related attributes such as earnings (Grossman, 2006). Cutler and Llera-Muney (2008) estimate that the benefits of increased health raise the private, individual return to schooling by 15 to 55 percent. To be conservative, we choose the lower bound of 15 percent of the estimated increase in earnings, leading to an estimated health benefit of $1,957 per participant in the first expansion and $1,468 per participant in the second expansion.

Both the Perry Preschool Program evaluation and the Abecedarian Program evaluation include social benefits from reduced welfare usage. Because welfare payments are transfer payments from the government to the recipients, any reduction in welfare benefits is not a benefit to society. Similarly, any reduction or increase in tax revenues can also be viewed as a transfer payment. Therefore, the reduction in welfare benefits is not included in our cost-benefit analysis.

Next we consider the public benefits that occur while the participants are still in K-12 education. A primary benefit of the early childhood programs we reviewed is the reduction in the probability that a participant in a preschool program will be placed in a special education program in grades K-12. Special education programs are very expensive; Currie (2001) estimates that it costs nearly $10,000 extra (in 2007 dollars) per year to place a student in special education and that students in special education remain there for 10 years. She also estimates that Head Start reduces the likelihood of special education placement by 2.8 percentage points. We feel that these assumptions are appropriate for Kentucky's expansion. Thus, our estimated benefit from reduced special education placement is $2,242 per student for the first expansion and $1,681 for the second expansion. This number is likely conservative, as it is well below the estimated reduction in the CPC preschool program.

Another advantage of preschool is the reduced likelihood of repeating a grade at some point between kindergarten and 12th grade. Again, we rely on estimates by Currie (2001) of the cost and likelihood of repeating a grade at some point before graduating from high school. Her estimates lead to a predicted benefit of $383 per student, again well below the estimated benefit from the CPC evaluation.

We assume that preschool expansion leads to better student behavior and student achievement beyond the reductions in special education placement and grade retention noted above. Examples of such benefits are lower teacher turnover, reduced teacher absences and the resulting reduction in the need for substitute teachers, reduced expenditures on school safety, and expenditures on remedial education programs, as discussed in Belfield (2006). However, translating these gains into dollar amounts is extremely difficult and is rarely done. For simplicity, we assume that the benefits are equal to the benefits from special education: $2,242 per student for the first expansion and $1,681 for the second expansion. This assumption is well below the predicted savings due to teacher turnover, substitute teaching, safety, and remedial education listed in Belfield (2006). Therefore, we view our estimated benefit as conservative.

Next, we turn to the public benefits of preschool expansion that occur after K-12 education. One benefit of the preschool expansion is that participants ultimately obtain more education than students that do not participate in preschool programs. However, this increase in education is actually a cost of the program, as public universities in Kentucky will need to accommodate these extra students. According to Watts (2001), the state government provides a subsidy of $7,414 (in 2007 dollars) per full-time equivalent student to attend the state's public universities. Garces, Thomas, and Currie (2002) calculate that the percentage of individuals with at least some college education is 10 percent higher for Head Start participants relative to student who do not attend Head Start (but may attend other types of child care or preschool), but this effect is only seen for white students. We interpret "some college" as up to two years of college, with a 30 percent attrition rate between the first and second year.[10] We assume that the state government contribution remains the same, which is equivalent to saying that the contribution rises at the same rate as the discount rate. We assume that 90 percent of attendees attend public institutions in Kentucky. Because in Garces, Thomas, and Currie (2002) the increased education level is only present for whites, we assume that the estimate is an upper bound and therefore reduce it by half. Thus, our estimate of the public cost of additional college education by the first preschool expansion is $588. For the second expansion, the estimated cost is $441.[11]

By far, the largest public benefit in the Perry Preschool Program was the dramatic reduction in the likelihood that participants will engage in criminal activity. For purposes of this report, we separate the benefits from reduced crime into two categories. The first is the decrease in the administrative costs associated with incarceration, and the second is the victims' costs of crimes, such as replacement of lost property, wages, etc. Given the staggeringly high crime rates for the participants in the Perry Preschool evaluation, along with the high quality of the Perry Preschool Program, we assume that crime costs associated with Kentucky's preschool expansion would be substantially lower.[12] The CPC evaluation also reports substantial reductions in crime. The CPC preschool program appears to be a similar program in terms of quality as the Kentucky expansion, but we are concerned that the crime reductions may still be overstated. Crime rates in Chicago are well above crime rates in Kentucky; murder rates are three times higher in Chicago and property crime rates are nearly two times higher in Chicago (U.S. Department of Justice, 2007a). The difference in crime rates, and the fact that the CPC preschool program is for two years of preschool compared to our estimated benefits from one additional year of preschool, suggest that estimated benefits of reduced crime may be overstated. Therefore, we conservatively estimate the crime benefits to be one third the benefits of the CPC preschool program. For the first expansion, our predicted benefits from reduced crime are $3,023 for administrative costs and $2,598 for victims' costs for a total crime benefit of $5,621 per participant. For the second expansion, the predicted per-participant benefits are $2,267 for administrative costs and $1,948 for victims' costs for a total crime benefit of $4,216 per participant.

[10] Attrition rates at the University of Kentucky are approximately 10 percent per year; attrition rates at community colleges are closer to 50 percent. Thirty percent is the average of these two.

[11] This assumption is not directly affected by the Council for Postsecondary Education goal of increasing postsecondary attendance in Kentucky. We are only interested in the difference in attendance rates between students who participated in the state's preschool program and students who did not.

[12] According to the Bureau of Justice Statistics, the incarceration rate in Kentucky was below the average for the U.S. as a whole (U.S. Department of Justice, 2007b).

As mentioned above, we do not include welfare payments in our calculation of benefits because we consider them to be transfers from taxpayers to welfare recipients. However, the reduction in administrative costs associated with the reduction in welfare payments can be viewed as a public benefit. The Abecedarian Program has a very small predicted benefit of just $226 per participant. Because the Abecedarian Program is considered higher quality than Kentucky's proposed expansion, we assume that the benefits from the Abecedarian Program would be higher than the benefits from the proposed Kentucky expansion. Specifically, we assume that the benefits for the first expansion are only 25 percent as large as in the Abecedarian Program; again, this assumption is made to be consistent with Belfield (2006). Under such a prediction, the predicted benefit is $56 per participant for the first expansion and $42 per participant for the second expansion.

Finally, the CPC preschool evaluation also includes public benefits from reduced expenditures on child abuse and child neglect services. To be consistent with our assumptions about crime savings and private education costs, we conservatively estimate that the reduction in these expenditures is one third as large as the estimates in the CPC evaluation. Therefore, we estimate the public benefit from reduced child abuse and child neglect is $326 per participant for the first expansion and $245 for the second expansion.

Comparison of Benefits and Costs

By combining the estimated private benefits discussed above, we predict an overall private benefit of $16,576 for the first expansion and $12,432 for the second expansion. Although these numbers are lower than the private benefits for the Perry, Abecedarian, and CPC evaluations, they are still larger than the costs. Also, we were conservative in our estimates of the private benefits, so that we can view them as lower bounds of the likely effects of either expansion.

By taking the sum of each public benefit, we estimate that the total public benefit is $10,282 per participant for the first expansion and $7,712 per participant for the second expansion. Again, both estimates are well above the estimated cost (from federal, state, and local government sources) of $5,329 per participant.

For both the public and private benefits, the estimated benefits exceed the estimated costs for each of the two proposed preschool expansions. Wherever possible, we were conservative when estimating the benefits, so our estimated benefits can be viewed as a lower bound on the likely gains from expanding the program. At the same time, we have attempted to provide an upper bound of the estimated costs of the proposed expansions. Thus, our cost-benefit estimates should be viewed as lower bounds of the likely benefit-cost ratio of the proposed expansion.

One assumption that might not be viewed as conservative is the choice of three percent as the discount rate. In recent years, we have experienced periods where the real value of money has grown by more than three percent, meaning that the discount rate during those periods has been greater than three percent. During the expansionary period of the late 1990s, most investments produced rates of return that were higher than three percent per year. Therefore, we

also estimate the predicted costs and benefits for each expansion using discount rates of five percent and seven percent. These results are shown in Tables 4 and 5, respectively. Note that seven percent is a very high rate of discount. It is unlikely that the real value of money will grow at a rate faster than seven percent each year over a long period of time.

In general, we followed the same estimation strategy as we did when constructing Table 3. The Perry and Abecedarian evaluations contain cost-benefit analyses using a discount rate of seven percent. However, the CPC cost-benefit analysis does not. To estimate benefits for the CPC preschool program, we inferred the likely benefits from a seven-percent discount rate based on the ratio of benefits between the three-percent discount rate and the seven-percent discount rate in the Perry and Abecedarian cost-benefit analyses. The Perry and CPC cost-benefit analyses do not contain cost-benefit analyses using a discount rate of five percent, so we inferred the likely benefits from a five-percent discount rate based on the ratio of benefits between the three-percent discount rate and the five-percent discount rate in the Abecedarian analysis. Because the Head Start evaluation measured outcomes in terms of percentages rather than dollar amounts, we can easily recalculate the estimated benefits using a five-percent or a seven-percent discount rate rather than a three-percent discount rate.

With a discount rate of five percent (Table 4), our predicted private benefits are $7,299 per participant for the first expansion and $5,474 for the second expansion. With a discount rate of seven percent (Table 5), our predicted private benefits are $2,776 per participant for the first expansion and $2,082 for the second expansion. We assume no change in the cost per participant of $5,329. The private benefits still exceed the costs even if we assume a more conservative discount rate of five percent. However, under the more conservative assumption of a seven-percent discount rate, the private benefits are less than the private costs for both expansions. Thus, if the individual parents had to pay for the program, they would likely still choose to participate under an assumed discount rate of five percent but not under the extremely conservative discount rate of seven percent.

Using a five-percent discount rate, the per-student estimated public benefits are $8,030 for the first expansion and $6,023 for the second expansion (Table 4). Using a seven-percent discount rate, the per-student estimated public benefits are $5,905 for the first expansion and $4,429 for the second expansion (Table 5). Again, the estimated costs are $5,329 per student. Thus, the public benefits from both expansions exceed the costs under the assumption of a five percent discount rate. Furthermore, under a seven percent discount rate, the public benefits from the first expansion of extending preschool to three-year olds with family incomes up to 150 percent of the poverty line exceed the estimated costs. The estimated benefits from the second expansion of extending preschool to three- and four-year olds with family incomes between 150 percent and 200 percent of the poverty line do not exceed the estimated costs assuming a discount rate of seven percent.

However, this estimate of the public benefits of the proposed second expansion is likely understated. A discount rate of seven percent is extremely high; the Office of Management and Budget recommends a real discount rate of 2.8 percent (Federal Register, 2008, page 5599). Also, we assume that the benefits of the second expansion are only 75 percent of the benefits of the first expansion. This assumption is based on the perception that the benefits for students with

family incomes between 150 and 200 percent of the poverty line are smaller than the benefits for students with family incomes less than 150 percent of the poverty line. However, Barnett and Belfield (2006) state that there is limited evidence to support this perception. We include the supposition to be conservative in the estimated benefits.

V. Conclusion

Based on our preferred set of assumptions concerning the discount rate, the estimated lifetime public benefits accruing to everyone in society from expanding the pre-K program in Kentucky are $16,576 for every student that participates in the first expansion, extending eligibility to three -year old students with family incomes less than 150 percent of the poverty line, in a year. The estimated lifetime public benefits from the second expansion, extending eligibility to three- and four-year old students with family incomes between 150 and 200 percent of the poverty line, are $12,432 for every participant in a year. Given our estimates that an additional 10,002 students participate in the expanding program in a given year, the estimated value of additional lifetime benefits is more than $200 million per year. In contrast, our estimate of the yearly cost of expanding the program is $42 million. This means that the estimated benefit is over $5 for every $1 invested. Given this large estimated return it appears to us that expanding the preschool program in Kentucky is a good use of public funds.

Although we have tried to ensure that our estimates are, if anything, an understatement of the true benefits of the program, one potential reason why the estimates we present may overstate the benefits from expanding the preschool program in Kentucky has to do with the number of home visits included in the existing preschool program in the State. Many of the high-quality preschool programs include weekly home visits, while the current program in Kentucky only includes two home visits per year. Research evaluating the high-quality programs suggests that home visits are one of the services that offer the largest benefits relative to their costs (see Grunewald and Rolnick, 2006). However, under the current proposed expansion there are no plans to increase the number of home visits, so Kentucky may be missing out on a valuable component of other pre-K programs. Therefore, we recommend that Kentucky consider including an increase in the number of home visits as part of any expansion of the program.

Finally, the expansions' benefits on which we have focused are the benefits that can be easily translated into dollar figures. This is because these are the benefits that can be most directly compared to the cost of the programs. However, there may be some important, though less easily quantified, benefits from the program, such as a decline in the gap in school performance between black and white students. Unfortunately, there has been very little research examining the impact of preschool programs on these outcomes, and we have no way to put a monetary value on the possible impact preschool programs have on these other outcomes. However, it is important to consider these other possible benefits when evaluating the potential benefits of expanding the preschool program in Kentucky.

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Table 1: Characteristics of the Perry, Abecedarian, and Chicago Child-Parent Centers Preschool Programs

	Perry Preschool	Abecedarian	Chicago Child-Parent Centers
Program Characteristics			
Location city and state	Ypsilanti, MI	Chapel Hill, NC	Chicago, IL
Program description	Preschool	Educational childcare	Preschool
Curriculum	Cognitive development	Language development	Language development
Enrollment age	3 to 4 years	6 to 12 weeks	3 years
Calendar	Academic year	50 weeks per year	Academic year; 6 week summer program
Number of days per week	5	5	5
Length of day	2.5 hrs	8 hrs	3 hrs
Child-teacher ratio	5:1	3:1 for infants to 6:1 for children age 5	8.5:1
Teacher qualifications	Master's degree; Child development training	Experience working w/ young children; In-service training	Bachelor's degree; Certified in early childhood education
In-home visits	1.5 hrs per week	none listed	As part of outreach services
Parental involvement	Monthly meetings	none listed	Half-day per week
Health services	none listed	On-site pediatric care	Health screening; speech therapy; nursing services
Nutrition	none listed	Free breakfast, lunch, snack	Free and reduced price meals

Sources: Belfield et al. (2006) for Perry Preschool, Barnett and Masse (2007) for Abecedarian, and Reynolds et al. (2002) for Chicago Parent-Child Centers.

Table 2: Estimated Per-Participant Costs and Benefits from the Perry, Abecedarian, and Chicago Child-Parent Centers Preschool Programs Using the Three Percent Discount Rate

	Perry Preschool	Abecedarian	Chicago Child-Parent Centers
Private Benefits			
Childcare	$1,091		$2,108
Education Costs	-$193		-$237
Participant Earnings	$60,743	$45,190	$26,098
Earnings of Future Generations		$6,890	
Parental Earnings		$82,754	
Health Benefits		$21,410	
Welfare Benefits	-$2,414	n/a	
Total Private Benefits	$59,227	$156,243	$27,970
Public Benefits			
Total K-12 Cost Savings	$10,155	$10,639	$6,197
Higher Education Costs	-$1,362	-$9,787	-$472
Total Crime Savings	$206,467		$16,863
Welfare Administrative Costs	$3,333	$236	
Child Abuse/Neglect Savings			$979
Total Public Benefits	$218,593	$1,088	$23,568
Total Program Costs	$18,261	$43,183	$8,512

Sources: Belfield et al. (2006) for Perry Preschool, Barnett and Masse (2007) for Abecedarian, and Reynolds et al. (2002) for Chicago Parent-Child Centers.
Notes: All dollar amounts are 2007 dollars. Belfield et al. (2006) include welfare benefits in their total estimate for welfare administrative costs. Because welfare payments are transfers, they provide no overall public benefit. Therefore, they are not included in welfare administrative costs in this table.

Table 3: Estimated Per-Participant Costs and Benefits from Two Kentucky Preschool Expansions Using the Three Percent Discount Rate

	Expansion	
	3-Year Olds w/ Family Income up to 150% of Poverty	3 and 4-Year Olds w/ Family Income between 150% and 200% of Poverty
Private Benefits		
Childcare	$0	$0
Education Costs	-$79	-$59
Participant Earnings	$13,049	$9,787
Earnings of Future Generations	$1,649	$1,237
Parental Earnings	$0	$0
Health Benefits	$1,957	$1,468
Welfare Benefits	$0	$0
Total Private Benefits	$16,576	$12,432
Public Benefits		
Special Education	$2,242	$1,681
Grade Retention	$383	$287
Other K-12 Cost Savings	$2,242	$1,681
Higher Education Costs	-$588	-$441
Crime Savings	$5,621	$4,216
Welfare Administrative Costs	$56	$42
Child Abuse/Neglect Savings	$326	$245
Total Public Benefits	$10,282	$7,712
Total Costs	$5,329	$5,329

Source: Authors' calculations.
Notes: All dollar amounts are 2007 dollars. Benefits and costs are for one year of preschool attendance.

Table 4: Estimated Per-Participant Costs and Benefits from Two Kentucky Preschool Expansions Using the Five Percent Discount Rate

	Expansion	
	3-Year Olds w/ Family Income up to 150% of Poverty	3 and 4-Year Olds w/ Family Income between 150% and 200% of Poverty
Private Benefits		
Childcare	$0	$0
Education Costs	-$54	-$41
Participant Earnings	5,979	$4,484
Earnings of Future Generations	$477	$358
Parental Earnings	$0	$0
Health Benefits	$897	$673
Welfare Benefits	$0	$0
Total Private Benefits	$7,299	$5,474
Public Benefits		
Special Education	$1,953	$1,464
Grade Retention	$361	$271
Other K-12 Cost Savings	$1,953	$1,464
Higher Education Costs	-$425	-$318
Crime Savings	$3,865	$2,899
Welfare Administrative Costs	$39	$29
Child Abuse/Neglect Savings	$285	$214
Total Public Benefits	$8,030	$6,023
Total Costs	$5,329	$5,329

Source: Authors' calculations.
Notes: All dollar amounts are 2007 dollars. Benefits and costs are for one year of preschool attendance.

Table 5: Estimated Per-Participant Costs and Benefits from Two Kentucky Preschool Expansions Using the Seven Percent Discount Rate

	Expansion	
	3-Year Olds w/ Family Income up to 150% of Poverty	3 and 4-Year Olds w/ Family Income between 150% and 200% of Poverty
Private Benefits		
Childcare	$0	$0
Education Costs	-$32	-$24
Participant Earnings	$2,316	$1,737
Earnings of Future Generations	$144	$108
Parental Earnings	$0	$0
Health Benefits	$347	$261
Welfare Benefits	$0	$0
Total Private Benefits	$2,776	$2,082
Public Benefits		
Special Education	$1,710	$1,283
Grade Retention	$341	$256
Other K-12 Cost Savings	$1,710	$1,283
Higher Education Costs	-$256	-$192
Crime Savings	$2,287	$1,715
Welfare Administrative Costs	$26	$19
Child Abuse/Neglect Savings	$87	$65
Total Public Benefits	$5,905	$4,429
Total Costs	$5,329	$5,329

Source: Authors' calculations.
Notes: All dollar amounts are 2007 dollars. Benefits and costs are for one year of preschool attendance.