The Economic Development Effects of Early Childhood Programs

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1. INTRODUCTION

This report provides new estimates of the job creation and earnings creation effects of three early childhood development programs. These three programs, which will be described further below, intervene in the lives of disadvantaged children from birth to age 5, in an attempt to improve the quality of their child development and thereby improve eventual adult economic outcomes. The job creation and earnings creation effects of these three programs are compared with previous estimates of the job creation and earnings creation effects of another early childhood program, half-time universal preschool for 4-year olds, and of subsidies to business (for example, property tax abatements) to promote job growth. The job creation and earnings creation effects that are considered include both short-run and long-run effects.

In recent years, there has been growing interest among policymakers in expanding and improving the quality of programs to improve the child development of disadvantaged children (for a review, see Kirp, 2007). Policymakers' interest in these programs is based in part on brain research showing the importance of early childhood for brain development. Policymakers' interest is also based on high-quality research studies that suggest large long-run benefits of some early childhood programs that target disadvantaged children. The theoretical rationale for these long-run benefits is the idea that children who acquire certain skills early are more readily able to acquire other skills later on, or that "skills beget skills."[1]

[1] The notion of greater returns to earlier skills investment has been most fully developed in a series of papers by Nobel prize winning economist James Heckman, such as Cunha and Heckman (2006).

Many recent studies have provided good evidence, from randomized experiments or studies of similar rigor, of the effects of some programs that intervene in early childhood.[2] Other studies have used these estimated effects to attempt overall benefit-cost analyses of these early childhood programs.[3] What distinguishes this present report is its focus on particular types of benefits that are of interest to policymakers and business groups that place a high value on promoting economic development, which in practice means most policymakers and most business groups.[4]

Most of the report's estimates focus on how these programs affect economic development at the state level. By effects on state economic development, I mean effects in creating jobs and earnings for state residents who remain in the state. This definition of state economic development effects excludes effects on other groups; among the excluded effects are effects on residents of other states, or in-migrants to the state, or state residents who leave the state. Because state economic development is a central preoccupation of state policymakers and state business groups, how a program affects state economic development is likely to have substantial effects on whether the program is supported by state policymakers. The support of state policymakers is important to preschool and many other early childhood programs because of the

[2] Studies of the Perry Preschool program, the Chicago Child Parent Center program, the Abecedarian program, the Nurse Family Partnership program, and the Parent Child Home Program, are referenced later in this report, and many such studies are also reviewed in Kirp (2007).

[3] Benefit-cost studies include: Schweinhart et al. (2005) for Perry Preschool, Temple and Reynolds (2007) for the Chicago Child Parent Center preschool program, Barnett and Masse (2007) for the Abecedarian program, Karoly et al. (1998) for the Nurse Family Partnership and the Perry Preschool program, and Aos et al. (2004) for many programs, including preschool, the Nurse Family Partnership program, and the Parent-Child Home Program.

[4] The potential for economic development effects of early childhood programs was highlighted in a well-known article by Rolnick and Grunewald (2003). Rolnick and Grunewald argued that early childhood programs had a much higher rate of return and higher benefit-cost ratios than some traditional economic development programs, such as subsidies for sports stadiums. However, they did not present actual calculations for benefits, costs, and rates of return for traditional economic development programs, including the most common forms of business subsidies such as tax abatements. In addition, their argument for early childhood programs focused on total benefits of these programs, and not on the types of benefits that are of greatest interest to economic development policymakers: more jobs and earnings for local residents.

American political tradition that state governments have the prime responsibility for education-related programs. Furthermore, in recent years, it is state governments that have played the lead role in expanding early childhood programs, for example, Oklahoma, Georgia, and Illinois all have in recent years enacted universal preschool.

Traditionally, state economic development policy has primarily relied on encouraging economic development through various subsidies to business. These subsidies include financial subsidies to business, such as property tax abatements. These subsidies also include various types of services customized to individual businesses, for example provision of customized job training or site-specific infrastructure. In recent years, the total annual resources devoted to state and local economic development programs that subsidize business has been estimated at over $30 billion (Bartik, 2001). If early childhood development programs can have effects on state economic development that are similar to or surpass the effects of business subsidies, this adds a powerful new argument in favor of greater state government support of early childhood programs.

Business subsidies affect the employment rates and earnings of state residents by increasing the quantity or quality of demand for state residents' labor (Bartik 1991). With increased demand for their labor, state residents are more likely to become employed, and more likely to become employed in better jobs. This greater employment experience, or greater experience in better jobs, allows state residents to obtain better job skills, greater self-confidence, and a better reputation with employers. All of these effects help state residents sustain higher

earnings over the long-run due to a one-time increase in labor demand in a state economy. These effects on state residents' dissipate as state residents move out of the state over time, or die.[5]

Early childhood programs affect the employment rates and earnings of state residents primarily by affecting the quantity and quality of labor supply in a state. Former child participants, when they are old enough to enter the labor force, will have more education, or be more employable in ways that are not captured by gains in educational attainment. Early childhood programs may also increase the quantity or quality of the labor supply of the parents of program participants, either by providing free or low-cost high-quality child care, or by providing encouragement or counseling for parents to obtain greater employment. These increases in the quantity or quality of labor supply of former child participants, or of parents of participants, will increase their employment rates and earnings. From a state perspective, these employment and earnings effects will dissipate as some of these state residents move to other states. Early childhood programs also increase the employment rates and earnings of state residents because the spending on these programs will stimulate the state economy, for example through providing jobs to teachers and other workers for these early childhood programs.[6]

The report also includes estimates of program effects on economic development at the national level. By effects on national economic development, I mean the net effects summed over all states on additional jobs and real earnings. Because economic growth and development is also important to national policymakers and business groups, political arguments that cite these national economic development benefits will have power in encouraging federal support

[5] The specific methodology for measuring these effects is detailed later in this paper and in the paper's appendices, and in my previous report (Bartik, 2006a).

[6] The methodology for estimating these effects is detailed later in the paper, and in an appendix to the paper.

for a program. One key issue is whether the magnitude of economic development benefits of these programs from a national perspective differs significantly from the economic development of these programs from a state perspective. If a program's benefits from a national perspective are significantly greater than benefits from a state perspective, there is a rationale for federal government intervention to encourage program expansion, beyond what states would do on their own; if a program's benefits from a national perspective are significantly less than benefits from a state perspective, there is a rationale for federal intervention to encourage states to contract these programs.

The national perspective on program effects will differ from the state perspective in part because some state residents who benefit from the program, whether it is an early childhood program or a business subsidy, will move to other states. In addition, in the case of business subsidies, some of the jobs created in this state by its business subsidies may come at the expense of reduced jobs in other states.

This report presents new evidence on the economic development effects of three early childhood programs targeted at disadvantaged children and their parents: the Abecedarian program, the Nurse Family Partnership program, and the Parent-Child Home Program. The Abecedarian program provides five years of free high-quality full-time and full-year child care and preschool services for disadvantaged children from birth to age 5. The program costs $83,000 per child,[7] and about 15% of all children would participate in a full-scale program.[8] The Nurse Family Partnership provides disadvantaged first-time mothers with 30 nurse visits during a two-and-a-half year period, from prenatal to the child's second birthday. The nurse visits aim at

[7] Unless otherwise stated, all dollar figures in this report are expressed in 2007 dollars.

[8] More details on the sources for these estimated costs and participation rates are provided in a later section of this report.

three goals: improved prenatal care, better quality of parental child care, and improved life prospects for the mother. The program costs $10,200 per child, and about 9% of all children would participate in a full-scale program. The Parent-Child Home Program provides disadvantaged parents and their children with two years of bi-weekly visits from a paraprofessional for 23 weeks per year, for two years while the child is ages 2 and 3. The paraprofessional provides a free educational toy or book at each visit, and models how the book or toy can be part of a high-quality parental interaction with the child. The program costs $4,500 per child, and about 5.5% of all children would participate in a full-scale program.

This report is a follow-up to my previous report which looked at the economic development effects of a universal preschool program (Bartik 2006a, 2006b). This universal preschool for 4-year-olds was modeled after the Chicago Child-Parent Center program. The modeled program was estimated to cost about $6,500 per child, and to elicit participation from 70% of all 4-year-olds. I concluded that for each dollar a state invested in universal preschool, the present value of earnings of state residents would increase almost three times as much.

In that 2006 report, I also compared the economic development benefits from universal preschool to the economic development benefits of traditional economic development programs which provide business subsidies. The most prominent example of such business subsidies is property tax abatements. Per dollar of cost to state and local budgets, universal preschool's effects on the present value of state residents' earnings are similar in size to business subsidies' effects. In the long-run, universal preschool has greater effects than business subsidies of the same cost: twice the effect on jobs for state residents, and a 15% greater effect on earnings for state residents.

From a national perspective, a typical state's adoption of universal preschool would have much greater effects on national jobs and earnings than that same state's adoption of similar-cost business subsidies. If we include earnings effects on persons who move out of the state, a state's investment in universal preschool yields, per dollar spent, an increase in the present value of national earnings of almost four dollars. Business subsidy programs' effects on nationwide earnings are typically much lower than the effects from a state perspective. The job gains to the state adopting the subsidies are largely offset by job losses in other states. In a typical state, investing a dollar in business subsidies increases the present value of national earnings by only 65 cents.

Why write a new report focusing on economic development effects of early childhood programs other than preschool for 4-year-olds? These other early childhood programs may add to the effects of universal preschool, with both types of programs improving long-run outcomes for disadvantaged children and their parents. (The Abecedarian program includes preschool for 4-year-olds, but its child care and preschool services from birth to age 3 may provide additional benefits.) In addition, ignoring early childhood programs other than preschool has a political risk: legislators may be tempted to cannibalize funding from other early childhood programs to fund universal preschool.[9]

Finally, perhaps other early childhood programs may provide more short-term benefits than universal preschool. A major political disadvantage of universal preschool is that its economic development benefits are extremely delayed. In my previous report (Bartik 2006a, 2006b), I found that most of the jobs creation and earnings creation benefits of preschool were

[9]This political tension between advocates for universal preschool and advocates for other early childhood programs is discussed in the recent book by Kirp (2007).

delayed at least 15 years after program start-up, until the former child participants in preschool begin to enter the workforce. The universal preschool program analyzed in my 2006 report only provided one year of half-day child care during the school year, which induces only a small immediate boost to mothers' labor supply.

In contrast, economic development subsidies to business provide considerable short-run benefits, as we will see later in this report. Many of the constituencies interested in economic development will find these short-run benefits attractive.

Some early childhood programs may more immediately affect a state's economy because these programs provide more dramatic interventions in the life prospects of parents. Free high-quality child care for five years is a far greater intervention in the lives of parents than half-time child care during the school year for 4-year-olds. In addition, some early childhood programs such as the Nurse Family Partnership have as an important goal trying to improve the life prospects of parents.

Despite these immediate effects on the economy of some early childhood programs, this report finds that for all four of these early childhood programs, the short-run effect (e.g., the first 10 years) on jobs for state residents is less than the effects of business subsidies. However, the long-run effect (e.g., after 30 or 40 years) on jobs for state residents for all four of these early childhood programs is considerably greater than the long-run effects of business subsidies. Furthermore, for all four of these early childhood programs, each dollar a state invests in the programs will increase the present value of state residents' earnings by two to five times as much. These ratios of earnings effects per dollar spent are similar to the ratios for business subsidies. However, as mentioned above, from a national perspective, business subsidies have

much smaller effects, because about four-fifths of the earnings benefits for this state's residents are offset by the jobs and earnings lost to residents of other states. In contrast, the earnings creation effects of these four early childhood programs are a third larger when including effects on persons who move outside the state. If implemented at full-scale in the nation, these programs could by 2088 boost U.S. employment, earnings, and GDP by over 4 percent. Although this percentage increase may sound modest, it amounts to an increase in 2088 in employment of over 7 million jobs, and an increase in GDP in 2088 of almost $3 trillion per year.

The main conclusions of this report are presented in the next three sections. I first consider effects of each program on the state economy, followed by effects on the national economy, and then followed by estimates of effects if these programs were enacted simultaneously. Following this, the remainder of the report explains in more detail how these conclusions are reached and how these conclusions should be interpreted. This includes discussions of how economic development is defined, more descriptive information on the programs and the results, and discussion of some implications of this analysis for program implementation and research. Appendices give even more detail on the methodologies and data used.

2. SUMMARY OF INDIVIDUAL PROGRAM EFFECTS ON STATE ECONOMIC DEVELOPMENT

This section summarizes this report's major empirical results for how these four early childhood programs, and business subsidies, affect state economic development.

Table 1 shows the ratio of the present value of earnings effects to the present value of net program costs, for these three targeted early childhood programs, economic development

subsidies for business, and universal preschool for 4-year-olds.[10] These ratios of earnings effects to costs are shown from a state perspective. The state perspective shows effects on the earnings of the original state residents who stay in the state. Excluded from this state perspective are earnings effects for state residents who move out of the state. Also excluded, for business subsidies, are negative effects on the earnings of other states' residents because this state's business subsidies will reduce job growth in other states.

From a state perspective, all of these programs increase state residents' earnings by two to five times their net costs. Business subsidies and universal preschool were presented in the previous report, and both have similar ratios of earnings effects per dollar spent, at around a 3 to 1 ratio. The Abecedarian program has a somewhat lower ratio of earnings effects to net program costs, despite what will be shown to be large effects, because this program is so expensive per child ($65 thousand in net costs for the Abecedarian program). Although the Nurse Family Partnership program is cheaper ($10,200 per child), its estimated program effects are lower. The Parent-Child Home Program has a high ratio of earnings effects to net program costs because this program achieves considerable increases in high school graduation rates at relatively low costs per child ($4,500).

The ratio of earnings effects to costs is an appropriate way to rank programs if a state policymaker is considering how to best invest a limited amount of government funds to maximize state earnings, and the policymaker can invest in only one of these programs. However, because all of these programs have a ratio of present value of earnings effects to costs

[10] Present value figures are calculated using a 3% real discount rate, which is commonly used in benefit cost analyses of government programs. An appendix considers how the results are altered by different discount rates. The finding is that these programs have present value of earnings effects that exceed costs for a wide variety of discount rates.

that exceeds one, all of these programs are worth doing from a state benefit-cost standpoint if the only benefits considered are earnings effects on state residents. It is likely that the net benefits from a state perspective of other effects of these programs (e.g., reductions in crime) is likely to be positive, so all of these programs are probably worth pursuing from a state perspective.

An alternative way of ranking programs is appropriate if the state policymaker is able to choose to operate one, but only one, of these early childhood programs at full scale. (Because business subsidies are assumed to be capable of being operated at any scale, there is no definition of full scale for this program.) If a policymaker can only operate one of these early childhood programs at full scale, then the policymakers should choose the program with the greatest net present value, that is the greatest difference between the net present value of program benefits versus program costs. If only earnings of state residents are considered and no other benefits, then the policymaker should choose the program with the greatest difference between the net present value of earnings minus the net present value of program costs. Therefore, in addition to the calculations of Table 1, this report also calculated the net difference between the present value of earnings effects and costs when each of the early childhood programs is operated at full-scale.

How does this report define "full-scale" for these early childhood programs? "Full-scale" for universal preschool means a program that is open to all 4-year-olds for free, but ends up enrolling about 70% of all 4-year-olds. "Full scale" for the three early childhood programs mean that these programs have sufficient funds to enroll all who wish to enroll among the disadvantaged families that are targeted by each program (about 15% of all children for the

Abecedarian program, 9% for the Nurse Family Partnership program, and about 5.5% for the Parent-Child Home Program).

These three early childhood programs, other than universal preschool, are modeled as targeted programs, and not universal programs, for several reasons. First, these three programs were all designed to target the needs of disadvantaged families. Second, all the evaluation data on these programs shows effects only for disadvantaged families. Therefore, there is no good basis for projecting these effects to the population at large. Third, the Abecedarian program is so expensive that it is difficult to imagine implementing it as a universal program. Fourth, the Nurse Family Partnership program and the Parent-Child Home Program both seem to provide services (regular nurse home visits, paraprofessional home visits) that are not currently purchased by middle class families. Therefore, it is not obvious that providing nurse or paraprofessional home visits as universal free programs will attract political support from the middle class for these programs. (One rationale for providing preschool or child care as universal programs is the need to attract political support from the middle class. But preschool and child care are clearly valued by the middle class, as evidenced by middle class spending on these services.)

Table 2 provides information on the present value of net earnings, net costs, and the net "benefits" (equal to the difference between the present value of earnings versus the present value of costs) of each of the four early childhood programs, when each program is operated at full-scale. Each program is also assumed to be operated on an ongoing basis into an infinite future. This information is presented from the perspective of a policymaker in a typical state. These present value effects are all scaled as a percentage of the total present value of earnings in the

state.[11] These figures can be seen as the state-level effects of these programs, averaged over the life of these programs, as a percentage of state economic activity, as measured by earnings.

As shown in Table 2, the Abecedarian program has the highest net benefits for the state economy, followed by universal preschool. If a state policymaker is assumed to only be able to choose one of these programs to operate at full-scale, these estimates support choosing the Abecedarian program. The Nurse Family Partnership Program and the Parent-Child Home Program have far lower net benefits. In the case of the Parent-Child Home Program, these lower net benefits occurred even though the program has the highest ratio of earnings effects to costs, as shown in Table 1 (and also evident in Table 2).

Although the Abecedarian program is the most costly program, it has the greatest net benefits because of its greater effects on state residents' earnings. As we will see in more detail later in this report, the program's estimated effects on the education, employment, and earnings of former child participants are large. The Abecedarian program also seems to have considerable effects on the employment and earnings of the mothers of participants due to the high-quality free child care provided.

Universal preschool for 4-year-olds also has large effects, although not quite as large as the Abecedarian program. Universal preschool has somewhat smaller effects per participant than the Abecedarian program, in part because it is assumed that a universal program will have smaller effects on non-disadvantaged children than on disadvantaged children. However, the number of participants in a universal preschool program is much larger than for the Abecedarian

[11] These percentage figures could be translated into actual dollar effects for a typical state. The actual dollar figures in the typical state may vary from what is implied by these percentage figures due to differences in long-run earnings growth across states from the average state, or difference in the scale of operation of the program in this state from the average state.

program (70% of all children vs. 15%), which helps boost the overall effects up to close to the Abecedarian program.

Both the Nurse Family Partnership program and the Parent-Child Home Program have much smaller effects even though they have high earnings effects per dollar spent. These small effects occur in part because as targeted programs, they only affect a limited percentage of children. Furthermore, even with a high ratio of earnings effects to dollars spent, the Nurse Family Partnership Program and the Parent-Child Home program do not spend enough per participant to have the extraordinary effects per participant of the Abecedarian program.

Although present value calculations are interesting to economists, and should be important to policymakers, they may be hard for many voters to grasp as tangible effects. We might also want to know how these programs affect jobs and earnings at a particular time, and the long-run permanent effects seem the most important to consider. Table 3 presents another perspective on these early childhood programs by looking at the percentage effects of these programs on state employment and earnings in the long-run, if these programs were permanently operated in the state at full-scale.[12] These early childhood program effects are each compared with business subsidies (such as property tax abatements) that are scaled to have the same present value of costs as a full-scale version of the early childhood program. As shown in Table 3, all four of these early childhood development programs have greater effects than business subsidies on long-run state job creation. These sizable long-run effects of these programs are

[12] These percentage increases in employment and earnings can be used as a rough guide to the actual number of jobs and dollar amount of earnings that would be created in any particular state by these programs. To do so, the reader must take current employment and earnings in the state, and project some reasonable growth rate for these figures by 2088, based on long-run forecasts from state planning offices or the U.S. Department of Commerce. There might be some variation in the relative size of these programs by state, depending upon the size of possible target groups; however, the plausible size of these programs in a typical state probably depend as much on the political situation in the state as on the size of possible target groups.

largely attributable to their powerful effects on the educational attainment, employability, and wage rates of former child participants.

The early childhood programs do not do quite as well, relative to business subsidies, in long-run effects on creating earnings for state residents. For example, the long-run effects of the Nurse Family Partnership Program, or the Abecedarian program, on state residents' earnings is somewhat less than the long-run effects on state residents' earnings of similarly costly business subsidies. The somewhat weaker performance of the early childhood development programs compared to business subsidies on earnings measures occurs for two reasons. First, business subsidies have been shown by previous research to have powerful effects in allowing state residents to upgrade to better jobs, which will increase earnings with no increase in employment. Second, a considerable portion of the effects of many early childhood programs is due to increasing the employment rates of former child participants, who tend to come from a disadvantaged background. While the program increases the job quality available to these disadvantaged participants, in many cases these former child participants do obtain employment at jobs that pay below average wages. This reduces somewhat the relative earnings effects of these early childhood programs.

As Table 3 shows, among the early childhood programs, the Abecedarian program has the largest long-run effects on the economy, increasing long run employment and earnings in a state by over 2%. The second largest long-run effects on a state economy are for universal preschool, which boosts state residents' long-run employment and earnings by 1.3 to 1.4%. Both the Nurse Family Partnership program and the Parent-Child Home Program have much smaller long-run effects, boosting the long-run employment and earnings of state residents by only 0.1%

to 0.2%. This pattern of relative effects across early childhood programs in Table 3 can be explained similarly to the pattern in Table 2. The pattern is explain by the greater spending at full-scale for the Abecedarian and universal preschool programs, compared to the Nurse Family Partnership or Parent-Child Home Program. The greater spending pays off in greater effects.

Table 4 shows how effects of universal preschool and the three early childhood programs are divided among various types of effects. These programs may affect the employment rates and earnings of a state's residents in three ways. (I elaborate more on these three ways in a subsequent section of this report.) First, increasing state taxing and spending for any purposes will boost demand for the state's goods and services. Second, any positive effects of the program on the quantity or quality of the labor supply of the mothers (or fathers) of program participants will stimulate job creation and earnings creation in the state economy. Third, any positive effects of the program on the quantity or quality of the child participants' labor supply, when they get old enough to be in the work force, will also stimulate job creation and earnings creation in the state economy.

As Table 4 shows, the higher taxes and spending of these programs does not boost the present value of state residents' earnings by much compared to the cost of the programs. There is some earnings benefit to state residents of hiring additional preschool or child care teachers, nurse visitors, or paraprofessional visitors. But the net effect on the state economy must also consider the negative effects of higher taxes. An extra dollar of higher taxes and spending only boosts the net present value of state residents' earnings by 4 cents.

Universal preschool for 4-year-olds has almost all of its positive effects on state residents' earnings by improving the labor supply of former child participants. We know from

studies of the Perry Preschool program and the Chicago Child-Parent Center studies that high-quality preschool has significant effects in improving educational attainment of former child participants. High-quality preschool also has positive effects on former child participants' employment rates beyond what would be predicted based on increased educational attainment. But preschool programs are not typically designed to significantly increase the labor supply of the parents of the child participants. The universal preschool program considered in my previous report, which was modeled after the Chicago Child-Parent Centers, only offered half-day child care during the school year for 4-year-olds. Such a limited increase in free child care would not be expected to boost parents' labor supply by much.

The Abecedarian Program has large effects on the educational attainment of former child participants, and also has other positive effects on their employment rates. However, as shown in Table 4, compared to universal preschool, these effects on former child participants are modest per dollar spent, because of the much larger costs per participant of the Abecedarian program. But the five years of free child care provided by the Abecedarian program would be expected to have much larger effects on employment rates and earnings of parents than the limited child care provided by universal preschool. For the Abecedarian program, state residents' earnings are increased more through higher parental labor supply than through higher labor supply of former child participants, although both effects are important.

The Nurse Family Partnership program aimed at improving the quality of prenatal care and early child care, which should improve the labor supply of former child participants. However, NFP also aimed at improving the "life course" of the mothers involved in the program, by encouraging these mothers to improve their education, employment status and family

relationships. As Table 4 shows, the empirical evidence suggests that the program had important effects both on the earnings of former child participants, and on the earnings of mothers.

The Parent-Child Home Program's effects on state residents' earnings are largely based on one study, which estimates large effects of the program in increasing high school graduation rates of former child participants. No study has looked at the effects of the PCHP on the labor supply of mothers. The PCHP does not seem to aim for such effects.

Table 5 summarizes some evidence on the timing of the earnings effects of these early childhood programs and universal preschool. (Later sections of this report and appendices B and C present year-by-year estimates of the effects, and look at job creation effects as well as earnings effects.) As mentioned above, universal preschool's effects on state residents' earnings are quite delayed compared to business subsidies. Most of universal preschool's effects on earnings are delayed until former child participants enter the labor market. However, as mentioned in the discussion of Table 3, the Abecedarian program and the Nurse Family Partnership program both have considerable effects on the earnings of mothers. Some of the effects on mothers would take place more immediately.

Table 5 analyzes the timing of earnings effects by examining the ratio of the cumulative present value of earnings effects of the program to the cumulative present value of net program costs at various time periods after the program is started. These ratios are the ratios of earnings effects to costs if all program earnings effects and costs somehow magically ceased after that time period.

As shown in Table 5, the Abecedarian program and the Nurse Family Partnership program do have greater earnings effects relative to costs for the first 10 or 15 years than is true

of universal preschool for 4-year-olds. However, over a 10 to 15 year time horizon, business subsidies are still more effective. For example, after 10 years, while universal preschool has only produced earnings effects of 18 cents for every dollar invested in this program, the Abecedarian program has produced earnings effects of 35 cents for every dollar invested, about twice as much. But business subsidies after 10 years have produced earnings effects of $1.59 per dollar invested. As we will see later in this report, the Abecedarian program and the Nurse Family Partnership program do somewhat better relative to business subsidies if we focus on jobs creation rather than earnings creation.

3. NATIONAL ECONOMIC DEVELOPMENT BENEFITS

The estimated effects that have been presented up to now take a state perspective. That is, these estimated effects only include effects on employment rates and earnings of state residents who stay in the state. Effects on in-migrants to the state, or non-state residents, or state residents who leave the state, are excluded.

Federal policymakers may be interested in estimates that take a national perspective. Such estimates would include effects on residents of any state.

Federal policymakers and others interested in federal economic policy, may be interested in these estimates that take a national perspective for two reasons. First, effects on national economic development by themselves may make a case for federal action to enact or expand these programs. Second, a comparison of effects on national economic development vs. state economic development may indicate how strong a case there is for federal intervention to offset the narrowness of the state perspective. If estimated effects of these programs from a national

perspective differ by a great deal from effects from a state perspective, there is a stronger case that federal intervention is needed. (Of course, even if estimated effects do not differ much from a state vs. national perspective, political considerations may still mean that federal action makes sense.) If the benefits of a program from a national perspective more greatly exceed the benefits from a state perspective, there is a stronger case that federal action may be needed to enact or expand the program. If the benefits of a program from a national perspective more greatly fall short of the benefits from a state perspective, there is a stronger case that federal action may be needed to curtail the program.

For business subsidies, economic development benefits from a national perspective are likely to be less than those from a state perspective. Business subsidies increase labor demand in a state, and thereby increase its employment rates and earnings, in part by enticing jobs from other states. To gauge the economic development benefits of business subsidies from a national perspective, I use estimates from previous research on how business taxes affect business activity at a national level. As one would expect, these estimated effects at a national level are less than the estimated effects from regional research on how business taxes affect business activity in a particular state, as state business taxes have the additional effect of encouraging business relocation from state to state.[13]

For early childhood programs, economic development benefits from a national perspective are likely to be greater than those from a state perspective. The state perspective excludes increased employment or earnings effects on parents or child participants who move

[13] An appendix to this paper, and Bartik (2006a), go into more detail on the estimates used. There also are the issues of multipliers at the state vs. national level, and the issue of effects on state residents who leave the state. However, at it turns out, in the end these factors are overwhelmed by the large differences in the responsiveness of business activity to taxes or subsidies at the state vs. national level.

out of the state, whereas the national perspective includes employment or earnings effects on persons regardless of where they live.

Table 6 provides one comparison of the national vs. state perspective on the economic development benefits of business subsidies and early childhood programs. The table presents estimates of the ratio of the present value of earnings effects to costs of these different programs, first calculated when only effects on state residents are considered (previously shown in Table 1), and then calculated when effects throughout the nation are considered.

As Table 6 shows, for business subsidies, the national earnings effects per dollar devoted to business subsidies is only 0.65. This is about one-fifth of the earnings effects per dollar spent on business subsidies from a state perspective. The discrepancy between the national and state perspective is largely because much of the earnings benefits to state residents of business subsidies are offset, from a national perspective, by the jobs and earnings lost to other states due to lost business activity. It is commonly said that states competing with business subsidies for business activity are engaged in a zero-sum game. These estimates suggest that this is not quite right; the zero-sum game argument assumes that business subsidy competition results in zero net gain in national business activity. Business subsidy competition will result in some net gain in national business activity. The estimates in Table 6 suggest that business subsidy competition is a one-fifth sum game, in which national benefits are about one-fifth of the benefits as perceived by state policymakers.

Because national benefits of a state's business subsidies are considerably less than the benefits that are perceived from a state perspective, we might expect states to engage excessively in business subsidies for economic development that is excessively as viewed from the

perspective of the national interest. This provides some rationale for federal policies to curtail state business subsidies to attract business activity that would have otherwise gone to other states. One proposal to do so has been made by Burstein and Rolnick (1995).

In contrast, for the four early childhood programs, the national earnings benefits of these programs are about one-third greater than the earnings benefits for state residents who stay in the state. These greater national earnings benefits occur because these national estimates include the increased earnings of former child participants in these programs, or their parents, who move outside the state in which the early childhood services were provided.

This one-third greater national benefits vs. state benefits provides some rationale for federal efforts to expand these programs. State policymakers, in considering how much to invest in these early childhood programs, may fail to consider the increased earnings for former child participants, or their parents, who end up moving to other states. This narrower perspective may discourage state policymakers from adequately investing in these early childhood programs. If there were no other political considerations, the federal subsidy for state early childhood programs should be equal to this extra national benefit, that is the federal subsidy rate should be one federal subsidy dollar for every three dollars that states spend on these high-quality early childhood programs.

Table 7 updates and expands Table 2 by looking at the net present value of the earnings effects, program costs, and net benefits of these programs when operated at full-scale, from a national perspective. From a national perspective, all of the net benefits of these early childhood programs are increased because of the inclusion of benefits to non-state residents. However, the pattern of relative effects across the different early childhood programs still continue, with the

Abecedarian program and universal program having the largest net benefits as a percentage of the economy, and the Nurse Family Partnership program and the Parent-Child Home Program having much smaller net effects.

Table 8 extends Table 3 by looking at the long-run effects of full-scale implementation of these programs at the national level. Table 8 also extends Table 3 by translating percentage effects into raw national totals, and by calculating revenue effects of the programs at the national level in the long-run. Consistent with the pattern of Table 3 results for a state economy, the Abecedarian program has by far the largest effects on the national economy, increasing long run national economic activity by around 3%.[14] This results in the creation of over 5 million jobs and over $2 trillion in GDP. Despite its large costs, the Abecedarian program also has the largest excess of long-run annual earnings effects or GDP effects over long-run annual costs, and the largest excess of long-run annual government revenue effects over long-run annual costs.[15]

Universal preschool for 4-year-olds also has large effects on the national economy, although not quite as large as the Abecedarian program. The long-run national effects of universal preschool are to boost the economy by a little less than 2%.

Both the Nurse Family Partnership program and the Parent-Child Home Program have much smaller effects, boosting the national economy by only 0.1% to 0.3%. Despite smaller

[14] This report's estimated effects for the Abecedarian program and Parent-Child Home Program after 80 years appear to be about three times the effects estimated in Dickens and Baschnagel (2007). On the other hand, this report's estimated effects for universal preschool appear to be one-half the preferred estimates for universal preschool's effects in Dickens et al. (2006). I consider some of the differences between my model vs. the Dickens et al. model in an appendix.

[15] These estimated effects on government revenue only incorporate effects on government revenue via the estimated increase in GDP. Furthermore, the estimated effects on government net costs only incorporate the costs of the program considered, and any immediate effect in replacing government spending on preschool or child care. Other cost effects, for example savings in special education costs, or extra spending on subsidies for college attendees, are not incorporated. Finally, the annual flow of government revenues or costs in 2088 is not the same as the present value effects on government revenue and costs; all these programs invest a great deal in the short-run and medium run, while the effects on GDP take a long time to reach their full potential. For all these reasons, these annual government revenue and cost estimates should not be interpreted as a full fiscal analysis of these programs.

effects, both the Nurse Family Partnership program and the Parent-Child Home program have a greater long-run effect on annual government revenue than their long-run annual program costs.

4. PROGRAM INTERACTION EFFECTS

So far, this report has only considered effects of the various programs when each program is adopted on its own, with none of the other programs in existence. But it is also important to consider how the return to adopting each program is affected by the other programs. For example, many proponents of early childhood programs are supporters of both universal preschool and of more targeted early childhood interventions at ages prior to preschool. Does this position make sense, or is just one type of early childhood intervention enough to overcome the disadvantages suffered by many children from low-income backgrounds? It is certainly possible that if a program dramatically reduces a child's disadvantages from his or her background, it may reduce the need for other interventions.

The most obvious interaction between program effects occurs for the Abecedarian program and universal preschool. The Abecedarian program incorporates preschool for disadvantaged 4-year-olds. Therefore, it is inappropriate to assume that the earnings benefits per dollar invested of these two programs are unaffected by whether the other program is adopted at full-scale. In particular, the adoption of the Abecedarian program at full-scale implies that the benefits of adopting universal preschool become the benefits of extending high-quality preschool for 4-year-olds from disadvantaged 4-year-olds to all 4-year-olds. Under plausible assumptions (see Appendix C), if the Abecedarian program is adopted, the earnings effects per dollar spent of extending universal preschool to non-disadvantaged 4-year-olds are a little more than half as

large as the benefits per dollar spent of universal preschool as a standalone program. Table 9 updates Table 1 and Table 5 by adding in these earnings effects of adding universal preschool for non-disadvantaged 4-year-olds to a targeted Abecedarian program operating from birth to age 5. However, the present value of earnings effects still considerably exceeds the costs of the extension to non-disadvantaged 4-year-olds.

These earnings effects to cost ratios for adding universal preschool to the Abecedarian program are derived by redoing the calculations of my previous report (Bartik 2006a) under different assumptions about who is served by preschool. The children served by this incremental expansion to preschool will come from families with higher average income than the children served by universal preschool as a standalone program. I assume in my previous report that benefits for preschool are smaller for children from upper-income families. Therefore, the incremental benefits of extending preschool to less disadvantaged 4-year-olds are lower than the average benefits of universal preschool for all 4-year-olds. I should note that the assumption that preschool benefits are smaller for children from upper income families has been challenged by some researchers (e.g., Barnett et al. 2004, 2005). If the benefits of preschool are similar in magnitude for upper-income and lower-income families, then the earnings benefits per dollar from universal preschool will be unaffected by the adoption of the Abecedarian program.

The incremental benefits of adopting universal preschool, when the Abecedarian program is already in place, also implies a benefits to costs total for the two programs adopted together, which is also shown in Table 9. In addition, it is possible to also calculate the incremental benefits of adding the Abecedarian program if universal preschool already exists, which is also shown in Table 9. Appendix C presents details on how these calculations are done. All these

calculations depend on the assumption that universal preschool has lower returns for more advantaged children than for disadvantaged children. Because of this assumption, preschool for disadvantaged 4-year-olds has unusually high returns. Therefore, extending early childhood services to either non-disadvantaged 4-year-olds, or to earlier age groups, has more moderate returns. However, it is still the case that extending services beyond disadvantaged 4-year-olds has earnings effects that considerably exceed costs.

The Nurse Family Partnership program and the Parent-Child Home Program provide home visiting services that are distinct from preschool, or from the child care services provided by the Abecedarian program. It is unknown whether the benefits of these home visiting services would be affected by the adoption of these other programs. This depends upon such issues as whether a child who has gone through the Nurse Family Partnership program or the Parent-Child Home Program would gain more or less from high-quality preschool or high-quality child care. If we assume that these services all have distinct benefits that do not interact, then the earnings effects per dollar spent for the Nurse Family Partnership program and the Parent-Child Home program will be unaffected by whether the Abecedarian program or universal preschool is enacted, and vice versa.

Table 10 updates Table 8 by adding in interaction effects to calculate the long-run effects from a national perspective of implementing both the Abecedarian program and universal preschool together. If both programs are implemented, the long-run boost to the economy is around 4%. The two programs together create almost 7 million jobs, and over $2.5 trillion in GDP.

What about the effects of all four early childhood programs adopted together? If the effects of the Nurse Family Partnership program and the Parent-Child Home Program are unaffected by the Abecedarian program or universal preschool, then the total effects of all four programs can be derived by adding the NFP and PCHP effects to the effects of the combined Abecedarian/universal preschool program. All four programs combined might plausibly boost employment and earnings by between 4 and 5%. This percentage increase, as of 2088, would increase national employment by over 7 million jobs, and increase GDP by almost $3 trillion.

5. MEASURING ECONOMIC DEVELOPMENT BENEFITS

This report and my previous research are based on a particular perspective on what aspects of local economic development provide significant social benefits. By "local economic development," I mean improvements in the quantity or quality of employment in some area that is large enough to comprise a local labor market, such as a metropolitan area. Local economic development is not valuable in and of itself, but for the benefits it has for specific individuals.

Previous research shows that the most significant benefits from local employment growth are associated with increases in employment rates and earnings for the original residents of the local area (Bartik 1991, 1994). Local employment growth also increases local land values and local business profits, but the present value of these benefits are small relative to the present value of the increases in real earnings per capita. A significant portion of the new jobs from local employment growth go to in-migrants, but the benefits to in-migrants are small, as these migrants could have obtained similar job opportunities in some other metropolitan area.

In addition, it seems reasonable that what should matter to local policymakers are the benefits to the local residents living in the local area at that time, and who stay in the local area in the future. Any benefits that accrue to in-migrants, or to local residents who move out of the local area, are less relevant to local policymakers. Of course, from a national perspective, these non-local benefits should be counted.

Therefore, this report focuses on how various programs, including business subsidies, universal preschool, and early childhood programs, affect economic development benefits, which are defined as the increased employment rates or earnings rates of state residents who remain in the state. The employment rates and earnings rate of the original local residents of a regional economy can go up due to either shocks to local labor demand or labor supply. These shocks can increase either the quantity of local labor demand or supply, or the quality, and hence wage rate, of local labor demand or supply.

Traditional economic development programs that offer subsidies to business largely work by increasing local labor demand. The business tax breaks or customized business services provided by economic development agencies make locating or expanding in the local economy more attractive to some businesses. The expansion of these businesses will have export-base "multiplier" effects on encouraging the expansion of local suppliers or local retailers. The subsidized businesses and their associated multiplier effects will expand local employment.

In the short-run, about 40% of these new jobs go to in-migrants, 40% reduce local unemployment rates, and 20% increase local labor force participation rates (Bartik 1991, 1993). After five years or so, in-migration increases, and unemployment rates return to their original level. However, about one out of every five new jobs continues to result in extremely persistent

effects on increasing local labor force participation rates and employment rates, effects that have been empirically shown to last over 15 years (Bartik 1993). In addition, increases in local employment growth result in some individuals moving up to better paying occupations (Bartik 1991). This occupational upgrading effect of local employment growth is similar in its long-run effects on local earnings per capita to the effects on local labor force participation rates. A 1% increase in local employment will in the long-run increase local real earnings per capita by about 0.4%, about half of which is due to higher local labor force participation rates, and half due to occupational upgrading.

These persistent effects on employment rates and occupational status are probably due to the long-run benefits to individuals of greater job experience in the short-run (Bartik 1991, 2001). In the short-run, local job growth allows some individuals to get jobs they otherwise wouldn't have obtained, or to get better jobs than they would have obtained. This greater experience boosts individuals' job skills, self-confidence, and reputation with employers, all of which increase long-run earnings.

As described in more detail below and in Appendix A, I use the empirical literature to estimate the local economic development benefits, in higher employment rates and earnings per capita for state residents who remain in the state, from economic incentives of a particular cost. These benefits depend upon how responsive business location and expansion decisions are to state business subsidies, the multiplier effects of export-base business growth, the details of how local labor markets respond to shocks to local labor demand, and how state residents move out of the state over time.

A small part of the economic development effects of early childhood programs and universal preschool are due to the effects of increased spending for these programs on local labor demand. Spending more on these programs will increase local labor demand due to the hiring of preschool and childcare teachers, nurse visitors, paraprofessional visitors, or whatever other additional employees are needed to deliver these early childhood or preschool services. This increased spending will in turn have multiplier effects on other local businesses that either provide supplies to the early childhood programs or preschool program, or sell goods and services to the employees of the early childhood programs and preschool program.

However, the taxes levied to support the increased spending for these programs will take money away from local consumers, which will reduce local consumer spending on goods and services, which will have its own multiplier effects on reducing local labor demand. It might seem that the increased spending and taxes are a wash, with no net effect on local labor demand. However, in general we would expect the demand increase from the increased local spending to exceed the demand decrease from the increased local taxes. Some of the reduced consumer demand from increased local taxes would have been used to buy non-local goods or services, or put into savings, whereas local spending is all spent in the first instance on local goods and services. This positive net demand effect of increased government spending and taxes is a standard result in macroeconomics, where it is labeled the "balanced budget multiplier." Its applicability to state spending and taxing decisions has been pointed out by Orszag and Stiglitz (2001). The balanced budget multiplier has been shown to empirically apply to real-world state spending and taxing decisions by Bartik and Erickcek (2003).

The positive labor demand effects, on state residents' employment rates and earnings, of increased taxes and spending on state early childhood programs or universal preschool can be modeled just like the effects of boosts to labor demand from business subsidies. However, as it turns out, when all the effects are considered, the economic development effects of simply spending more money on programs are small relative to the economic development benefits of business incentives. Bartik (2006a, p. 39) has some discussion of why this is so.

The more major effects on state economic development of early childhood programs or universal preschool are due to these programs' effects on the labor supply of former child participants or their parents. Consider labor supply effects on parents first. Parental labor supply may be affected by these programs' provisions of low-cost or free child care. Parental labor supply may also be affected by any direct counseling services these programs provide to the parents, or indirectly by parents feeling more able and confident to work longer hours if their child is developing better. Any extra employment experience that parents obtain as a result of these programs in the short-run may increase parents' long-run employment and wage rates. In addition, free or low-cost child care, direct counseling with parents, or parents feeling better about child development may also help parents to increase their educational attainment. Increases in educational attainment will also increase parents' employment rates and wage rates.

What about labor supply effects on the former child participants? Early childhood programs and universal preschool programs are commonly rationalized by their positive effects in encouraging better child development. Better child development should result in adults with better cognitive and non-cognitive skills. These better skills will increase educational attainment, which will increase employment rates and wage rates. In addition, better cognitive and non-

cognitive skills may also increase employment rates and wage rates beyond what would be predicted based on these programs' estimated effects on educational attainment. In my previous report on universal preschool, it turned out that these extra effects on employment rates, beyond what is predicted based on educational attainment, were an important component of the economic development benefits of universal preschool.

This discussion so far has assumed that the increased labor supply of parents and former child participants in a state's economy will be fully matched by increases in the quantity of labor demanded in the state economy. If the quantity of labor demanded in the state does not fully respond to increased state labor supply, then others in the state may have a harder time finding jobs—that is, they will be displaced from job opportunities by the expanded labor supply of parents and former child participants in these programs—and state wages may be reduced. Of course, more available labor looking for work and lower state wages should expand the quantity of labor demanded in a state. Empirical research on how local labor demand and supply respond to wages and unemployment rates suggests that it is plausible that about two-thirds of a boost to state labor supply will be accommodated by increased quantities of labor demanded (Bartik 2001). The remaining one-third will represent some displacement effects on other state residents of the initial boost to state labor supply.

Improving the child development of some children may improve the child development of other children at school due to peer effects. There is substantial research showing significant peer effects in school (Hanushek et al. 2003; Hoxby 2000). These peer effects act like multiplier effects, which increase the labor supply effects of early childhood programs or universal preschool by some multiple of their initial impact on former child participants. The empirical

literature suggests an estimate that peer effects might add 54% to the effects on the former child participants (Bartik 2006a, pp. 52–55).

Another spillover effect of these programs on a state's employment or earnings are the effects of increased college graduation rates on overall state productivity, beyond the direct effects on the productivity of the college graduates. The estimated effects of any increased educational attainment of parents or former child participants already reflect the increased employment rates, wage rates and productivity of an individual who gets a college degree. However, there is some evidence that an individual who gets a college degree will also increase the productivity of others in the state economy. For example, there is some evidence that an individual's wages depend not only on his or her own education, but also on the percentage of college graduates in the local economy (Moretti, 2003). If this is so, then any effects of these programs in increasing college graduates will have an additional spillover effects in increasing productivity of the state economy, which will attract additional employment to the state and increase wage rates in the state. The detailed procedures for estimating these spillover effects of college graduates are described in Bartik (2006a, pp. 62–68). Although these social spillover effects of increased college graduates have some importance in this report=s estimates, they are not a major component of program effects. These spillover effects of increased college graduates could be a significant component of some human capital programs, if these programs have more major effects on the percent of college graduates in a state.

This report and the previous report on preschool ignore and implicitly treat as negligible some other possible general equilibrium effects of early childhood programs and business subsidies. This report treats as negligible possible supply-side effects of the increased taxes

needed to finance these programs. (Demand side effects are considered in evaluating the balanced budget effects of expanding both taxes and spending on early childhood programs.) Supply-side effects of the increased taxes will be zero if the increased taxes are assumed to be imposed on land, a completely inelastic factor of production. Supply-side effects of the increased taxes may be small enough to be negligible if we assume that the increased taxes are imposed on households, and we either assume households are not very mobile in response to state taxes, or we assume that the net supply-side effects on households of increased taxes and increased preschool or early childhood services are small. Finally, whatever the supply-side effects of increased taxes, these effects will be similar for all the programs considered. This implies that comparative effects across programs will still be valid regardless of the supply-side impact of the source of financing.[16]

The report also treats as negligible possible demand side effects of increasing some taxes, such as household taxes, in order to expand economic development subsidies to business. As discussed further in Bartik (2006a, p. 29, footnote 12), this assumption is plausible if we assume that the net package of increased taxes on household taxes, reduced business taxes due to business subsidies, and possibly expanded customized public services to business, has a net effect on state demand for goods and services of close to zero.

The overall effect of early childhood programs or universal preschool programs are estimated in this report by incorporating all of these effects into a model of a state economy. For each cohort of child and parent participants, I estimate effects on labor supply, both due to increases in educational attainment, and due to effects beyond those predicted by educational

[16] In public finance, this is referred to as a differential incidence analysis.

attainment. These estimates are based on the experimental studies of the effects of these programs on former child participants and their parents. (The next section of this report considers these studies and their results in more detail.) For the former child participants, I add some extra effects due to school peer effects. I reduce the estimated labor supply effects over time as individuals leave the state, and for those who stay in the state, estimated effects are adjusted as former child participants age and eventually die. Final effects on state employment rates and earnings rates are also reduced due to some displacement of other state residents from jobs. Finally, the estimates allow for some spillover productivity effects on other state residents of an increased percentage of college graduates. Once effects are estimated for each cohort, effects in a given year are estimated by summing over all cohort effects for that year.

These are economic development effects when considered from a state perspective. I also look at economic development effects from a national perspective. I analyze these by adding in the negative or positive spillovers on other states of one state adopting business subsidies or an early childhood program.

For business subsidies, one negative spillover is that business subsidies may attract some business activity that otherwise would have occurred in some other state. On the other hand, subsidies to business investment would be expected to create some additional national business activity, although not as much as perceived from the state perspective. Economic development subsidies to business are not a pure zero-sum game, even for the typical state. To determine the ratio of national to state job creation from business subsidies for the typical state, in Bartik (2006a, pp. 111–115) I do some calculations based on estimates of the business subsidy cost per job created at the state level, and the business subsidy cost per job created at the national level.

These calculations conclude that in a typical state, about 19% of the jobs created in a state by the state's business subsidies represent a true increase in national jobs, whereas the remaining 81% of these jobs would have otherwise been created in some other state.

I also point out in Bartik (2006a) that these calculations only hold for a state with unemployment close to the national average. Redistributing jobs to a high unemployment state may reduce overall upward pressures on wage and price inflation, and thereby allow greater expansion of national employment without an increase in inflationary pressures. In the highest unemployment states, economic development subsidies to create jobs may create almost as many jobs in the nation as they create in the state (Bartik 2006a, pp. 116–118). In other words, in the highest unemployment states, the state's use of business subsidies to attract jobs has little cost in reducing job creation in other states.

The effects of early childhood programs on the labor supply of mothers and former child participants do not divert any labor supply from other states. This may not be true of all state policies to boost labor supply. For example, state policies that try to attract via migration the "creative class," which is thought by some economists to be important to state economic development (Florida 2002), would have negative effects on the supply of the creative class to other states.

There are some positive spillovers of early childhood programs on other states, because the calculations of jobs and earnings effects from a state perspective do not include state residents who move to other states. From a national perspective, effects on these out-migrants should be included. To include such effects, all simulation models of jobs and earnings effects are re-calculated with zero out-migration assumed.

There are also some positive spillovers of business subsidies on other states, as state residents who gained job experience due to jobs created in this state move to other states. I also take account of these effects through suppressing all out-migration responses. For the typical state, these positive spillovers of economic development subsidies are far outweighed by the negative spillovers.

6. PROGRAM DESCRIPTIONS, ESTIMATES, AND RESULTS

This section of the report provides further description of each of the five programs considered (the business subsidy program, universal preschool, and the three other early childhood programs), the program effect estimates used in the simulations, and the simulation results. The below discussion mentions whether estimates used in the simulations are statistically significant or not.[17] I use point estimates in the simulations even when the estimates are statistically insignificantly different from zero; the issue of how to deal with various sources of uncertainty in the estimates is discussed further in the next section. This report's appendices provide more detailed information on the estimates used in the simulations and how the simulations are done.

The analysis of the business subsidy program and the universal preschool program differs somewhat from the analysis of the three other early childhood programs because the business subsidy program and the universal preschool program have not been researched in the exact form

[17] In this report, "statistically significant" means that the estimated probability of a result of that size or greater occurring by chance is less than 5%, "marginally statistically significant" means that the estimated probability of a result of that size or larger occurring by chance of more than 5% and less than 10%, and "close to statistically significant" or "not quite statistically significant" means that the estimated probability of result of that size or larger occurring by chance is more than 10% and less than 15%. Other results are described as "not statistically significant." All estimated probabilities are based on two-tail tests.

considered in this report or the previous report. Therefore, the estimated effects of these programs are based on extrapolations from the effects of closely-related programs and policy. In contrast, the analysis of the other three early childhood programs (the Abecedarian program, the Nurse Family Partnership, and the Parent-Child Home Program) is considering programs that are simply scaled up versions of already-tested programs.

Before assessing in detail the data available to estimate each program's effects, I want to emphasize the inherent challenges to using social science data to estimate economic effects or to predict the outcomes of larger-scale, longer-term implementations. First, there are major issues involved with using studies of a single site, or just two or three, as the basis for advocacy for large-scale implementation. Replicability is clearly a key criterion for a research study's solidness, yet very few early childhood programs other than preschool have been replicated in a sufficient number of contexts to allow for any certainty about their effects on a larger scale or in a different situation. Both Abecedarian and PCHP clearly present this challenge; as mentioned below, the Abecedarian program was conducted in Chapel Hill and, thus, has a very different social context and school system from that likely to be faced by most at-risk children and their families who might enroll in such programs elsewhere. With respect to PCHP, while evaluations have been conducted in many sites, only one – Pittsfield – was sufficiently well designed to merit the use of its data for economic estimates. Finally, although the Nurse Family Partnership program has been implemented at several different sites, the estimated effects vary across the different sites, causing some uncertainty about replicability.

A second problem is follow-up. Clearly, we cannot know the economic impacts of any program unless we know, at the very least, its impact when former child participants are in high

school. While we can impute high school graduation rates or adult earnings from test scores during elementary school, or even early childhood, such imputations are problematic, given the many intervening events that may affect adult employability and productivity. Following former participants through at least their 30s, when their job trajectories are more established, is ideal, but, again, very few studies provide such evidence. Abecedarian, Perry Preschool, and PCHP are among the few that do follow children at least through high school, giving them an advantage over some others. As discussed below, NFP reports some data on criminal activity of former child participants through age 15, which allows some estimates of effects on adult employment and earnings. To my knowledge, no other "non preschool" early childhood program has followed former participants into their high school years.

Along with follow-up comes attrition, which is a common problem that manifests itself differently in differently studies. In some cases, it may not affect economic predictions; when it occurs in ways that do not bias randomization, for example, researchers do not have to worry about it. In most instances, however, we are not so lucky, and we have to make assumptions that may bias the results in other ways. All of these issues should be considered when using social science research to predict future outcomes.

Notwithstanding the above, or perhaps because of it, the inherent uncertainty in the estimates from a social program implemented at only one site or only a few sites should not be an excuse for inaction. Until these early childhood programs are replicated in different sites, and for people from different demographic backgrounds, and, perhaps most important, at a larger scale, we will have only very limited ability to know their true potential, rather than, as presented in this paper, their "what if" potential. Of course, if and when such investments take place, it is

critical that the programs be designed so that the ability to conduct rigorous, long-term evaluations is embedded and funded. This issue is discussed further in section 7 below.

Business Subsidy Program

The business subsidy program being considered is a state government offering subsidies of the same real value each year to a business for 10 years, in an attempt to entice the business to relocate to the state or expand in the state. The estimated effects of this program are based on the assumption that the present value of this subsidy will affect job creation decisions by businesses to the same extent as a similar present value change in state and local business taxes.[18] The long-run elasticity of business employment in a state with respect to state and local business taxes is assumed to be −0.20, based on Wasylenko. This estimate is based on dozens of studies, in many cases with statistically significant results.

The estimated responsiveness of business employment or location with respect to business taxes is used to infer how many jobs will be created by providing businesses with a given 10-year stream of business subsidies. This inference requires assumptions about how businesses discount cash flows from business taxes or subsidies, and the multiplier effects of business location decisions on other businesses in the local economy.

The scale of these business subsidies is set at four different levels to compare business subsidies with each of the four early childhood programs. Each early childhood program is compared with a business subsidy program that has the same present value of costs. Each early childhood program has an annual cost that grows over time as the population increases and as

[18] The present values here are based on the discount rates used by businesses in making investment decisions. Based on Summers and Poterba (1994), this is assumed to be a real discount rate of 12%.

real wages of early childhood program employees increases. This ongoing early childhood program is compared with a business subsidy that each year promises a ten year stream of business subsidies that has the same present value of costs to the taxpayer as the annual cost of that early childhood program.[19]

Universal Preschool Program

The universal preschool program is a program design originally outlined by Karoly and Bigelow. This program design is based on the Chicago Child Parent Center program, but differs in many crucial features. The program is assumed to be universally available to all 4-year-olds, with 70% of all 4-year-olds actually participating in the program. The program operates for 3 hours per day for 175 days per year for one year for all participants. The program has a class size of 20 children, with one certified teacher as lead teacher, and one paraprofessional as a teacher's aide.

Following Karoly and Bingham's lead, I assume that the effects of this universal program on the future life course of child participants are 23% of the effects per participant of the Chicago Child-Parent Center Program. This 23% is based on Karoly and Bingham's assumptions about how much program effects per participant might be reduced from the CPC program due to two factors: a universal preschool program will include many middle-class and upper-class families, whereas the Chicago Child Parent Center program was targeted for low-income families; the estimated effects of the Chicago Child Parent Center are relative to other families who are not in any preschool, whereas a considerable proportion of the children

[19] In equating the present value of business subsidies to the annual costs of early childhood programs, I assume that taxpayers will want to use a real social discount rate of 3%.

participating in a universal preschool program would have otherwise been enrolled in some other preschool program. The 23% of CPC effects assumption might also be rationalized because the modeled universal preschool program has somewhat larger class sizes and a somewhat shorter duration than the CPC program. The modeled universal preschool program has student to staff ratios of 20-to-2, whereas the CPC program averaged 17-to-2. Some researchers on preschool believe such a class size differential will not alter a program's effectiveness (Schweinhart et al., 2005, p. 202), but it might lower effectiveness somewhat. The modeled universal preschool only is provided for 1 year to 4-year-olds, whereas the CPC program was offered for 2 years, at ages 3 and 4, to each child. However, only about half of the CPC program participants actually participated in the program for two years, and the estimated program effects on long-run outcomes did not differ by much between one-year participants and two-year participants (Reynolds et al., 2002, p. 285).

As mentioned, the estimated program effects per child participant in the universal preschool program were assumed to be 23% of those estimated in the Chicago Child-Parent Center Program. The CPC program was a preschool program started in 1967 in various Chicago schools, and still continuing today. Estimates of the CPC program's effects are based on non-experimental evaluations, although the comparison group appears to be quite similar to program participants. Estimated effects on former child participants are based on all 989 CPC participants who were born in 1980, and who participated at 24 different CPC sites at 24 Chicago public schools. The outcomes for these former child participants are compared with outcomes for 550 children born in 1980 who attended five Chicago public schools that did not have the CPC

program, but were otherwise similar in socioeconomic status to the participating schools and students.[20]

Based on studies of the CPC program, as of ages 20 and 21 the CPC program has reduced the percentage of high school dropouts by 11 to 12 percentage points, a reduction which is statistically significant (Reynolds et al., 2002). This dropout reduction percentage, or rather 23% of that dropout reduction percentage, was used, along with data on how employment rates and wages vary with educational attainment, to estimate the effects of the modeled universal preschool program on jobs and earnings.

I wanted to allow for longer-term effects of universal preschool on subsequent educational attainment and employment, beyond what is observed at ages 20 and 21. To do so, I relied on estimates from the Perry Preschool Program, but modified to be appropriate for the CPC program. The Perry Preschool program was conducted from 1962–1967 in Ypsilanti, Michigan.[21] The 58 randomly assigned experimental child participants and 65 randomly assigned control group children have been followed ever since program participation to ascertain a wide variety of effects of the program. Because of the small sample sizes for the Perry Preschool program, even quite large estimated effects of the program are frequently only marginally statistically significant.

The Perry Preschool Program is a preschool program that is similar to CPC, but somewhat more intensive in resources used. The Perry Preschool program had a somewhat smaller student to teacher ratio, averaging 22 students to 4 teachers versus the CPC class size

[20] The description of the Chicago Child-Parent Center Program and research on the CPC program are based on various publications by Arthur Reynolds and his colleagues, and particularly on Reynolds et al (2002) and Temple and Reynolds (2007). These descriptions are also based in part on Galinksy (2006).

[21] The descriptions of the Perry Preschool program and its associated studies are based in part on Schweinhart et al. (2005) and on Galinsky (2006).

ratios of 17 students for 2 teachers. In addition, all four of the Perry Preschool teachers were certified teachers, whereas only the lead CPC teacher was required to be a certified teacher. Both the Perry Preschool Program and the CPC program were half-day programs that only operated during the school year. Both were offered for two years, for ages 3 and 4, but 80% of the Perry Preschool children participated for two years versus only half of the CPC children. Finally, the Perry Preschool program, but not the CPC program, included a 1.5 hour home visit by a teacher to each child's home once a week.

The estimated effects of the Perry Preschool Program at age 19 were to reduce the high school dropout rate by 22 percent (Schweinhart et al. 2005). This effect is marginally statistically significant. This is a little less than twice the CPC program's effect on high school dropouts at age 20 (Reynolds et al., 2002.). Based on these comparative results for the Perry Preschool program and the CPC program, I assume that the long-run effects of the CPC program on educational attainment at later ages, or on employment rates at later ages, will be about one-half of the estimated effects of the Perry Preschool program. In turn, the effects for the modeled universal preschool program on child participants are assumed to be 23% of the imputed CPC effects.

The Perry Preschool program shows effects on long-run employment rates that are far greater than one would predict based on the Perry program's effects on educational attainment alone. For example, the Perry Preschool program is estimated to increase the employment rate by 14% at age 40 (this increase is marginally statistically significant), but the estimated effects of the program though educational attainment alone are only 2% (Schweinhart et al. 2005; Bartik 2006a, Table 11). These "extra employment rate" effects of Perry preschool are used to infer

plausible long-run employment rate and earnings effects for the modeled universal preschool program, above and beyond the universal preschool program's effects on educational attainment.

The estimated effects of the modeled universal preschool program on parents are based on the extensive research literature on how child care costs affect mothers' labor force participation rates. (See Blau 2001, Blau and Hagy 1998, and Anderson and Levine, 2000. Also see discussion of implications of this research in Bartik 2006a, p. 41.) Based on this research, the increase in percentage rate points in mothers' labor force participation rates is assumed to be about one-fifth of the percentage reduction in child care costs. (For example, a 100% reduction in child care costs, that is making child care free, would be assumed to increase mothers' employment rates by 20 points, or if the base employment rate was 30%, free child care would increase the employment rate to 50%). However, free half-day school-year child care for one four-year-old child does not reduce child care costs by 100%. I made a number of adjustments to determine the true effective percentage reduction in child care costs. In addition to adjusting for the limited number of hours covered by half-day school-year child care, these adjustments included: about 47% of the participants in Karoly et al.'s model of universal preschool would have already received free child care from another preschool program; 39% of parents of 4-year-olds also have a younger child (author's calculations using the March 2004 Current Population Survey). I ended up concluding that for the average family participating in the modeled universal preschool program, the average effective reduction in child care costs is only about 8% (Bartik 2006a).

Based on these estimates and assumptions, Figures 1 and 2 show the estimated effects of an ongoing universal preschool program on the employment rates or earnings rates of state

residents who remain in the state.[22] Effects are stated as a percentage of state employment or earnings. For comparison, the figure also shows effects on a state's residents of an ongoing program of business subsidies of the same cost as this universal preschool program. The numbers behind these figures are in Appendix B, and in Bartik (2006a).

In the long-run, the universal preschool program is estimated to increase a state's jobs for state residents by over 1.3%. As mentioned in the introduction to this report, this effect is over twice the long-run jobs creation effects of a similar-cost business subsidy program. In contrast, the long-run percentage increase in earnings of universal preschool is only about 15% greater than the percentage increase in earnings due to similar cost business subsidies.

The somewhat smaller effects on earnings versus jobs of universal preschool, compared to business subsidies, occurs in part because of differences in who gets jobs due to these programs. As mentioned above, universal preschool is assumed to have effects in increasing employment rates, above and beyond its effects on educational attainment, for former child participants, and effects on employment rates of the mothers of child participants. These increases in employment rates are for former child participants and mothers who typically are from lower-income backgrounds, and hence tend to earn below average wages. This causes the universal preschool program's impact on earnings to be similar in percentage size to its impact on jobs, even though the program does have effects, via increased educational attainment, in increasing wages (which will increase earnings without increasing jobs). In contrast, the jobs created by business subsidies to business tend to be at average wages. In addition, the job growth due to business subsidies will bring about some occupational upgrading, which will increase

[22] The specific numbers behind Figures 1 and 2 are in appendix B.

wages. As a result, the percentage effects of business subsidies on earnings are considerably greater than their percentage effects on jobs.

Although the creation of lower-wage jobs for disadvantaged persons lowers the earnings effects of universal preschool, it probably makes the program's impact on the income distribution more progressive than the impact of business subsidies. Research has shown that the job growth generated by business subsidies has modestly progressive effects on the income distribution (Bartik 1991, 1994). The income distribution effects of universal preschool should exceed this modest progressivity.

As Figure 1 shows, in the short-run universal preschool's effects on job creation are minuscule compared to the job creation effects of a business subsidy program of similar costs. This largely occurs because almost all the economic development effects of universal preschool occur due to effects on former child participants. Effects on employment rates and earnings of mothers are small because the effective reduction in child care costs due to universal preschool is small.

It should be recalled that Figures 1 and 2 compare effects of universal preschool with business subsidies from a state perspective. As discussed and shown in previous sections of this report, the effects are quite different from a national perspective. The effects of universal preschool go up about one-third, and the effects of business subsidy are reduced by about four-fifths.

Abecedarian Program

The Abecedarian program was operated as a random assignment experiment from 1972 to 1977 in Chapel Hill, North Carolina. The program provided disadvantaged families with five

years of free full-time and full-year child care with an educational orientation, from 6 weeks of age until the child entered kindergarten, plus home visits every other week. The child care provided was from 7:30 a.m. until 5:30 p.m., five days a week, 50 weeks per year. The child care incorporated educational goals from the very beginning, but with a highly individualized curriculum. The child care/preschool had group size and staff ratios of 6 infants to 2 teachers for the first year; 8 toddlers to 2 teachers for the second year; 10 preschoolers to 2 teachers for the third year; and 14 preschoolers to 2 teachers for the fourth and fifth year. Teachers were mostly high school graduates for ages from birth to age 2, and mostly college graduates from ages 3 to 5. Salaries were competitive with public school salaries.[23]

The high costs of the Abecedarian program (over $80,000 per child, in 2007 dollars) are due to the intensive nature of this intervention. In addition to the relatively small class sizes, the Abecedarian program is intensive because of the amount of time the program devotes to each child. Children potentially received over 12,000 hours of services from this program. (5 years × 50 weeks per year × 5 days per week × 10 hours per day = 12,500 hours.)

The Chapel Hill environment of this experiment probably resulted in very good follow-up services for the Abecedarian students and families. The public school system in Chapel Hill was considered to be one of the two best public school systems in the state (Galinksy 2006, p. 14). The Chapel Hill public schools had a relatively small percentage of disadvantaged children, and a large number of different support services for children who were behind. In addition, among both the treatment and control group, half were randomly assigned to additional school-age interventions. In these school-age interventions, home/school resource teachers helped provide

[23]The description of the Abecedarian program in this paragraph is based on the various papers from the project, but particularly Ramey and Campbell (1991). I also used information from descriptions of the Abecedarian program by Galinsky (2006) and Ludwig and Sawhill (2007).

supplemental materials for parents to work on with their children at home. Therefore, the estimated effects of the Abecedarian intervention represent the effects of early childhood intervention when subsequently these children are frequently eligible for a variety of services. If early childhood services have synergistic effects with school-age services, this may affect the magnitude of the effects of the Abecedarian program.

The Abecedarian program was targeted at families who scored at high risk on a risk index. This risk index was based on a number of factors, including low educational level of the mother or father, low family income, whether the family was a single parent family, family receipt of welfare, and low-IQ mother or father. It is difficult to determine exactly what percentage of the U.S. population would be eligible for a full-scale Abecedarian program with similar targeting criteria. Ludwig and Sawhill (2007) assume that similar results to the Abecedarian program could be achieved by targeting the program at families below the poverty line.

The estimated effects of the Abecedarian program that are used in the program's various evaluations, as well as in the simulations used in this current report, rely on the Chapel Hill Abecedarian program being conducted as a random assignment experiment. Random assignment allows us to be confident that the differences between the treatment group and the control are not due to systematic differences between the two groups other than program assignment. However, the sample size for most results for this random assignment experiment is quite limited, with only 57 children in the program group and 54 children in the control group. This means that in some cases the odds are somewhat high that the differences between the program and control

group could be due to chance. Estimated effects may be statistically insignificant, even when the differences between the program and control group imply "large" program benefits.

The free child care provided by the program would be expected to increase the labor supply of parents during the five years of the program. As described in Bartik (2006a) and Appendix C, we have good estimates from the research literature of the effects of child care prices on mothers' labor supply. We would expect this extra employment experience of mothers during the program's five years of services to increase mothers' subsequent labor supply and wages. Program data also provides direct evidence that employment and earnings of mothers increase by sizable amounts after the program was completed. However, the estimated employment increase is statistically insignificant and the estimated earnings increase is only marginally statistically significant.[24] In addition, the Abecedarian program results suggest that the program increases post-secondary education of mothers, although this result is not quite statistically significant.

The Abecedarian experiment estimated that the program increased attendance in college BA programs for former child participants as of age 21. (Effects on women are statistically significant, while effects on men are only marginally statistically significant.) I use the program's estimated effects on education activity and enrollment at age 21 to project final educational attainment of Abecedarian program participants. These effects on educational attainment imply effects on employment rates and wage rates. In addition, it appears that former child participants are more likely to be employed at age 21 than one would expect based on their educational attainment. This estimated "extra" employment effect is not quite statistically

[24] The Appendix provides more detail on the specific estimates used, their magnitude, and their probability of occurring by chance.

significant. However, estimated effects of the Abecedarian program on the percentage of former child participants at age 21 employed in skilled jobs is statistically significant. As discussed in Bartik (2006a, p. 48 and Table 11), results from the Perry Preschool program suggest that early childhood interventions may have employment rate effects beyond their effects on educational attainment that are quite persistent. I use estimated results from Perry Preschool to predict how the Abecedarian results for former child participants at age 21 might change as these former child participants age.

Based on these estimates, Figures 3 and 4 show the estimated effects of an ongoing full-scale Abecedarian program on the employment rates or earnings rates of state residents who remain in the state. "Full-scale" means that the program is available to all of the targeted disadvantaged families. Likely targeting and participation rates are based on assumptions made by Ludwig and Sawhill (2007), which result in about 15% of all children participating in the program. Effects are stated as a percentage of state employment or earnings. For comparison, the figure also shows effects on a state's residents of an ongoing program of business subsidies of the same cost as the full-scale Abecedarian program.[25]

As shown in Figure 3, the Abecedarian program eventually boosts state employment by over two percent. The program=s effects on state employment in the long-run are about 50% greater than a similar cost program of business subsidies. In contrast, the Abecedarian program's effects on state residents' earnings in the long-run come close to the effects of a similar cost program of business subsidies, but are never quite as great.

As was the case for universal preschool, the somewhat smaller effects on earnings versus jobs of the Abecedarian program, compared to business subsidies, occurs because of differences

[25] The specific numbers behind Figures 3 and 4 are in Appendix C, tables C1 and C2.

in who gets jobs due to these programs. The Abecedarian program is assumed to have some considerable effects in increasing the employment rates of former child participants and mothers of a disadvantaged group. This increase in employment tends to occur at below-average wages given the disadvantaged nature of this group. This causes the Abecedarian program's impact on earnings to be similar in percentage size to its impact on jobs, even though the program does have effects in increasing wages (which will increase earnings without increasing jobs.) In contrast, the jobs created by business subsidies to business tend to be at average wages. In addition, the job growth due to business subsidies will bring about some occupational upgrading, which will increase wages. As a result, the percentage effects of business subsidies on earnings are considerably greater than their percentage effects on jobs.

As with universal preschool, although the creation of lower-wage jobs for disadvantaged persons lowers the earnings effects of the Abecedarian program, it probably makes the program's impact on the income distribution more progressive than the impact of business subsidies.

As Figure 3 shows, in the short-run the Abecedarian program's effects on job creation are perhaps two-thirds of the job creation effects of a business subsidy program of similar costs. This is a considerably better relative performance than the job creation effects in the short-run of a universal preschool program for 4-year-olds. The Abecedarian program can come close to matching business subsidies in the short-run, in the period when the program is providing all parents with free full-time child care. The Abecedarian program's effects then begin to lag relative to business subsidies, in the period when some parents no longer have children in the program, and before former child participants enter the labor market. The Abecedarian program's effects on job creation finally catch up and surpass the effects of business subsidies

when a sufficient number of former child participants have entered the labor market and then entered their prime earnings years. In Figure 4, for earnings, all of the short-run and medium effects of the Abecedarian program are somewhat muted because so many of the jobs created due to the program are for disadvantaged persons who earn lower wages.

The reader should recall that Figures 3 and 4 show effects from a state perspective. As shown in previous sections of this report, the Abecedarian program does much better relative to business subsidies when the perspective taken is national.

Nurse Family Partnership Program

The Nurse Family Partnership program has been subject to three experimental studies: Elmira (NY) starting in 1977, Memphis in 1987, and Denver in 1994. The program now is operating in over 290 counties in 23 states, serving over 12,000 families per year (Nurse Family Partnership website; Olds 2005). The NFP provides disadvantaged first time mothers with about two and a half years of regular nurse visits, from prenatal up to the child turning age 2. The nurse home visits usually last 75 to 90 minutes. On average, across the three experimental sites, about seven visits were completed prior to the birth of the child, and about 23 after the birth of the child.[26]

The "curriculum" presented in the nurse visits is aimed at three goals: healthier prenatal care; more sensitive child care; and a better maternal life course, including better spacing and planning of subsequent pregnancies, helping the mother to complete education and find work, and figuring out ways to involve fathers more constructively in the family (Olds 2002).

[26] The program descriptions of NFP in this report are based on Olds et al. 1997, 1998, 2004a, 2004b; Olds 2002, and Kitzman et al. 2000.

Therefore, in contrast to many early childhood programs, the goals of the Nurse Family Partnership focus at least as much on the mother as on the child. The program is aimed at first-time mothers as it is thought that first-time mothers will be more open to the program=s information and influence. Nurses are used as home visitors as it is felt that nurses have advantages of credibility with mothers and health care knowledge. There is evidence from the Denver experiment that nurse home visitors are more effective than paraprofessionals in delivering the NFP curriculum (Olds et al. 2004b).

In the initial Elmira experimental test of the Nurse Family Partnership, the program was only modestly targeted at disadvantaged pregnant first-time mothers. However, research suggested that the program had significantly greater effects for more disadvantaged women (Olds et al. 1997; Karoly et al. 1998). Therefore, subsequent experimental tests of the program have been more targeted at disadvantaged women. Isaacs (2007) estimates that a full-scale NFP program might have 9% of all children be eligible.

The Nurse Family Partnership is far less intensive in hours of intervention per family than child care and preschool programs such as the Abecedarian program or universal preschool. For example, the Nurse Family Partnership program only interacts with its target group for perhaps 45 hours over two and a half years (30 visits × 90 minutes per visit), while the Abecedarian program interacts with children for up to 12,000 hours. Of course, the theory of programs such as the Nurse Family Partnership is that interventions at a crucial period with the mother will have large effects later on in how the mother acts and in particular with how the mother interacts with the child. There is evidence from the experiments of such effects on the mother's behavior. The Elmira and Memphis experiments indicated that the program statistically significantly reduced

subsequent pregnancies, whereas the Denver experiment indicated statistically significant effects in delaying the time until a second birth (Olds et al. 1997, 2004a, 2004b). Fewer subsequent pregnancies, or even delayed second births, are likely to significantly improve the quantity and perhaps the quality of the mother's interaction with the first child.

The lower intensity in hours of service of the NFP program compared to the Abecedarian program is not fully matched by lower costs. Costs of the NFP program per family are a little more than 10% of the costs per family of the Abecedarian program (about $10,000 per family versus $80,000 per family), whereas the hours of service per family of the NFP program are less than one-half of 1% of the hours of service per family of the Abecedarian program (45 hours versus 12000 hours). The lower differentials in costs than in service hours probably reflects several factors: a greater reliance of the NFP program on one-on-one service (nurses meet individually with the mothers, whereas there are multiple Abecedarian children per teacher), more NFP program resources being devoted to non-direct service hours, and perhaps higher average salaries for NFP program nurses than for the average Abecedarian employee.

The three NFP experiments have larger sample sizes than the Abecedarian program or the Parent-Child Home program, which allows program effects to be estimated with more statistical precision. Sample sizes for treatment group and control groups at each site are in the hundreds.[27]

The Nurse Family Partnership program's effects on increasing the employment of mothers, and reducing welfare usage, are greater in the Elmira experiment than in the Memphis

[27]If we focus only on treatment group members who received the full NFP treatment, and treatment and control group members who were followed up after the program, the typical sample sizes for the program evaluation estimates are as follows: Elmira treatment group 97, control group 148; Memphis treatment group 197, control group 444; Denver treatment group 204, control group 220. These figures are based on Olds et al. (1998, 2004a, 2004b). For the Elmira site, the sample size for the low socioeconomic status, unmarried sample is smaller: 38 for the treatment group vs. 62 for the control group.

and Denver experiments. The lower effects in the later experiments may reflect changes in welfare policy that increase pressure on welfare mothers to be employed.[28] After welfare reform, reductions or delays in subsequent pregnancies are less likely to affect mothers' employment. Because of the national shift towards welfare policies that encourage employment, I rely on the Memphis and Denver experiments in estimating the likely effects of the Nurse Family Partnership program on mothers' employment and earnings.

The Memphis and Denver results suggest modest effects of the experiment on increasing mothers' high school graduation rates (Olds et al. 2004a and 2004b). In addition, the results also suggest some short-run results in increasing employment of mothers, during the period from the child's 2nd to 4th birthdays, beyond what is predicted based on educational attainment (Olds et al. 2004b; Kitzman et al. 2000). However, these short-run extra employment effects then appear to fade away (Olds et al. 2004a). The estimated effects on mothers' educational attainment and employment are both statistically insignificant.

None of the three experiments has direct evidence on former child participants' employment or earnings, or their educational attainment. Therefore, various earlier indicators of effects on former child participants must be used to predict effects on employment and earnings of former child participants when they are old enough to enter the workforce. Estimates from Memphis suggest some small and statistically insignificant effects of the Nurse Family Partnership program on age 6 reading and math scores (Olds et al. 2004a). These reading and math score test results can be used to predict adult employment rates and earnings. The Elmira results also report statistically significant and large effects of the Nurse Family Partnership

[28]Olds et al. (2004b) note no effect on mothers' use of welfare in the Denver trial. This result differs from the effects estimated in Memphis and Elmira. They speculate that this may be due to welfare reform (p. 1566).

program on reducing the former child participants' arrests through age 15 (Olds et al. 1998). These reductions in adolescent criminal activity can be used to predict reductions in adult criminal activity. Predicted reductions in adult criminal activity can then be used to predict changes in adult employment rates. Appendix C provides more information on the details of how these predictions are done, and the next section of the main text discusses some of the issues involved in using indirect predictors of adult employment and earnings.

Based on these various estimates, Figures 5 and 6 show estimated effects over time of an ongoing full-scale NFP program on the employment rates and earnings of a state's residents who stay in the state. As with the Abecedarian program, full-scale means a program in which all targeted families can receive services. Also, these effects are expressed as a percentage of state employment or state earnings. For comparison, the figures also show effects in a typical state of an ongoing economic development program of business subsidies that has the same costs as a full-scale NFP program.

As Figure 5 shows, in the long-run, a full-scale NFP program has about a third greater effect on state residents' jobs than a business subsidy program of the same costs. As Figure 6 shows, the long-run earnings creation effects of the NFP program are somewhat below those of a business subsidy program of the same costs. As with the Abecedarian program and universal preschool, this pattern occurs because the NFP program has considerable effects on employment rates of children and parents who are relatively disadvantaged and earn below-average wages. Despite some higher wage effects due to the NFP program's effects on educational attainment, overall the percentage effects of the program on jobs and earnings end up being quite similar in the long-run. In contrast, business subsidies have considerably higher percentage effects on

earnings than on jobs, due to these programs= creation of many average-wage jobs supplemented by effects on occupational upgrading. As with the Abecedarian program and universal preschool, the NFP program's greater effects on job creation for lower-wage workers implies that the income distribution effects of the NFP program are more progressive than those of business subsidies.

The long-run jobs creation and earnings creation effects of a full-scale NFP program are far below those of the Abecedarian program. For example, the job creation effects of a full-scale NFP program in the long-run are about 0.2%, compared to 2.1% for the Abecedarian program. These lower effects of an NFP program are somewhat less than one would predict based on the program's relative costs, but much greater than one would predict based on the program's direct service hours.

In the short-run, the Nurse Family Partnership Program has about one-third to one-half of the jobs creation effects of business subsidies. This is due to the short-run effects of the NFP program on the employment of mothers. However, the NFP program falls far behind businesses subsidies in job creation effects in the medium run, as these short-run effects on mothers' employment fade. NFP job creation effects do not begin to pick up again until former child participants enter the labor force after 20 years or so.

Again, the reader must recall that Figures 5 and 6 show effects from a state perspective. The Nurse Family Partnership does much better relative to business subsidies from a national perspective, as discussed extensively elsewhere in this report.

Parent-Child Home Program

The Parent-Child Home Program, begun in 1965, now provides services at over 150 sites (http://www.parent-child.org/). The program has been subject to a number of quasi-experimental and experimental evaluations, but only one of these evaluations provides evidence relevant to this report, as will be discussed further below.

The Parent-Child Home Program provides a disadvantaged mother and child with half-hour visits from a paraprofessional twice a week, for 23 weeks per year, for children ages 2 and 3 (e.g., a total of 92 home visits over two years, for a total of 46 hours). The visits alternate bringing a book vs. a toy. The paraprofessional informally models with the mother and child how to verbally interact with the child using the book or toy rather than directly teaching the mother. The purpose is to encourage the mother to engage in more such verbal interactions with the child, which are meant to stimulate better child development (Levenstein et al. 1983, 1998).

The program costs only $4,500 per child (e.g., $2,250 per year × two years of service) (Dickens and Baschnagel 2007). It costs a little less than half as much as the Nurse Family Partnership program for about the same number of contact hours. Presumably this lower cost reflects the Parent-Child Home Program's use of paraprofessionals versus the Nurse Family Partnership's use of nurses. The Parent-Child Home Program has a narrower focus than the Nurse Family Partnership program. Whereas the NFP program attempts to address better prenatal care, better child care, and improved life course for the mother, PCHP is more narrowly focused on encouraging more and better verbal interaction by the mother with the child.

Compared to the Abecedarian program, the Parent-Child Home Program costs a little over 5% as much, and provides less than one-half of 1% as many contact hours. The higher cost per contact hour of PCHP than the Abecedarian programs probably reflects reliance on one-on-

one service rather than working with groups, and a greater ratio of non-contact hours to contact hours for program employees. As with the NFP program, PCHP=s aspirations of achieving significant impact on children with such a limited number of hours must rest on somehow leveraging larger changes in how mothers interact with children during the many hours outside of direct program service.

Although criteria for recruitment of mother-child pairs into the program vary from site to site, the experimental results which I will use are based on a site that selected families if they met five of eight criteria for being high-risk, which included income below the poverty line, welfare receipt, low parent education, or being a single parent family. Dickens and Baschnagel (2007) estimate that about 5.5% of all U.S. children would be eligible for the Parent-Child Home Program under these criteria, and would participate in the program.

There are a variety of quasi-experimental and experimental evaluations of the Parent-Child Home Program that yield mixed results.[29] However, there is only one study that presents experimental evidence that allows an evaluation of the program's effects on employment rates and earnings rates. This experiment was conducted in Pittsfield, Massachusetts on children who entered the program at age 2 in 1979 or 1980. The experimental evaluation involved looking at whether the children graduated or dropped out of school by June 1996. The evaluation did not examine what happened to PCHP mothers. Altering the life course of mothers is not a primary goal of PCHP.

[29]For example, Madden et al. (1976) reports mostly positive findings, whereas Madden et al. (1984) reports mostly negative findings. These findings are for effects on IQ.

This experiment involved only 108 participants in the Parent-Child Home Program, and 15 persons in the randomized control group. Given this extremely small sample size for the control group, all estimates will have considerable statistical imprecision.

As detailed in Appendix C, the results suggest that PCHP has sizable and marginally statistically significant effects on the probability of children graduating from high school on time. I use these estimates and other figures for how many students will graduate or get a GED late to project final effects of the PCHP program on high school graduation. I then use these high school graduation effects to project effects of the PCHP program on the employment rate and wage rate of state residents.

As shown in Figure 7 and Figure 8, the long-run effect of a full-scale PCHP program is to create jobs for state residents who stay in the state by about 0.1% of total state jobs, and to create earnings for state residents who stay in the state by about 0.18%. The jobs effect is less than 1/20th of the jobs effects of a full-scale Abecedarian program, and the earnings effect is about 1/13th of the effects of the Abecedarian program. Of course, the cost of the PCHP program is a little more than 1/40th of the cost of the Abecedarian program, largely because of its lower cost per child, but also because of its somewhat more targeted clientele.

Compared to business subsidies of the same annual cost, the Parent-Child Home Program in the long-run creates almost three times as many jobs, and over twice as much in annual earnings for state residents. However, the effects of the PCHP program are long-delayed. Because there is no reason to think that PCHP affects maternal jobs or earnings, the program has little or no effect on job creation or earnings creation for over 15 years. All of these effects are

from a state perspective. PCHP does even better relative to business subsidies from a national perspective.

7. IMPLICATIONS OF ACCURACY ISSUES FOR RESEARCH AND PROGRAM IMPLEMENTATION

There are several important issues about the likely accuracy of this report's simulations. These issues have implications for future research. These issues also have implications for how policymakers might want to approach full-scale implementation of these early childhood programs. I will review how this report deals with these issues before discussing their implications for future research and program implementation.[30]

First, there is the issue of how to deal with the frequent statistical imprecision of estimates of these programs' effects in the research literature. In many cases, estimated program effects are estimated imprecisely. In some cases, estimated program effects are statistically insignificantly different from zero, or are only marginally statistically significantly different from zero.

In this report, the simulations use point estimates of program effects, even if the point estimate is statistically insignificantly different from zero. As argued by Ludwig and Phillips (2007), in any analysis of a program's benefits and costs, using the point estimates of program effects provides our best estimates of the expected value of benefits and costs.[31] This report

[30] This section of the report focuses on reducing our uncertainty about whether these programs are effective. There is extensive research on program implementation that focuses more attention on mobilizing the organizational and staff resources needed to replicate a program of demonstrated effectiveness. These include Fixsen et al. (2005) and Metz et al. (2007).

[31] We might want to go beyond estimating the expected value of program benefits and costs to estimating the entire probability distribution of program benefits and costs. However, this would require knowing something about the covariance of the various estimates of program effects. This covariance is likely to be sizable given that

acknowledges the imprecision of estimates by making it clear the degree to which different results depend upon estimates with varying statistical significance. For example, as discussed above, all of this report's simulations of the job creation and earnings effects of the NFP program associated with mothers are based on estimates that are statistically insignificant.

Second, there is the issue of the lack in many cases of direct estimates of effects of these early childhood programs on the employment rates and wage rates of former child participants and mothers. I deal with this issue by using estimates of these programs' effects on proxy variables which can predict future employment and wage rates. Such prediction using proxy variables provides the best available estimate of the expected effects of these programs on employment rates and earnings. For example, for all the programs, I use estimated effects on educational attainment to predict short-run and long-run effects of the programs on employment rates and wage rates. For the NFP program, I use effects on crime rates during adolescence among former child participants to predict adult criminal activity, and thereby to predict adult employment rates.

Third, there is the issue of how program effects when a program is implemented at full-scale may differ from program effects observed in these experiments. Because the experiments had close ties to the researchers, program quality may be higher in the experiments than it would be with full-scale implementation. On the other hand, perhaps program performance might improve over time with full-scale implementation, as program managers gain experience. The experiments may also differ from full-scale implementation because of special features of the environment of the experiments. For example, as noted above, it is possible that the Chapel Hill

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many of the estimates are from the same data sets and the same researchers. However, we generally do not have available information on how these different estimates will covary.

site of the Abecedarian program might result in more favorable results for the experiment. The higher quality K–12 atmosphere in Chapel Hill may have some synergistic interaction with the program, and thereby cause more positive effects on the treatment group than on the control group. On the other hand, it is possible that the better K–12 atmosphere in Chapel Hill might have helped the control group more than the treatment group. For example, K–12 school personnel in Chapel Hill may have devoted an unusual amount of resources to students who were behind. There is little that this report's simulations can do to estimate plausible differences between program effects in the experiments and program effects with full-scale implementation. The simulations use the estimated program effects from the experiments as our best estimate of the expected effects of the program if implemented on a full-scale.

What implications to these issues have for research? The problems with statistical imprecision suggest that research could be further informed by additional studies with much larger sample sizes. It is clear that the Abecedarian program, the Parent-Child Home Program and the Perry Preschool program have such promising results that they deserve replication at a number of sites with much larger sample sizes. Such replications would provide some preliminary evidence of program effects in the short-run, and much more research knowledge in the long-run.

The problems with reliance on proxy measures to predict employment rates suggests that research could be further informed by collecting additional follow-up data from the current experiments on the employment rates and wage rates of former child and parent participants. The Perry Preschool results already suggest that the employment rate and wage rate effects of early childhood programs may greatly exceed what one would predict based on program effects on

educational attainment. The Abecedarian, NFP program, and PCHP should have follow-up studies that directly collect information from treatment and control groups of mothers and former child participants on employment rates, wage rates, and earnings.[32]

For policymakers considering full-scale implementation of these programs, these issues suggest that actual effects in a full-scale program might differ from these small experiments. How should policymakers respond to this possibility?

Perhaps the best response to this uncertainty about program effects is to run any large-scale implementation of early childhood programs as an ongoing experiment or quasi-experiment. If there are insufficient program slots for all families targeted by these programs, families could be admitted to these programs by random assignment. If there is sufficient funding to serve all targeted families, then denying services to eligible families would be ethically questionable. However, funding could be provided to collect follow-up data on families who "just missed" being eligible for the program. Effects on these non-participants could be compared with effects on participants who "just made" the program's targeting criteria. Such a quasi-experimental comparison would be almost as good as an experiment using random assignment.[33]

Program administrators may benefit in the short-run from collecting data from program participants, and these randomly assigned or close comparison control groups. This short-run performance data may help program administrators in modifying program design to improve

[32]I know that the Abecedarian program is having a follow-up at age 30 for the original child participants, although I do not know what data have been and are being collected. I do not know what plans there are for follow-up to the NFP and PCHP experiments.

[33]Within the evaluation literature, this is referred to as using a "regression discontinuity design," and is a widely used technique of measuring the effects of some intervention. For a recent example, see Jacob and Lefgren (2004). They trace the beginning of this approach to Thistlewaite and Campbell (1960).

program performance. In the long-run, this ongoing data collection would enormously expand our research base for understanding the effects of these early childhood programs. To some extent, we can have our cake and eat it too. We can move forward to implement at a large scale those early childhood programs that have expected benefits that exceed costs, while monitoring the results of the implementation to make sure that the expected benefits materialize, and to improve program design.

8. CONCLUSION

The important conclusions of this report are listed below.

$ A wide variety of early childhood programs will increase the present value of earnings in a state economy by double or more the program=s costs. The economic development effects on a state economy of early childhood programs are similar in magnitude to the effects of boosting state economies via business subsidies.

$ If adopted at full scale, the Abecedarian program and universal preschool would have the highest economic impact on a state economy among the four early childhood programs analyzed. Among these 4 programs, the Parent-Child Home Program has the largest ratio of state economic effects per dollar spent, but is too small-scale in its number of participants and intensity per participant to have large absolute effects on a state economy.

$ From a national perspective, the earnings effects of early childhood programs are about a third greater than they are from a state perspective, because of the benefits for program participants who move out of state. These “spillover” benefits of state early childhood programs provide one rationale for federal subsidies of these state programs.

$ From a national perspective, the earnings benefits from early childhood programs are probably at least three times greater than the national benefits of business subsidies. Unlike business subsidies, early childhood programs do not steal jobs from other states.

$ In the long-run, many early childhood programs have greater effects on job creation for state residents than is true for business subsidies.

$ The economic development benefits for a state economy of early childhood programs are somewhat delayed compared to business subsidies. This problem can be alleviated but

not completely overcome by existing early childhood programs. The short-run job creation effects for state residents of early childhood programs are greater for programs that are more oriented to providing useful services to mothers. It is possible that further efforts to incorporate services to mothers into these programs (for example, job training programs for mothers) might do even more to increase the short-run job creation potential of early childhood programs.

$ Achieving the large potential economic development benefits of early childhood programs requires that these programs, when fully implemented, retain their high quality. Full-scale programs may be more likely to be high quality if these programs are continuously monitored to evaluate their effects and improve their designs. Such real world evaluations will also improve our research knowledge.

APPENDIX A
METHODOLOGY FOR ESTIMATING THE EFFECTS OF BUSINESS SUBSIDIES[34]

The traditional economic development subsidy analyzed in this report is assumed to be a financial subsidy for the location or expansion of export-based businesses. Such financial subsidies comprise the bulk of the resources devoted to economic development. Based on my knowledge of typical economic development programs, the subsidy is assumed to be paid out over a 10-year period.

The subsidy modeled is based on data on average economic development subsidies. Based on Peters and Fisher's (2002) research, this average subsidy is assumed to be $1,047 per job per year in 2004 dollars, for 10 years. The probability that such a subsidy will prove decisive in positively affecting the location decision is estimated at 3.7%, based on business location research.

The essential assumption to derive this estimate is that subsidies to business location will be no more effective on average than general business tax cuts in inducing business location decisions. Hence, the net cost of creating a job should be similar in general business tax cuts and economic development subsidies. Although state and local governments may seek to be more selective and choose to give subsidies only when needed to induce a location decision, in practice government officials lack sufficient knowledge of a business's relative profitability at different locations to be able to offer the optimal subsidy to just tip the location decision.

[34] This appendix is a modified version of the discussion in Bartik (2006a). Dollar figures are stated in this Appendix in 2004 dollars, consistent with this previous report.

What is the cost of creating a job through state and local business tax cuts that is implied by previous research? The research literature on state and local business taxes and business activity has been reviewed by Wasylenko (1997), who concludes that a plausible elasticity of state and local business activity with respect to state and local business taxes is !0.2, that is a 10% reduction in all state and local business taxes will increase a state or metropolitan area's business activity by 2%. Annual state and local business tax revenue per job seems to average about $3,889 per job in 2004 dollars, based on Peters and Fisher's research (2002, p. 106). The Wasylenko elasticity figures implies that if we offered a group of firms a 10% business tax cut, of $388.90 per job, then if we would have attracted *x* jobs without the business tax cut, now we will attract *x* times 1.02 jobs, for example if we would have attracted 100 identical firms each employing *x* workers, now we will attract 102 identical firms each employing *x* workers. We sacrifice 388.90 × *x* workers per firm × 100 firms in tax revenue to gain in jobs *x* workers per firm × two firms. The annual cost per job gained is equal to (388.90 × *x* × 100) / (2 × *x*) = $19,445 in annual foregone business tax revenue per job gained. More formally, a little algebra shows that the cost in foregone tax revenue in creating jobs through business tax cuts is equal to the annual business tax revenue per job divided by the elasticity of business activity with respect to taxes, or $3,889 / (0.2) = 19,445, based on Peters and Fisher and Wasylenko.

To determine what effects subsidies of different lengths will have, we have to make some assumptions about how firms discount future cash flows. Research on firm's discount rates suggests that corporate decisionmakers use a real annual discount rate of about 12% (Summers and Poterba 1994). Using this discount rate, the present value of a permanent tax cut of $19,445 per year is $181,487, or the implication is that just giving firms a lump sum of cash up-front

would have a cost per job created of $181,487. A lump sum of $181,487 corresponds to a 10-year subsidy, using a 12% discount rate, of $28,679 per job per year. If the average economic development subsidy of $1,047 per job per year is to result in the same cost per job created, the subsidy would have to be decisive in 3.7% of subsidized firms, as 3.7% = 1,047 / 28,679.

If the subsidy induces the subsidized business to make a positive location decision, and the business is 100% an export base business, then the business location decision will have some positive "multiplier" effects by increasing local demand for other goods and services. Specifically, the subsidized business's induced new activity will increase demand for local suppliers, who will as a result expand their employment. In addition, the additional wage and salary income for the subsidized business=s additional employees, and the additional employees at local suppliers, will increase demand for goods and service at local retail industries, which as a result will also expand employment. We assume an average multiplier of 1.80, based on data on multipliers calculated by the University of Michigan for Michigan's MEGA economic development subsidy program.

These assumptions together determine the average cost per job created in a state or local area by this typical economic development subsidy program. For the baseline simulation, the present value, at a 3% discount rate, of the $28,679 in annual subsidies over 10 years that would be needed to create one export-base job, is $251,975.[35] Including multiplier effects, the present value of the subsidies needed to create one job is $139,986 (= 251,975 / 1.8).

But how many of these new jobs will go to state residents? Ultimately, the new jobs created in the subsidized business, and any jobs created in suppliers and retailers as a result of

[35] $251,975 = 1.03 \times (28,679 / 0.03) \times (1 - 1 / (1.03)^{10})$.

the multiplier, must ultimately either go to non-employed state residents or to individuals who otherwise would have lived in another state, that is the job increase must be divided among increasing the employment rate of state residents or increasing the state population. Of course, some of the newly created jobs go directly to other state workers who already were employed. But this hiring of current state workers results in vacancies that either are filled by state residents who otherwise would be nonemployed, persons who otherwise would have lived outside this state, or state residents who otherwise would be employed. The chain of created vacancies goes on until eventually each new job either goes to a new resident or a newly employed state resident.

There is extensive research on how local job growth is typically apportioned among new jobs for local residents vs. local population growth (for a review, see Bartik 1993). This research suggests that in the short run, after a year or two, between 50 and 80% of the new jobs go to increasing the employment rates of local residents, and the rest go to persons who otherwise would have lived elsewhere, such as in-migrants. The proportion going to in-migrants increases over time, but even after 17 years, perhaps 2 of 10 new jobs are still reflected in higher employment rates for local residents. All of this extra local employment is due to higher local labor force participation rates; effects of local job growth on local unemployment rates dissipate after 4 to 8 years.

One theory offered to explain these highly persistent effects on local employment rates is that the short-run increases in employment rates for local residents due to job growth lead to permanent advantages for a few local residents in the labor market. Due to the short-run job growth, local employers hire some local residents who otherwise they would have avoided

hiring. As a result, these local residents gain valuable job skills, self-confidence, and a stronger reputation with that employer and other employers. These changes in worker skills, confidence, and reputation allow these local residents to more easily be hired in the future, and allow them to maintain their higher employment rates even after more in-migrants are able to enter the local labor market. Some of the evidence for this theory is further reviewed in Bartik (2001) and Bartik (1991).

If this is the cause of persistent effects of job growth on local residents' employment rates, then these effects will dissipate as the local residents who experienced the initial job growth either die or relocate to other local areas. Therefore, the effects of a one-time local job growth shock on local employment rates are not permanent, but are extremely persistent, and gradually fade over about a 50-year period.

To simulate these likely persistent but gradually decaying effects on state employment rates, I assume initial effects on unemployment rates that fade over five years, consistent with the empirical literature (Bartik 1993, 1991; Blanchard and Katz 1992). Effects on local labor force participation rates fade based on assumed patterns of out-migration from the state and mortality rates. This fading is based on dividing the initial employment shock as an equal increase in employment rates among all workers ages 16–79 in the state's workforce

In addition to persistent effects on local employment rates, job growth seems to have persistent effects on local real hourly wage rates (Bartik 1991). These effects seem to be due mainly to individuals with given credentials being successful in moving up to higher paying occupations; the real wage for a given occupation seems to not increase much if at all due to job growth.

A plausible explanation for these persistent real wage effects via higher occupational attainment is that some currently employed workers are also successful in gaining extra job skills, self-confidence and employer reputation due to the one-time shock to job growth. As a result of the job growth, in the short-run some local residents are hired by employers for higher paying occupations that they otherwise would have been able to attain. Some of these short-run promotions result in persistent advantages for those promoted, who continue in the future to attain higher-paying occupations than would otherwise have been expected.

If this explanation is accurate, then the persistent effects of local job growth on local occupational attainment and hence real wages should also eventually fade due to worker mortality and out-migration. In the simulation, I assume that real wage gains fade in a similar pattern to the fading of effects on labor force participation. The level of worker real wage gains is set so that it matches empirical estimates for worker real wage gains during the 10 years after the job shock; the remaining 65 years of real wage effects is a plausible extrapolation.

These simulations only deal with effects on the employment rates and earnings of state residents who stay in the state. How do we estimate effects at the national level, including all U.S. residents?

To evaluate the national effects vs. the state effects of reductions in business costs, we need to have national estimates of the costs of creating a job by business subsidies. For this report, I derive such estimates from a study by Jonathan Gruber and Joshua Rauh (2005) of the national elasticity of corporate investment with respect to the federal corporate tax rate. Their estimates, when combined with estimates of corporate tax revenue per employee, imply that the cost of creating a job in the nation through federal corporate tax breaks is $141,714 in annual

foregone revenue, ignoring the increase in the corporate tax base due to the expanded business activity.

From above, the cost of creating a job in a state from subsidizing an export-base firm is $19,445 in annual foregone revenue, again ignoring the resulting increase in the state business tax base. These estimated costs of national and state job creation imply that if we provide an annual subsidy of $19,445 to create one job in a state, the national job creation will only be a fraction of one job on average, specifically the fraction 19,445 / 141,714 = 0.137.[36] So about seven-eighths of the export-base jobs attracted by economic development subsidies represent reductions in export-base jobs for other states.

These estimates aren't a complete picture of national and state employment effects of subsidies, because jobs created in export-base businesses by economic development subsidies will result in multiplier effects that increase employment in other businesses. We would expect national multiplier effects of a boost to export-base businesses to be greater than state multiplier effects. National multipliers exceed state multipliers because some suppliers to export-base businesses will be located in other states, and some of the expansion in consumer demand will increase sales and production of firms located in other states.

Because of multiplier effects, the costs of creating a job in a state through economic development subsidies is given by 19,445 / *Ms*, where *Ms* is the state multiplier. The costs of creating a job nationally through economic development subsidies becomes $141,714 / *Mn*, where *Mn* is the national multiplier. Therefore, the ratio of the jobs created in the state from

[36] The number of state export-base jobs created by an economic development subsidy of $*S* is *Js* = *S* / 19,445. The number of jobs created nationally in export-base industries by this subsidy is *Jn* = *S* / 141,714. Therefore, *Jn* / *Js* = 19,445 / 141,714.

economic development subsidies to the jobs created nationally becomes (19,445 / *Ms*) / (141,714 / *Mn*) = 0.137 H *Mn* / *Ms*.

Estimates from the REMI model for Michigan suggest that the average ratio of national to state multipliers (*Mn* / *Ms*) is 1.407, that is the national multiplier is 41% greater than the state multiplier. As a result, the ratio of the jobs created in the nation by the economic development subsidy, to jobs created in the state is equal to 0.193 (= 0.137 H 1.407). Therefore, approximately four-fifths of the jobs created by economic development subsidies result in reduced jobs elsewhere, and only one-fifth represent a net increase in national jobs.

In addition, to go to national effects from state effects, we need to include effects on persons who move out of the state. Therefore, the true national effects of economic development subsidies should be calculated as 19.3%, or about one-fifth, of the effects that would have occurred in a state if there was no out-migration, which will be somewhat greater than one-fifth of the state effects with migration.

The resulting calculation of the national effects of economic development subsidies results in the estimate that the ratio of the present value of the national earnings effects to the present value of the economic development subsidies is 0.65. This is considerably below the ratio from the typical state's perspective, of 3.14. (See Table 6.)

APPENDIX B:
METHODOLOGY FOR ESTIMATING THE EFFECTS OF UNIVERSAL PRESCHOOL[37]

The universal preschool program being analyzed has the characteristics assumed in the study by Karoly and Bigelow (2005). These include:

$ Although the program is universally available for free for all 4-year-olds, only 70% of all 4-year-olds end up participating in the program.

$ The program operates for 3 hours per day for 175 days per year for one year for all participants. This design is similar to the Chicago Child Parent Center (CPC) program.

$ Following Karoly and Bigelow, the gross cost of the program per 4-year-old participant is $5,856, in year 2004 dollars. After considering cost savings on current public spending for preschool, the net cost of the new program is $4,234 per participant.

$ In the baseline estimates, the effects of the program on participants are largely based on evaluations of the CPC program. However, I use the assumption of Karoly and Bigelow that effects per participant in a universal preschool program are only 23% of the effects per participant of the CPC program. The CPC program's effects are for low-income families who otherwise would not have been in any preschool. These effects should be scaled down if preschool=s effects are lower for more affluent families, because free universal preschool will include many middle and upper income participants. In addition, universal preschool's net effects will be lower for participants who otherwise would have participated in preschool.[38]

There are four ways in which universal preschool might increase the employment and earnings of state residents. Only one of those four ways leads to large effects. However, before exploring this way in more detail, I will explain each of the four ways:

1. **Balanced budget multiplier effects**. First, there are net stimulative effects on demand for goods and services produced in the state, and thereby on labor demand in the state,

[37] This Appendix modifies the discussion in Bartik (2006b), which in turn is based on the full report in Bartik (2006a). Dollar figures in this Appendix are given in 2004 dollars.

[38] The 23% comes from estimates of the proportion of participants from various income groups, the proportion who otherwise would be in private or public preschool, and assumptions about how benefits of universal preschool vary with income and default preschool enrollment. See Karoly and Bigelow (2005) or Bartik (2006a).

due to spending more state government dollars on preschool education, even when that spending is financed by increased taxes. These stimulative effects would be similar for any type of increased state spending financed by higher state taxes.

The stimulative effect on the economy of an equal-sized increase in government spending and taxes is commonly presented in introductory macroeconomics courses as the "balanced budget multiplier." The intuition for the demand effects of spending to exceed those of taxes is as follows: State government spending directly increases final demand for goods and services sold in the state by the same dollar amount as the spending. In contrast, only a portion of the increased state taxes reduces final demand for goods and services sold in the state, because state residents also accommodate the increased taxes by reduced savings, and reduced spending on goods and services that they purchase out-of-state or on-line. Similar arguments are made in introductory macoeconomics courses for why balanced budget increases in federal spending and taxes will stimulate the national economy.

In the simplest regional economic models, a balanced budget increase in state spending and taxes increases state production by the same amount. The indirect multiplier effects of the increased state spending, as this spending leads to increased production, increased incomes of state residents, and increased respending, will in a simple model exactly offset the negative effects of the increased state taxes. All that remains is the initial increase in state spending, which will be matched by an increase in state production. More complex models allow for the propensity to respend on state goods and services to differ between those whose incomes are affected by state spending versus state taxes.

Using the REMI regional econometric model, a well-known and well-respected model (Treyz 1993), I estimate that the balanced budget multiplier effects of greater state government spending on preschool will increase earnings of state residents by a present value of $0.04, per dollar spent on preschool education.[39]

2. **Parental labor supply effects**. Second, there are the economic development effects of the increased labor supply of parents due to the free child care provided by universal preschool, for part of the day and part of the year. These effects depend upon how parental labor supply responds to (partially) free child care, and how in turn job creation in a state responds to the increase in labor supply.

I assume, based on previous research, that the job creation response is about two-thirds of the shock to labor supply (Bartik 2001, 2006a). However, the labor supply effects of this partially free child care will be limited, for two reasons. First, many of the parents whose children participate in preschool already work. Second, the child care provided by universal preschool is limited in the number of hours and days offered.

Based on the research literature on labor supply effects of child care prices, I estimate that for every dollar invested in universal preschool, real earnings of state residents will increase, due to parental labor supply effects, by a present value of $0.05. For details on this calculation, see Bartik (2006a), which in turn is based on Blau and Hagy (1998) and Anderson and Levine (2000).

[39] As detailed in Bartik (2006a), these estimates are based on the Upjohn Institute's REMI model for the state of Michigan. The magnitude of the balanced budget multiplier effects should be similar in different states, as the extent of leakages to out-of-state spending has offsetting effects on spending effects and tax effects.

3. **Participant and peer effects (summary)**. Third, there are economic development effects of universal preschool education due to preschool=s effects on increasing the future employability and productivity of participants, which will increase participants' future employment rates and earnings rates. In addition, because preschool participants fare better in K–12 education, the school atmosphere in K–12 schools will improve, which improves achievement for all students, including peers of the preschool participants. These peer effects also improve future employment rates and earnings rates.

I will go into more detail on these participant and peer effects later on in this Appendix. For now, I simply note that I estimate that for every dollar invested in universal preschool, these participant and peer effects increase the present value of future earnings by $2.65.

4. **Social productivity effects of education**. Fourth, there are effects that occur because preschool's effects in increasing education will increase the overall productivity of the state economy, and thereby attract new business activity. There is evidence that local economies with a more-educated population have higher employment growth (Glaeser and Saiz 2003). In addition, there is evidence that an individual's wages are not only affected by the individual's own education, but also by the average education level in the local economy (Moretti 2003). A plausible interpretation of these effects is that higher average education levels allow businesses to use more advanced technologies and production methods.

However, the empirical evidence suggests that these productivity effects on the overall economy of average education levels are mainly related to the percentage of college graduates in the local economy, not the percentage with lesser credentials such as a high school diploma (Moretti 2003). Furthermore, the evidence is that preschool education, although it has large

effects on high school graduation rates, does not substantially affect college graduation rates (Schweinhart et al. 2005).

Therefore, the effects of preschool education on economic development by affecting overall social productivity are modest. Using estimates of preschool effects on college graduation, and estimates of how college graduation rates affects affect employment growth, I estimate that for every dollar invested in universal preschool education, the present value of real earnings increases, due to social productivity effects, by $0.04 (Bartik 2006).

Summary of preschool effects. Therefore, the total effect of preschool education on economic development, per dollar invested, is to increase the present value of real earnings by $2.78. Of the $2.78 total, $2.65 is due to effects on the future earnings of preschool participants and their peers. Therefore, these participant and peer effects are worth going into in some detail, which I will do next.

Participant and peer effects (more detail). What are the mechanisms by which a universal preschool program causes higher future earnings for preschool participants and their peers? How do I estimate the magnitude of these effects?

First, the cost-effectiveness of preschool spending depends upon the costs per participant. I assume, as mentioned before, that the net costs of universal preschool per participant, after allowing for current preschool spending, will be $4,234.

Second, as mentioned before, we need to scale down the effects of preschool participation from the effects we would expect for an exclusively low-income group of 4-year-olds who otherwise would not have participated in preschool. The best studies of preschool's effects are for the Perry Preschool program and the CPC program, which served low-income

participants, and evaluated effects compared to a control group that did not participate in preschool. We need to use these high quality studies, but scale down estimated effects per participant for a universal preschool program that will include many middle and upper income participants, and many participants who would have been in preschool without the universal program.

For the baseline estimates, I follow Karoly and Bigelow (2005) and assume that the effects per participant are only 23 percent of the effects that would be obtained for a preschool program that exclusively served low-income participants who otherwise would not have participated in preschool.

Third, preschool will in part increase future employment rates and earnings rates by increasing educational attainment of participants. I use data from the CPC program to estimate the effects on educational attainment through age 19 (Reynolds et al. 2002). I use estimates from the Perry Preschool program for later ages, scaled down to allow for the somewhat lower effects at younger ages of the CPC program versus Perry Preschool, to estimate the effects at later ages on educational attainment (Bartik 2006a; Schweinhart et al. 2005). I then use data from the Current Population Survey, Outgoing Rotation Group, to estimate how changes in educational attainment affect employment rates and wage rates at different ages.

Fourth, there is strong evidence from the Perry Preschool study that preschool participants' employment rates will go up more than would be predicted based on the effects of preschool on educational attainment. Presumably, this reflects more intangible effects of preschool on various soft skills and character traits of participants. I use estimates from the Perry Preschool program to estimate this extra employment rate effect of preschool participation.

Fifth, there is an adjustment to reduce effects by the percentage of preschool participants who move out of state, as we only want to count effects on employment rates and earnings rates of state residents in these estimates from a state perspective. I base this downward adjustment for out-migration on data from the Panel Survey of Income Dynamics on how many individuals remain at different ages in the state they live in at age 4, and data from the U.S. Census on how many persons at various ages still live in their state of birth.

Sixth, there is a downwards adjustment to account for preschool participants who die. I estimate this based on National Center for Health Statistics mortality tables.

Seventh, there is an upwards adjustment to account for effects of universal preschool in improving the effectiveness of K–12 education for the peers of the universal preschoolers. Based on evidence from Hanushek et al. (2003) and Hoxby (2000) for how greater achievement of one student affects his or her peers in the same class, these peer effects are assumed to be a little over half of the direct effects on participants (Bartik 2006a).

Eighth, there is a downwards adjustment to account for the displacement effects of shocks that increase labor supply. It should be understood that preschool education is an increase in the quantity and quality of employable, higher skill labor available in the labor market. This increase in the quantity and quality of labor supply does nothing directly to increase employment rates and earning rates. Rather, this increase in the quantity and quality of labor supply will induce an increase in labor demand, in part by the availability of more unemployed labor of high quality, which makes it easier to fill vacancies, and possibly also by some downward adjustment of wages. From the research evidence, as reviewed in Bartik (2001), there are some displacement effects, but very modest or negligible effects in reducing

wages. I assume, based on the relevant empirical estimates reviewed in Bartik (2001), that the increase in labor demand will be about two-thirds of the increase in labor supply of preschool participants and their peers.

These various factors can be multiplied together to yield estimated effects of universal preschool education on the employment and earnings of each cohort of preschool participants and their peers for each year of their lives. The long-run effects of universal preschool education are then derived by adding up these effects for all cohorts as the ongoing universal preschool program proceeds.

Tables A1 and A2 add up all these effects of preschool education on the employment and earnings of state residents, and present estimates for the percentage effect on state residents' employment and earnings of an ongoing universal preschool program started in 2009. Effects are broken down into whether they are caused by simply spending more money, effects on parents of participants, or all direct and indirect effects of the greater human capital of participants (including peer effects in school, and social productivity effects of more college graduates in the state). For comparison, the tables also show effects for a business subsidy program of the same costs as the universal preschool program. These tables are the basis for Figures 1 and 2 in the report's text.

To estimate universal preschool=s effects from a national perspective, I re-estimate preschool's effects under the assumption of zero out-migration. This corresponds to including all the earnings effects on out-migrants. The present value of the earnings effects of preschool, per dollar invested, increase from $2.78 to $3.79. The $1.01 of preschool benefits accruing to non-state residents could justify some federal subsidy for state investments in preschool.

APPENDIX C
METHODOLOGY AND ADDITIONAL RESULTS FOR THE NEW SIMULATIONS COMPLETED FOR THIS PAPER

INTRODUCTION

This Appendix describes the assumptions made to perform the new simulations described in this paper, and these assumptions' basis in either prior empirical literature or logic. I also provide some additional results for the paper. I consider in turn each of three early childhood programs: the Abecedarian Program, the Nurse Family Partnership (NFP) Program, and the Parent-Child Home Program (PCHP). I then consider the calculations reported in the text for how the universal preschool program's earnings effects to cost ratio is affected by the creation of an Abecedarian style program.

Each program is assumed to start in 2009, and to continue forever. Each simulated program is scaled to operate at "full scale" as a "targeted program." This means that the program has sufficient resources to serve everyone who is a member of the disadvantaged targeted group, but the programs are not scaled up to serve everyone. This approach allows us to easily use each program's research on the effects of the program, which typically estimates the effects of the program on some type of disadvantaged population.

Because full-scale for each program requires quite different costs, each early childhood program is compared with a business subsidy program of the same present value of costs as that program, or three different scales of ongoing business subsidies. The early childhood programs can be compared in two ways: in terms of effects per dollar, by looking at the present value of earnings effects relative to the present value of each program's costs; in terms of effects at scale,

in terms of the net present value of the difference between program earnings effects and program costs.

The simulations seek to estimate the effects of these programs on "economic development," which we take to be an increase in the employment rates or earnings per person of state residents who stay in the state after the program. These increases in employment or earnings per person are described as increases in jobs or earnings created in the state. In the state models, in-migrants or out-migrants are not considered, either positively or negatively. That is, a participant whose earnings or employment is increased because of the program, but who leaves the state, is not counted; an employed individual who leaves the state because of the program is not counted; an individual who moves into the state and obtains a job is not counted. In models that take a national perspective, we consider what happens to everyone=s employment or earnings. This is implemented by assuming there is no out-migration or in-migration.

Each program potentially has effects through similar mechanisms. First, there are the effects of increasing both taxes and spending in a state. Second, there are the effects through the employment and earnings of the parents of the child participants, principally the mothers of the child participants. Third, there are effects through the employment and earnings of the child participants when they become adults. In turn, each of these transmission mechanisms may affect other state residents through spillover effects: the Keynesian multiplier; the displacement by participants or their parents of other state residents from jobs or earnings; positive spillover effects of higher human capital in schools or the labor market.

Estimated program effects are based on the best research evidence available. Point estimates are used even when the estimated effect is not statistically significant. I note below

when the estimates are based on empirical results that are not statistically significant at conventional levels. I use the terminology "statistically significant" for estimates that are significant at the 95% confidence level for a two-tail test (e.g., probability of result of this magnitude occurring by chance in this sample is less than 5%); "marginally statistically significant" for estimates that are not significant at the 95% level for a two-tail test, but are statistically significant at the 90% level (e.g., probability of result of this magnitude occurring by chance in this sample is less than 10% but more than 5%); and "close to being statistically significant" for estimates that have a probability of occurring by chance of more than 0.10 but less than 0.15.

All of these programs are imbedded in the same hypothetical future U.S. economy. As was assumed in my previous paper on the economic development effects of preschool (Bartik (2006a), and consistent with various research on long-term growth trends in the U.S. economy, both employment and population are assumed to grow at 0.3% annually, and real wages are assumed to grow at 1.2% annually. In addition, under the assumption that the main cost of running these programs is labor costs, the annual cost per participant of each program is assumed to increase with the real wage rate at 1.2% annually. The baseline size of the economy is derived by using 2006 figures from the Regional Economic Information System on total wage and salary employment in the U.S. (available at http://www.bea.gov/regional/spi/), and using 2004 figures from the Current Population Survey-Outgoing Rotation Group on average hourly wages, with both these figures updated to 2009 based on the assumed growth trends.

The actual calculations used treat the entire U.S. as if it is one state, with out-migration trends similar to the average U.S. state. The presented numbers then scale the employment and

earnings effects as a percentage of this imaginary U.S.-size "state," or calculate the present value of these effects relative to the present value of costs. These scaled effects will be accurate for the typical U.S. state.

All prices are arbitrarily measured in 2007 prices, with 2007 prices derived by using the Consumer Price Index-Research Series (available from the U.S. Bureau of Labor Statistics at http://www.bls.gov/cpi/cpiurs1978_2006.pdf), and assuming prices increased at the same rate from 2006 to 2007 that they did from 2005 to 2006.

All calculations are carried out in Excel spreadsheets. I first model the effects for one cohort and everyone affected by that cohort. I then model the effects on each subsequent cohort; these effects will be similar to the effects on the first cohort, but will occur later, and will be altered by increased population size, costs per person, and earnings effects as the U.S. economy grows over time. The effects of each program in a hypothetical state in a given year are the sum over all cohort members still alive and living in that state in that year.

To make the simulations manageable, simulations are explicitly carried out from 2009 until 2088, which is the year the original child participants in the Abecedarian and NFP programs are 79, and the original child participants in PCHP are 81. At this point, each program's effects have generally stabilized as a percentage of total employment and total earnings. Present value calculations use this stability to project forward the present value of earnings beyond 2088.

Each description of simulation procedures below considers for each program the following areas: participants and costs in a full-scale program; effects on moms and associated effects; effects on child participants and associated effects; total effects. For each program, the balanced budget multiplier effects of the program are estimated in the same way, by scaling the

effects found for universal preschool education in Bartik (2006a) by the pattern of spending for this particular program. Programs that are phased in over time are modeled by considering the spending for each phase separately, and adding together the effects of each phase.

For all three programs, simulations of effects on a given cohort of parents or former child participants use similar methods for measuring the number of surviving members of the cohort who remain in the state. Survival rates are measured using 2003 data from the National Center for Health Statistics on the expected survival rates of black men and black women from birth to age 79. (Excel spreadsheet versions of these data are available as Tables 8 and 9 at ftp://ftp.cdc.gov/pub/Health_Statistics/NCHS/Publications/NVSR/54_14/.) Survival rates for black men and women are used because these programs serve a disadvantaged clientele that in most cases is predominantly black.

The proportion that remain in the state is measured by using tabulations from the Public Use Microdata Samples of the 2000 Census on the proportions of individuals who live in their state of birth at various ages. Investigations in the previous study (Bartik 2006a), and some empirical work done for this study, suggest that changes in the proportion of individuals living in their birth state may provide reasonable estimates of out-migration of individuals from a given state at various ages. These investigations were based on comparing panel data evidence from the Panel Survey on Income Dynamics to data from the 2000 PUMS. I compared PSID estimates of the proportion of persons living in the same state at age x as at age y to ratios calculated from the 2000 PUMS for the proportion of persons living in their birth state at age x divided by the proportion of persons living in their birth state at age y.

For the mothers of program participants, I estimate the proportion of mothers remaining as of age *x* in the state in which the program was delivered as the ratio, measured using the 2000 PUMS, of the proportion of persons living in their birth state at age *x* to the proportion of persons living in their birth state at the mean age of program mothers at the onset of the program. For the former child participants, I estimate the proportion remaining as of age *x* in the state as the PUMS ratio of the proportion living in their birth state as of age *x* to the proportion living in their birth state when they entered the program (age 0 for Abecedarian, after birth for NFP, age 2 for PCHP).

For child participants, the PUMS proportions living in the birth state are measured using data on black men and women. The rationale is the same as using survival rates for blacks: these programs serve a disadvantaged clientele that in most cases is predominantly African-American. For the mothers of participants, the PUMS proportions living in their birth state is measured using data for black unmarried women. Data on black unmarried women are used because these programs generally serve children from single-parent families.

The estimated effects on the employment rates and earnings rates of former child participants, and of mothers of participants, are sometimes in part projected using estimated effects on educational attainment. For such estimates, I use pooled data from the Current Population SurveyBOutgoing Rotation Group from 2002 to 2006, with all wages measured in 2007 dollars. For former child participants, I calculate employment rates, wage rates, and average weekly hours for black males and black females for all ages from age 18 to age 79. For mothers of participants, I calculate employment rates, wage rates, and average weekly hours for black unmarried females for all ages from age 18 to age 79. Various educational breakdowns of

these groups are used depending upon what data on educational attainment are available for mothers or former child participants for a particular program. As was argued before, data on black men, black women, and black unmarried women provide a reasonable approximation to the groups that will be served by these three programs.

The initial measured CPS-ORG employment rates, wage rates, and average weekly hours are only measured using non-imputed data. For workers paid by the hour, I use hourly wages. For other workers, I measure wages as usual weekly earnings divided by usual weekly hours, where available. For workers whose usual weekly hours vary, I use actual weekly hours the previous week. For workers whose usual weekly earnings are top-coded, earnings are estimated by multiplying the top-code by 1.4. Wage observations are treated as outliers and dropped if the real wage is less than $2 per hour or more than $200 per hour in 2004 dollars, deflated using the Consumer Price Index research series produced by the U.S. Bureau of Labor Statistics. (As the reader might suspect, I have processed such data using identical procedures for previous projects.)

Using these data, I first calculate weighted means using person weights for average employment rates, wage rates, and weekly hours for all ages from 18 to 79 for these groups (black men, black women, and black unmarried women, broken down by various measures of educational attainment that vary by program). To smooth the changes in these variables with age, I do a set of regressions in which the initial estimates for each variable and group are regressed on a quartic in age. The fitted values from these regressions, which change smoothly with age, are then used to estimate how changes in educational attainment will change employment rates, wage rates, and weekly work hours (and hence earnings) over time.

ABECEDARIAN PROGRAM

Scale

The simulations use assumptions from Ludwig and Sawhill (2007) about the national number of participants in an appropriately targeted Abecedarian program, the gross annual cost of the program per participant in 2007 dollars, and the net annual costs after allowing for reduced costs for other day care program. Their assumptions are that an Abecedarian program would have 615,000 national participants in 2007, cost $16,600 in 2007 dollars per participant per year, and would have 21.6% of its gross costs offset by reductions in spending on other child care and preschool programs. The Abecedarian program provides free high-quality child care from birth to age 5. The resulting program has a gross present value for the initial 2009 cohort of $50.7 billion (in 2007 dollars), and a net present value of $39.8 billion. These net costs per cohort are over twice those of the universal preschool program modeled in Bartik (2006a). These costs grow over time for subsequent cohorts based on assumed trends in population growth and real wage growth.

Effects of Free High-Quality Child Care for First Five Years on Employment Rates and Earnings of Mothers, and Subsequent Effects on a State Economy

I initially approximate the employment rate and earnings effects per mother using the research evidence on the effects of free child care and increased education of mothers. I then refine these estimates using direct evidence from the Abecedarian Program on the employment rate and earnings effects of mothers at different points in time.

Based on research on the effects of child care prices on mothers' labor supply (Blau 2001; Blau and Hagy 1998; Anderson and Levine 2000; this evidence is reviewed by Bartik 2006a, p.41 and footnote 18), I initially assume free child care will increase employment rates by 0.20 during the five year life of the program. In addition, I project changes in employment rates and earnings rates based on Abecedarian program information that postsecondary education of mothers increases due to the program, with an eventual increase 15 years after the program began from 34% attending post-secondary among the control group to 52% for the treatment group (Ramey et al. 2000). (This difference is almost but not quite statistically significant at normal significance levels, with a t-statistic for the difference of 1.66, and a probability of 0.102.) I do initial estimates of how this postsecondary education increase will affect employment rates, wage rates and weekly work hours of mothers using CPS-ORG data on how the employment rates, wage rates, and weekly work hours of black unmarried mothers differ between those with and without some postsecondary education, as outlined above. For these simulations, I assume all the mothers have the program mean initial age of 20.

However, this initial increase in employment experience due to the free child care should increase subsequent employment and wage rates of the mothers. To measure this increment to employment rates, I use information from the program research (Ramey et al. 2000) that the employment rate of moms after 15 years increased by 10 points, which is 6.4 points greater than predicted by their increase in educational attainment. (This difference of 10 points is statistically insignificant at conventional levels, with a t-statistic of 1.11 and a probability of 0.274). I assume this extra employment rate increment applies throughout the work career of these women. This is not an unreasonable increase in work given that the program's effects on child care increased

their initial employment rate by 20 points for five consecutive years, and previous research suggests substantial persistent effects of employment experience on subsequent work, particularly on low-income workers (Bartik 2001).

To measure the increment in wage rates, I see what additional increase in wage rates would be needed to match the earnings increases for mothers 21 years after program start that are reported in Masse (2002, p. 208; the reported probability level is 0.06). It turns out that these earnings increases can be matched if we assume that the extra work experience, beyond what is predicted by education, has an effect on the log of wage of 0.0274 per year of work experience for the first 10 years of work experience. Because these women obtain a little more than a year of additional work experience from age 20 to age 29, the natural log of their wage eventually is assumed to increase by 0.0343 beyond what would be predicted based on their increase in post-secondary education alone. This return to work experience is not unusually high. The research of Gladden and Taber (2000) suggests a return to actual work experience of black women during their early careers of an increase of 0.0535 in the ln(wage) per year of work experience.

The number of mothers affected by this intervention will be less than the number of child participants, as a full-fledged Abecedarian program will have multiple children ages 0–4 per mother. Calculations I made from the CPS-ORG suggest that among unmarried black mothers with any child less than age 5, the mean number of children less than age 5 is 1.27. The initial number of mothers in the state goes down over time due to mortality and outmigration, and these declines are modeled as described in the introduction.

Using these calculations, the gross effect on the number of jobs in a state is derived by multiplying the numbers of mothers who will survive and stay in the state by the employment

rate effect per mother. The gross effect on earnings in the state is derived by multiplying the number of mothers staying in the state by the annual earnings effect per mother, which in turn is calculated based on effects on employment rates, wage rates, and weekly hours per mother. These initial gross effects are then adjusted to account for displacement. I assume, based on Bartik (2001) that the labor market is such that a shock that increases labor supply will have one-third of its effect offset by displacement of other workers from jobs; in other words, the net effect on total state employment and earnings is only two-thirds of the gross effect for the mothers.

As with my previous study of the economic development effects of preschool, I also allow for spillover effects of increases in the percentage of college graduates in a state on the state's employment growth and wage rates. The magnitude of these effects is discussed in Bartik (2006a), and is based on the research of Glaeser and Saiz (2003) and Moretti (2003). Based on my tabulations of CPS-ORG data on black unmarried women ages 25 and over, I assume that 36.2% of the additional women who get some postsecondary education due to the Abecedarian program will eventually get a BA. The number of additional college graduates per cohort due to the Abecedarian program's effects on mothers ends up being calculated to be 1.61 times the number of additional college graduates per cohort in the preschool program considered in Bartik (2006a). However, these additional college graduates will be added to the state economy about 20 years earlier, as the college graduates stem from effects on mothers rather than child participants. Therefore, I calculate the social spillover effects due to Abecedarian mothers getting college degrees as being 1.61 times the 20 years later social spillover effects estimated in Bartik (2006a).

Effects of Five Years of High Quality Child Care on Child Participants' Adulthood Employment Rates and Earnings, and Associated Effects on State Economy

I seek to model effects on the employment rates and earnings of former child participants in the Abecedarian program when they are ages 19 to 79 (labor supply effects prior to age 19 or after age 79 are ignored). I use both estimated effects of this program on educational attainment and directly measured effects on employment rates.

I use data from Masse's (2002) dissertation to turn observed Abecedarian program effects on education as of age 21 to effects on the final educational attainment of males and females. (My chi-squared tests using the Masse data show that the estimated differences between the educational distribution of the program versus control group of women have a probability of 0.103, which is almost but not quite statistically significantly different at normal levels of statistical significance. Chi-squared tests show that the differences between the educational distribution of program versus control group men have a probability of 0.208, which is not statistically significant at normal levels of statistical significance. On the other hand, some of the educational attainment distributions do differ significantly between the program and control group. For example, the proportion enrolled in BA programs at age 21 is statistically significantly higher for women in the program group than in the control group, with a t-statistic of 2.21 and a probability of 0.034. The proportion of men enrolled in BA programs at age 21 is marginally statistically significantly higher for men in the program than men in the control group, with a t-statistic of 1.92 and a probability of 0.061.) I initially assume that the program's effects on educational attainment will be translated into effects on employment rates and earnings by using tabulations from the CPS-ORG on how employment rates, wage rates and weekly hours of black men and women vary with educational attainment for each year of age

from ages 19 to 79, as outlined in the Appendix introduction. For ages 19 through 22, I only use the Abecedarian program's effects on high school dropouts versus high school graduates or higher to infer initial effects on employment rates, wages, and weekly hours. For ages 23 through 79, I define educational attainment based on the four mutually exclusive and exhaustive categories of high school dropout, high school graduate but no higher degree, AA degree but no higher degree, and BA degree or higher degree.

However, based on Campbell et al.'s (2002) research on age 21 effects of the Abecedarian program, it appears that the program's effects on employment rates of participants at age 21 are about 12 rate points higher than would be predicted based on the program's effects on educational attainment. (The observed employment rate differences at age 31 have a t-statistic of 1.46, which has a probability of 0.147, which is close to but not quite statistically significant at normal significance levels. However, the proportion of program individuals employed in more skilled jobs, out of the total program sample, is significantly greater than the proportion of individuals in the control group holding skilled jobs, with a t-statistic of 2.53 and a probability of 0.0126.) This result is consistent with previous research on the Perry Preschool program that shows that this program has much greater effects on employment rates than would be predicted by only looking at effects on educational attainment (see discussion in Bartik 2006a, p. 48 and Table 11). Based on the Perry Preschool results, I assume that the Abecedarian program's "extra employment rate effect" of 12 points diminishes to 6 points by age 27. After age 27, the extra employment rate effect is assumed to be the same percentage of the control group mean employment rate as it is at age 27.

The estimated effects on gross employment and earnings of former child participants in Abecedarian is then modeled by multiplying the employment rate effects and earnings effects per participant by the estimated number of participants surviving and staying in the state. These gross estimates are then modified to allow for peer effects during school and displacement effects in the labor market. I assume that the increase in the quantity and quality of labor supply effects of on child participants in the Abecedarian program corresponds to a similar sized increase in their performance during school. As described in Bartik (2006a, pp. 52–55), such peer effects are estimated, based on research on school production functions by Hanushek et al. (2003) and Hoxby (2000), to be 0.54 times as great as the effects on the child participants. I assume that these peer effects in school will correspond to similar sized increases in the labor supply quantity and quality of peers during adulthood. This means that the gross effects on the employment and earnings of former child participants in the Abecedarian program must be multiplied by 1.54 to include extra employment and earnings of peers.

However, these gross effects on former child participants and peers will also result in some displacement in the labor market. As described above and in Bartik (2006a), I assume that because of displacement, the net effects on employment rates and earnings rates in the state labor market will only be two-thirds of the gross effects. Peer effects and displacement effects roughly offset each other, which is happenstance rather than an inevitability.

Finally, I also allow for social spillover effects of the increasing number of former child participants who are college graduates, and the effects of a higher percentage college graduates on state economic growth. Based on the numbers, the estimated effect of the Abecedarian program on the number of former child participants who become college graduates is about 3.9

times the effects of the universal preschool program considered in Bartik (2006a) on college graduates. (Why is there such a large differential? The Abecedarian program's effects on college graduates is relatively high, and the Perry Preschool program's effects on college graduates is surprisingly low given its effects on high school graduates. Furthermore, the universal program modeled in Bartik (2006a) is assumed to have only half the impact on high risk participants as was true for Perry, based on the CPC program's lower effects than Perry. Finally, the effects per universal participant are assumed to be only 23% of the effects on high risk participants.) Therefore, this social spillover effect is modeled by simply multiplying the spillover effects estimated in Bartik by 3.9.

Total Effects

The total effects on the state economy associated with each yearly cohort of a full-scale Abecedarian program are then calculated by summing for each year these three categories of effects: balanced budget multiplier effects, effects on mothers of participants, effects on former child participants. The effects for an ongoing program are then calculated for each year by summing effects over all cohorts in the state. These calculations allow for population growth and real wage growth over time.

The resulting effects on jobs creation and earnings creation, as a percentage of the state economy, are shown in Tables C1 and C2, for each year from 2009 to 2088 for a full-scale Abecedarian program begun in 2009 and continued at full scale for the next 79 years. Table C2 also includes the present value of earnings per present value dollar of net program costs. All these tables break down the Abecedarian program's effects into these three categories of

balanced budget effects, effects via effects on mothers, and effects via effects on former child participants. The estimated present value effects per dollar of costs are somewhat less than the benefit cost ratios reported in Barnett and Masse (2007). This is in part because their analysis is a complete benefit cost evaluation counting benefits other than earnings effects. In addition, there are numerous detailed differences in assumptions about earnings effects, how earnings evolve over time, etc.

NURSE FAMILY PARTNERSHIP PROGRAM (NFP PROGRAM)

Scale

My estimates of the size and costs of a full-scale NFP program are based on Isaacs (2007). She estimates that a full-scale NFP program would have had 367,000 participants in 2004, based on the assumption that there would have been 75% participation in the program among first-time mothers with family income below 185% of the poverty line. She also reports estimates that imply that the costs in 2007 dollars of the NFP program would be $10,189 per participant. These program costs are divided among three years. I assume that the annual costs are one-third of the total costs (the first year is the half year before the birth, but the number of visits per month is higher then, and presumably the program has some set-up costs). Using these numbers, I project that in 2007 dollars a NFP program would have a total present value of costs for an annual cohort starting in 2009 of $3.7 billion. These costs are less than one-tenth of the net costs per cohort of a full-scale Abecedarian program, and about one-fifth of the costs of a universal preschool program.

Effects of 2.5 Years of Nurse Visiting on Employment and Earnings of Mothers, and Associated Effects

The effects of the NFP Program have been studied in three different experimental studies of the program, first in Elmira, then in Memphis and Denver. For effects on employment and earnings of mothers, I largely rely on the results from Memphis and Denver. This is important as the effects on mothers' employment appear to be larger at the Elmira site than at the Memphis and Denver sites. Where the Memphis and Denver results overlap, average effects across these two sites are used. (The Elmira results that are most relevant to this paper are in Olds et al. 1997 and Olds et al. 1998. The Memphis results that are most relevant to this paper are in Kitzman et al. 2000, and Olds et al. 2004a. The Denver results that are most relevant to this paper are in Olds et al. 2004b.)

In examining effects on mothers' employment and earnings, I choose to rely more on the Denver and Memphis results than on the Elmira results because the Elmira program took place prior to welfare reform in a state with relatively liberal welfare laws. Because it is thought that some of the effects of the NFP program take place because the program reduces subsequent pregnancies, which in turn may affect welfare usage and employment incentives, the effects of the program on mothers' employment are likely to differ greatly pre- and post-welfare reform. Estimated effects per mother are based both on effects of the program on educational attainment, and direct measures of effects on mothers' employment rates. Based on Memphis and Denver results, on average the NFP Program has slight effects on educational attainment, increasing the high school graduation rate by 3.25 points from 71% to 74.25%.(Neither estimated change in the graduation rate is close to being statistically significant, with the Memphis results in Olds et al. 2004a, having a probability of 0.54, and the Denver results in Olds et al. 2004b, having a

probability of 0.35). These effects on educational attainment, along with data from the CPS-ORG, are used to make an initial estimate of the effects of the NFP Program on the employment rate, wage rate and weekly hours of NFP mothers for all ages from age 19 to age 79. (I assume that all NFP mothers are age 19, which is the average age of NFP mothers at program onset across the three study sites.)

In addition, the information from these three studies suggests that the NFP program may have some extra effects on employment rates of NFP mothers above and beyond the effects predicted by the program's small effects on educational attainment. Memphis (Kitzman et al. 2000) and Denver (Olds et al. 2004a) results suggest an increase of 1 month in employment during the period from 24 months to 48 months after the child's birth. (These increments in employment are both statistically insignificant, with the Denver employment differences between program and control groups having a probability of 0.22, and the Memphis employment differences having a probability of 0.24.) The Elmira results (Olds et al. 1997) suggest an additional 16 months of employment during the period from birth up to the child's 15th birthday; the Memphis data (Olds et al. 2004a) suggest no such long-run effect. (For the Elmira results, I focus on the results for the low-SES unmarried sample, which is similar in its composition to program participants at the Memphis and Denver sites, and is similar to the group targeted in the full-scale program considered in the current paper. The reported confidence interval suggests a probability of 0.13, which is close to being marginally statistically significant.)

Based on the Memphis and Denver results, I assume that the mother's employment rate increase by 1/24 = 0.043 when the child is ages 2 and 3. At age 4 and beyond, I assume no subsequent boost to employment beyond what would be predicted based on the change in

education. This discounts the Elmira results, because they are contradicted by the Memphis results. I allow for the extra employment experience at ages 2 and 3 to increase the mother's subsequent wages. I assume that an extra year of actual work experience increases the natural log of subsequent wages by 0.0274, which is what was derived above for the mothers in the Abecedarian program. This appears to be a conservative estimate of likely returns to actual experience.

Gross effects of the NFP program on the total employment and earnings of NFP mothers who stay in the state are calculated for each cohort by multiplying the employment rate effects and earnings effects per NFP mother times the estimated number of remaining NFP mothers. Total gross effects are then summed over all cohorts. Net effects are derived by assuming a displacement effect of one-third, which means net effects on state employment and earning are two-thirds of the gross effects.

Finally, we calculate social spillover effects of the extra education of NFP mothers. Based on the proportion of black women ages 25 and over who have a high school degree, versus the proportion who have a BA degree, I assume that about one-fourth of black women who obtain a high school degree will obtain a BA degree (Digest of Education Statistics, 2006, Table 8, available at http://nces.ed.gov/programs/digest/d06/tables/dt06_008.asp). Therefore, about one-fourth of the extra 3.25 percent of NFP mothers who obtain a high school degree because of the NFP program are assumed to obtain a BA degree. The resulting estimates suggest that the NFP program will increase the number of NFP mothers per cohort who are college graduates by about 0.14 times the effects per cohort on college graduates of the preschool program considered in Bartik (2006a). However, these effects occur about 20 years earlier, as these effects are for

mothers rather than former child participants. Therefore these spillover effects are calculated by multiplying the spillover effects of 20 years later in Bartik (2006a) by 0.14.

Effects of Nurse Visiting on Employment and Earnings of Former Child Participants, and Associated Effects

Studies of the NFP program have had little data on the later employment and earnings of former NFP children. Two types of data allow some projection of future effects on employment and earnings of former child participants. The first type of data is estimates of how the NFP Memphis program affected reading and math scores at age 6. The second type of data is estimates from the NFP Elmira program on how the NFP program affected children=s arrests and other criminal activity through age 15.

The estimated effects of the NFP Memphis program on age 6 reading and math scores are positive but statistically insignificant. (The study by the Washington State Institute for Public Policy of NFP cited significant effects of NFP on test scores (Aos et al. 2004). But these significant test score results are for a mental processing composite test, and for a receptive vocabulary test. Unlike reading and math test scores, these other types of tests have not been directly linked to adult employment and earnings.). A study by Currie and Thomas (1999), using British data, links reading and test scores at age 7 to male and female employment rates and wage rates at ages 23 and 33. (Krueger (2003) provides helpful advice on interpreting the Currie and Thomas results in terms of the effects of a given change in test scores measured in effect size units.) Combining the NFP Memphis results with the Currie and Thomas study allows us to estimate the effects of the NFP program on employment rates and wage rates when former child participants are ages 23 and 33. The employment rate effects and wage rate effects in between

ages 23 and 33 are interpolated from these results. Effects before age 23 are assumed to be zero. Effects from ages 34 to 79 for employment rates are assumed to be the same percent of the control group mean that they are at age 33.

I add to these estimated employment rate effects my projections of how the program's estimated effects on arrests and other criminal behavior will affect future employment rates and hence also earnings. The NFP Elmira program appears to have reduced the proportion of former NFP child participants being arrested from 0.45 to 0.20, a reduction of 55.6%. (Olds et al. 1998, Table 3, p. 1242; these effects are significant at a probability level of 0.03.) (These estimated effects are for the low socioeconomic status unmarried NFP families in Elmira. Effects are somewhat lower for the entire Elmira NFP sample, at a reduction from 0.36 to 0.17, or 53%. As the NFP program has evolved, the program design increasingly has moved towards targeting more disadvantaged groups such as the low SES unmarried families in Elmira, and the Denver and Memphis sites attempted to implement more stringent targeting. Hence, the NFP program being simulated in the current paper is this targeted version of NFP, which means that the estimates should rely on results for the more disadvantaged group in Elmira.)

I use data from Raphael and Stoll (2007) to estimate the proportion of the disadvantaged males and females targeted by the NFP program that will be in jail or prison at different ages. (I use their Table 7 figures on black males, under the assumption that the disadvantaged group's experience with jail and prison will more closely match black males than it will other racial groups. I interpolate and extrapolate using the data they give on imprisonment for different age ranges. I use their information in Figure 29 and 30 to infer imprisonment rates for black females.) I use information from Bonczar (2003) on the cumulative proportion of the black male

or black female population that has been incarcerated at various ages as an estimate of the cumulative incarceration experience rates of the NFP targeted groups. I assume that the results through age 15 of a reduction in arrests of 55.6% will persist into adulthood, but at a reduced rate of a reduction of half as much in percentage terms. Therefore, I assume that imprisonment at any point in time and cumulative incarceration experience is reduced due to the NFP program by 27.8% (= half of 55.6%).

The NFP program's assumed reduction in imprisonment at a particular age will increase the employment rate by the proportion of individuals who are not in prison because of the NFP intervention at that age, times the normal employment rate for that age and gender. The NFP program's assumed reduction in cumulative incarceration experience will increase the employment rate if prior incarceration experience reduces employment probabilities, due to employers discriminating against former inmates, or simply because prior incarceration experience is an indicator of other problems with the individual's broadly defined skills. According to Holzer et al. (2005), prior incarceration experience probably reduces employment population ratios by somewhere in the range of 0.10 to 0.25. I use a midpoint value of 0.175, and I assume that such a midpoint effect applies to males age 40. Effects at other ages are restricted to be the same percentage of the control group employment rate that is true for males age 40; this allows employment effects of prior incarceration to decline in absolute terms as individuals age and leave the workforce. These employment rate effects of the NFP program due to reduced crime in turn imply effects of the NFP program on increasing earnings.

Gross effects of the NFP program on the employment and earnings of former NFP child participants for each cohort are calculated by multiplying the total number of former child

participants by age on the employment rate and earning effects by age. Total gross effects for all cohorts in a given year are calculated by summing effects across all cohorts for that year. As was done for child participants in the Abecedarian program and universal preschool, these gross numbers are then adjusted for peer effects by multiplying by 1.54, and adjusted for displacement by multiplying the results by 2/3rds. Social spillover effects of extra college graduates among the former child participants are not considered, as there is no quantitative basis for any estimates of the extra college graduates among these former child participants.

Total Effects of NFP Program on State Employment and Earnings

Tables C3 and C4 show the total estimated effects of the NFP program on state employment and earnings by year, from 2009 to 2088, as a percentage of state employment and earnings, for an ongoing full-scale NFP program started in 2009. Table C4 also includes calculations of the present value of these earnings effects as a ratio to the present value of the NFP program's costs.

Overall, the estimated effects of the NFP program, per dollar of spending, are somewhat smaller than for the Abecedarian program. The effects are similar for former child participants, but somewhat smaller for NFP mothers. This is largely because we discount the Elmira results for the increased employment of mothers. If I assume that the employment rate effects observed in Elmira for NFP mothers from birth of the first child to the child's 15th birthday would occur for a full-scale program, and would persist, then the ratio of present value of earnings effects per dollar of present value costs increases from 1.85 to over 5.

The results are also somewhat smaller than the more complete benefit cost analyses of NFP in Karoly et al. (1998) and Aos et al. (2004). This is in part because these previous studies consider a broader range of benefits than just earnings effects. It is also in part due to a combination of different assumptions in these studies. Karoly et al. rely on results from Elmira, which yielded much larger and more persistent effects on mothers' employment. Aos et al. used other test score results to infer larger earnings effects for former NFP child participants. On the other hand, only the current study uses the NFP estimated effects on crime to infer effects on employment rates.

PARENT-CHILD HOME PROGRAM (PCHP)

Scale

I use estimates from Dickens and Baschnagel (2007) to project the scale of the PCHP program. Dickens and Baschnagel estimate that the PCHP targeting criteria would identify 5.5% of all 2-year-olds as eligible for the program. This implies that a full-scale national implementation of PCHP would serve around 228,000 2-year-olds in 2009. Dickens and Baschnagel also estimate that the program costs $2,250 per year per participant. PCHP is a two-year program that serves 2- and 3-year-olds. Based on these numbers, a full scale national implementation of PCHP would have a present value cost for the 2009 entering cohort of about $1.0 billion. This is about one-fourth of the cost per cohort of a full-scale NFP program, and is minuscule compared to a full-scale Abecedarian program or universal preschool.

Effects on PCHP Mothers?

There are no available estimates of the effects of PCHP on PCHP mothers.

Effects on Employment and Earnings of Former PCHP Child Participants

Only one study provides direct evidence that is relevant to the effects of PCHP on the adult employment and earnings of former PCHP participants (Levenstein et al., 1998). This study compares the educational status of a treatment group of 108 former child participants, and a control group of 15 students, at a time when all these students should have graduated from high school if these students made normal grade-to-grade progress.

The estimates reveal some differences between educational attainment in the treatment vs. control groups. However, whether these estimates are statistically significant depend upon the particular educational variables and samples one focuses on. The proportion of graduates in the two groups is marginally statistically significantly different. 74% (80 out of 108) in the treatment group have graduated on time, versus 47% (7 out of 15) of the control group; this difference has a t-statistic of 2.02, which has a two-tailed probability of 0.06, which is marginally statistically significant. On the other hand, the difference in the proportion of dropouts is statistically insignificant at conventional levels (22% = 24/108 vs. 40% = 6/15 has a t-stat of 1.34 and a two-tailed probability of 0.197). (The remaining four students in the treatment group and two students in the control group are still enrolled in high school.) Finally, for the estimates that have baseline IQ measured (13 of the 15 students in the control group, and 98 of the 108 students in the treatment group, with the 10 treatment group members who have missing baseline IQ being students who participated in PCHP for less than one year), baseline IQ appears to be higher in

the treatment group. After controlling for baseline IQ, differences in dropout rates and completion rates are only statistically significant at the 0.28 level.

For this study, I use all the available data because of limited sample size, and because there is no strong reason to think that the estimates not controlling for IQ are biased. Other variables could also differ between the two samples, and we do not know what IQ levels are for the unmeasured cases. In fact, there is reason to think that the "missing IQ data" cases for the treatment group, all of whom were children who participated in PCHP for less than one year, have lower baseline IQs than the other children in the treatment group. We do know that the baseline IQs of treatment group children who participated in PCHP for only one year were statistically significantly lower than baseline IQs for treatment group children who participated in PCHP for two years. In addition, I focus on completion rates as of normal high school graduation and how they relate to final high school completion status. The available evidence suggests that many students who do not complete high school on time, whether dropouts or still in school, eventually get either a diploma or a GED (Mishel and Roy 2006). There is some evidence that GED completion is not as valuable in the labor market as a high school diploma. However, the CPS-ORG data that I use to determine the value of educational attainment combines both a high school diploma and GED completion as a high school degree. Therefore, the estimated value of obtaining a high school degree in the CPS-ORG data implicitly is the average value of obtaining a high school diploma or GED, and we should count the attainment of either credential to match these data.

Based on data from Mishel and Roy (2006, Table 1, p. 17) on black students, I assume that 67.4% of former PCHP children who do not complete high school on time will eventually

get a high school diploma or GED. The result is an estimate that the PCHP increases eventual high school completion from 82.6% to 91.5% (91.5 = (80 + (0.674 * 28)) / 108; 82.6% = (7 + (0.674 * 8)) / 15)). These estimates of the program's effects on high school completion, together with CPS-ORG info, are used to estimate how PCHP will affect employment rates and wage rates for former child participants for all ages from 19 to 79. Differentials before age 19 or after age 79 are assumed to be zero.

As described in the Appendix introduction, the number of PCHP participants for a full scale program who survive and stay in the state are estimated based on NCHS survival data on blacks and PUMS data on the proportion of blacks at various ages that live in their state of birth. Gross employment and earnings effects at each age for each cohort are calculated by multiplying the estimated number of PCHP participants remaining in the state times the estimated employment rate and earnings rate differentials for that age. Total gross effects for the state in a given year are calculated by summing effects for all cohorts in that year. Gross effects are adjusted for peer effects and displacement effects in a similar manner to what was done with the Abecedarian program and the NFP program.

Finally, social spillover effects are estimated by using observed patterns from the Digest of Education Statistics that about one-quarter of black high school completers eventually get a BA. (Digest of Education Statistics, 2006, Table 8, available at http://nces.ed.gov/programs/digest/d06/tables/dt06_008.asp). The resulting calculations suggest that the number of additional college graduates from PCHP is about one-fifth of the number from a universal preschool program. This proportionate factor is used to calculate social spillover effects from the extra college graduates resulting from PCHP.

Total

Tables C5 and C6 report annual jobs and earnings effects of PCHP as a percentage of the state economy. Table C6 also reports the present value of PCHP earnings effects as a ratio to the present value of PCHP costs. PCHP has a highly favorable earnings to cost ratio because it is so cheap. Even a high school graduation rate effect of less than 10 rate points is more than enough to generate earnings effects that far exceed the program's costs.

EARNINGS EFFECTS AND EARNINGS EFFECTS TO COST RATIOS IF UNIVERSAL PRESCHOOL AND A FULL-SCALE ABECEDARIAN PROGRAM ARE BOTH ADOPTED

I also consider how the total effects and incremental effects of the Abecedarian program and universal preschool change if both programs are simultaneously adopted. Under this combination program, the 15% of all children who the Abecedarian program considers to be disadvantaged would be enrolled from ages 0–5 in a high-quality child care and preschool experience that would be full-day and full-year for those five years. Another 55% of all children would be enrolled at age 4 in a high-quality preschool program for half the day and half the school year.

If a full-scale Abecedarian program is adopted, this will change the earnings effects to cost ratio for universal preschool for two reasons. First, the net earnings per child effect of universal preschool will change because universal preschool=s incremental services are now targeted as a more advantaged clientele. Second, net costs per child of universal preschool will change because of reduced offsets from existing programs.

For benefits, I assume that the Abecedarian program serves 15% of all 4-year-olds, and all of those are in the group classified as high risk in Table 7 in Bartik (2006a). The universal preschool program was originally assumed to serve high risk children who constitute 18% of all 4-year-olds. I assume that the remaining 3% of all 4-year-olds who are high risk and served by the universal preschool program, and not the Abecedarian program, fall into the following categories in Table 7: 1% in the group that would otherwise not be in any preschool program; 2% in the group that would otherwise be in a lower-cost public preschool program.

Based on these assumptions, we discover that the incremental effects of this new universal preschool program are 13.2% of the benefits per child of a preschool program targeted at high-risk children who otherwise would not have been in any preschool program. The universal preschool program as originally modeled in Bartik (2006a) had benefits equal to 23% of such a perfectly targeted preschool program. Therefore, the incremental benefits of adding this preschool program to the Abecedarian program are 0.132 / 0.23 = 0.5739 of the original earnings benefits.

These calculated incremental benefits reduce the portion of the originally calculated benefits that accrue to former child participants, either through direct labor supply effects or through the social benefits of more college graduates. I assume no additional child care benefits from a universal preschool program, once an Abecedarian program is in place. Finally, the balanced budget multiplier or spending benefits of an incremental universal preschool program should still be the same per dollar spent.

For net costs, if we look at how Table 7 in Bartik (2006a) is modified by considering universal preschool as an add-on to the Abecedarian program, we can no longer consider the cost

savings in universal preschool for the high risk students (10% of all 4-year-olds) served by the Abecedarian program who otherwise would be in a public preschool. These cost savings have already been counted in calculating net costs for the Abecedarian program. But of the 55% of all 4-year-olds who still are added to preschool enrollment by a universal preschool program, 23% of all 4-year-olds would still have been in some public preschool program (see Table 7). Therefore, the net costs per student of adding universal preschool as an incremental program to the Abecedarian program will be, in 2004 dollars, $5,856 (gross costs) − (23/55) × $3,441 (assumed cost of public preschool) = $4,417. This is analogous to the net cost calculation made in Table 2 of Bartik (2006a). Therefore, costs per child of universal preschool as an increment to the Abecedarian program will be higher by a factor of 1.0432 = 4,417 / 4,234, where $4,234 was the net cost in 2004 dollars in Table 2 of Bartik (2006a).

Therefore, from the state perspective, the earnings effects per dollar spent become: 0.04 (spending effects) + 0.5739(2.65 (child labor supply benefits) + 0.04 (college grad spillovers)) / 1.0432 = 1.52. A similar calculation from a national perspective gives 0.04 + 0.5739(3.66 + 0.04) / 1.0432 = 2.08.

To be consistent, these calculations also imply an earnings benefits per dollar spent for the Abecedarian program, assuming universal preschool is already in place. Allowing for the overlap in services, the incremental net costs of universal preschool are equal to the ratio of 55% of all 4-year-olds served to 70% of all 4-year-olds served, times the higher net cost per child of serving these non-disadvantaged 4-year-olds, or 1.0432, which equals 0.8196 = (55 / 70) * 1.0432. Based on the present value per cohort figures in the current report's Table 8, the total costs of the two programs taken together will be, in relationship to the cost of the Abecedarian

program alone, equal to 1.368 = (17.87 (0.8196) + 39.75) / 39.75. Therefore, if the Abecedarian program is considered to take place first, the cost shares of the Abecedarian program and the universal program conditional on the Abecedarian program, are 0.73 (= 1 / 1.368) and 0.27 (= 0.368 / 1.368). Similarly, the cost shares of the universal program, followed by the incremental cost of the Abecedarian program, are 0.33 = 17.87 / 1.368 * 39.75 and 0.67.

We know that the present value of both programs taken together in relation to costs are given by the following equation: PV earn total / PV cost total = (Cost share of Abecedarian program by itself) * (PV of earn to cost ratio of Abecedarian program by itself) + (Cost share of universal preschool added to Abecedarian program) * (PV of earn to cost ratio of universal preschool added to Abecedarian program). We can also express the total PV of earnings to cost ratio when the Abecedarian program is considered to be the incremental program: PV earn total / PV cost total = (Cost share of universal preschool by itself) * (PV of earn to cost ratio of universal program by itself) + (Cost share of universal preschool added to Abecedarian program) * (PV of earn to cost ratio of universal preschool added to Abecedarian program). Using these equations, and the numbers given in Table 2 of the current paper, we get that the overall present value of earnings to cost ratio for both programs taken together, is 2.05 from a state perspective, and 2.78 from a national perspective. Furthermore, the implied incremental earnings to cost ratio for the Abecedarian program, conditional on universal preschool already existing, is 1.69 from a state perspective, and 2.28 from a national perspective.

I also estimate the long-run effects on the national economy in 2088 if both the Abecedarian program and universal preschool are implemented together. The incremental effects of either program conditional on the other can then be derived by comparing the total effects

with the program taken by itself. To do these estimates, I take the long-run national percentage impacts on jobs and earnings for universal preschool that were originally estimated in Bartik (2006a). To calculate the incremental effect of universal preschool conditional on the Abecedarian program already being in place, the portion of universal preschool's effects associated with former child participants are assumed to be multiplied by (55/70) to account for the lower number of incremental participants in universal preschool, and by 0.5739 to account for the lower benefits per child. In addition, the portion of universal preschool's effects associated with child care benefits is assumed to be zero. These incremental effects of universal preschool are then added to the effects of the Abecedarian program to get total effects of the two programs when implemented together. In addition, the cost estimates for universal preschool as an incremental program are assumed to be equal to the originally estimated costs of universal preschool as a standalone program, times the higher cost per child of 1.0432, times the ratio of incremental participants to stand-alone participants of 55/70. These incremental costs of universal preschool are then added to the standalone costs of the Abecedarian program to get the total costs of the two programs when implemented together.

Appendix D
Alternative Assumptions About Discount Rates

The calculations of the present value of earnings effects of these programs, relative to the present value of program costs, use a 3% real discount rate. This discount rate is commonly used in benefit-cost analysis. However, there is wide controversy over appropriate discount rates.[40] Obviously, this report cannot settle this controversy. However, we can consider how the results change when we consider discount rates that have been prominently advocated.

These programs are assumed to be financed by taxes rather than borrowing. Therefore, these projects will displace current consumption rather than investment. The appropriate discount rate should therefore be some rate of interest appropriate for discounting consumption flows rather than investment flows.

The most commonly used equation for deriving appropriate discount rates for discounting future flows of consumption is the well-known Ramsey equation:

$$r = d + ge$$

where r is the social discount rate, g is the assumed annual growth rate of per capita consumption, e is the elasticity of personal utility with respect to per capita consumption, and d is the assumed annual discount rate for future utility (sometimes called the pure rate of time preference). The basic idea is that we should discount the future more heavily either because we have an inherent preference for the present over the future, or because the future will be

[40] For example, consider the recent controversy over the appropriate discount rate to use in analyzing policy towards global climate change, as exemplified by the debate over the Stern Report (2007), by Nordhaus (2007), Weitzman (2007), Quiggin (2006), and others.

wealthier, and a dollar of real per capita consumption to the richer future should be valued as having a lower social value than a dollar of real per capita consumption in the poorer present.[41]

Whatever we assume about the parameters *d* (the rate of pure time preference) and *e* (the elasticity of marginal utility with respect to per capita consumption), we must choose *g* to be consistent with the model used in this report. This report assumes that real wages will increase by 1.2% per year. It is the difference between this assumed growth rate of wages and the social discount rate that mainly affects the present value calculations. It would be inconsistent to use a social discount rate that used rates of growth of per capita consumption other than 1.2% without also altering the rate of wage growth assumed in the model's calculations.[42]

There are a variety of perspectives for appropriate values of *d* and *e*. The Stern report assumed values for *d* of 0.1 and for *e* of 1. The low value of *d* rests on the notion that there is no reason that increases in utility in the future should be valued differently from increases in utility today. The value of *e* of 1 corresponds to assuming that a given percentage change in per capita consumption has the same effect on utility for all persons at all times. The Stern report therefore implies a social discount rate for future consumption of 1.3%.

[41] This is the appropriate risk-free discount rate, but models of the appropriate discount rate do not show that a large amount should be added for risk (Weitzman 2007). Furthermore, even if we assume that a large amount should be added for risk, based on the discrepancy between real interest rates on government bonds and rates of return to equities, if program benefits are only moderately correlated with per capita consumption, the rate of discount for benefits that are 30 years or 40 years in the future, when the bulk of the benefits from early childhood programs occur, will be closer to risk free rates than to rates incorporating risk (see Weitzman 2007, pp. 711–712).

[42] For example, one could argue for using a rate of per capita consumption growth equal to 1.6% per year, as that is the rate of per capita GDP growth used in this report and my previous reports. However, if we are going to use that rate of per capita consumption growth to generate a discount rate, we probably should focus on total labor compensation rather than only straight earnings. It seems likely that the labor share of GDP will not significantly decline, which implies that overall labor compensation will grows at 1.6% per year, even though the earnings growth figure is only projected to grow at 1.2% per year.

A recent prominent report in the *Journal of Policy Analysis and Management* by Moore et al. (2004) advocated a value for *d* of 1 and for *e* of 1. This yields an implied discount rate for future consumption of 2.2%.

Nordhaus (2007) and Weitzman (2007) advocate for assumptions about the parameters *d* and *e* that yield real discount rates that are closer to real rates of return on investment that we observe in the market. Nordhaus assumes a value for *d* of 1.5 and for *e* of 2, which yields a discount rate on future consumption of 3.9%. Weitzman assumes a value for *d* of 2.0 and for *e* of 2, yielding a discount rate on future consumption of 4.4%.

I recalculated the ratio of the present value of earnings effects for state residents to the present value of costs under this wide variety of discount rate assumptions.[43] These calculations are shown in Table D1. The most important conclusion from this table is that under a wide variety of discount rates, the present value of earnings effects for all these programs exceeds their costs from a state perspective. If one were to use these ratios to rank these programs—which is only appropriate if one is choosing to devote a marginal dollar to each type of program, then the Parent-Child Home Program is always the number 1 ranked program. The Abecedarian program and the Nurse Family Partnership are always the two lowest ranked programs. The relative ranking of universal preschool versus business subsidies depends upon the choice of discount rates.

An alternative to making assumptions about discount rates is to look at the implied "rate of return" for these programs. This is the interest rate for each program which yields a ratio of present value of earnings effects to present value of costs that is just equal to 1.0. Although the

[43] For the Stern report assumptions, the present value calculations blow up to infinities if we use a discount rate of 1.3%, as the assumed rate of aggregate earnings growth is equal to 1.5% (the sum of 1.2% wage growth plus 0.3% population growth). Therefore, I used a discount rate of 1.6% to approximate the Stern report assumptions.

"rate of return" to each program does not depend upon assumptions about discount rates, it is never an appropriate way to choose which program to pursue. The rate of return just tells us the maximum discount rate at which the program would be worth pursuing. What one wants to know is whether the program is worth pursuing in the world as it is, at whatever discount rate is believed to be appropriate. If the choice is between investing a marginal dollar among several programs, then the ratio of present value of earnings effects to costs is the appropriate way to rank programs. If the choice is between choosing one program versus another, then the net difference between the present value of earnings versus the present value of costs is the appropriate way of choosing between programs.

Table D2 shows the implied rate of return for each program, both from a national perspective and from a state perspective. As the Table shows, at any reasonable discount rate, with one exception, all of these programs will generate net positive earnings effects from both a state and national perspective. The one exception is business subsidies from a national perspective, which do not have positive net earnings effects except at unreasonably low discount rates of less than 0.7%.

Appendix E
Differences in Assumptions Between This Report and Studies by Dickens et al.

Both the Bartik (this report, 2006a) and the Dickens et al. (2006, 2007) studies look at the long-run effects on national GDP of universal preschool, a full-scale Abecedarian program, and a full-scale Parent Child Home Program. Because the Bartik and Dickens et al. studies use quite different simulation models and assumptions, it would not be expected that they would yield identical estimated effects. It turns out that for universal preschool, the Bartik model and the Dickens et al. model yield similar results, but with the Dickens estimates tending to be somewhat greater than the Bartik estimates. Bartik estimates a long-run (75-year) increase in national GDP due to universal preschool of 1.9%. Dickens' preferred estimates yield a long-run effect of universal preschool on national GDP of 3.5%, with two other alternative models estimating national GDP effects of 1.3% and 4.0%. In contrast, for the Abecedarian program and the PCHP program, the Dickens' model estimates long-run effects on national GDP that are one-third or less of those estimated by Bartik. Bartik estimates a long-run effect on national GDP of the Abecedarian program of 3.3%, versus the Dickens' model's estimate of 1.1%. Bartik estimates long-run effects of PCHP on national GDP of 0.3%, versus the Dickens estimates of less than 0.1%.

It is not possible to determine all the reasons for these differences without much more extensive simulations using each model. What I aim to do in this Appendix is outline some of the key differences in the features of the Bartik and Dickens models, and explain what type of effects these different features are likely to have on the estimates. These different features include: methodologies and assumptions for estimating effects on the earnings of former child

participants in these programs; methodologies and assumptions for estimating effects on the earnings of mothers of child participants; peer effects in education; displacement effects in the labor market; savings feedback effects; social spillover effects of education; tax effects on labor supply.

Methodologies and assumptions for estimating effects on earnings of former child participants in these programs. The Dickens model uses as an input how much each program increases average years of education for former child participants. Studies of how years of education affect wages are used to ascertain how this would be expected to affect wages of former child participants. In addition, for the Dickens study of the Abecedarian program and the PCHP program, but not for the study of universal preschool, the model also includes estimates of how years of education affects employment rates.

The Bartik model uses as an input how much each program is estimated to affect high school graduation and college graduation. The Bartik model then uses estimates of how much high school graduation and college graduation affect wages and employment rates.

In addition, the Bartik model, in the case of universal preschool and the Abecedarian program, uses estimates that preschool and the Abecedarian program will increase employment rates of former child participants significantly more than would be predicted based on educational attainment alone. The inclusion of this extra employment rate effect is likely to significantly increase Bartik's estimated effects for universal preschool and the Abecedarian program relative to Dickens's estimated effects

Estimated program effects on educational attainment for universal preschool are taken from the Perry Preschool program for the Dickens model, and from the Chicago Child Parent

Center program for the Bartik model. As educational attainment effects of preschool in Perry Preschool are about twice those of the CPC program, this factor is likely to increase Dickens' estimates of the effects of universal preschool relative to Bartik's estimates.

Dickens' estimated effects on educational attainment for the Abecedarian program and the PCHP program are taken directly from the last observed data, which are at ages 21 for the Abecedarian program, and ages 17–22 for the PCHP program. These are ages that fall well before many participants have reached their final years of completed education. In contrast, Bartik extrapolates the observed educational differentials from the last observed data into a prediction for final completed years of education. This factor probably increases Bartik's estimates of the effects of the Abecedarian program and the PCHP program relative to Dickens's effects.

Methodologies and assumptions for estimating effects on earnings of mothers of child participants in these programs. For PCHP, neither the Bartik model nor the Dickens model includes any effects on mothers. For universal preschool, the Dickens model includes no effects on mothers. Bartik's model incorporates modest effects on mothers due to the universal preschool's modest reduction in child care costs. This factor will slightly increase Bartik's estimates of the effects of universal preschool relative to Dickens's estimates.

For the Abecedarian program, Dickens incorporates the assumption that the Abecedarian program will lower child care costs by 50%, leading to effects on mothers' labor supply. In contrast, Bartik's model uses the assumption that the Abecedarian program will lower child care costs by 100%, which will lead to larger estimates of the effects on mothers' labor supply. In addition, Bartik's model uses estimates from the Abecedarian program that the program

increases the educational attainment of mothers, with resulting effects on their wages and employment rates. Finally, Bartik's model allows for effects of the extra employment experience due to lower priced child care on the long run employment rates and wages of mothers. These estimated effects of extra employment experience are calibrated to estimates from the program of how much the employment rates and earnings rates of mothers increased over and above what one would expect based on program effects on the educational attainment of mothers. All of these additional estimated effects in the Bartik model would be expected to significantly increase the Bartik model estimates of the effects of the Abecedarian program relative to the estimates of the Dickens model.

Peer effects in education. Bartik's model includes estimates that the extra human capital resulting from early childhood programs will have beneficial effects on the human capital of other children due to peer effects in school. These peer effects add about 50% to effects on former child participants in the Bartik model, and would be expected to increase estimated effects in the Bartik model relative to the Dickens model.

Displacement effects in the labor market. Bartik allows for an increased quantity and quality of labor supply to displace some other workers. The net effect is that the final effects on earnings are only two thirds of the initial shock to earnings of former child participants and mothers of participants. This allowance for displacement effects will tend to reduce Bartik's estimated effects relative to Dickens' estimated effects. These displacement effects will more than offset the assumed peer effects in education.

Savings feedbacks. The Dickens model allows for the higher GDP resulting from these programs to feed back into the economy in the form of higher savings rates that will be invested

in additional physical capital and human capital. These savings feedback effects will increase the estimated effects in the Dickens model relative to effects in the Bartik model.

Social spillovers of human capital. The Bartik model allows for an increased percentage of college graduates to increase the productivity of all workers. The Dickens model appears to allow for more education to have returns in aggregate production that exceed the extra wages generated, although this varies with the specific production function used. It is unclear how this factor affects the relative estimates of the two models.

Tax effects on labor supply. The Dickens model allows for tax rates to affect labor supply, whereas the Bartik model does not include tax rate effects on labor supply. Under the Dickens model, the higher tax rates needed to finance the programs in the short-run reduce labor supply. However, in the long-run, the programs generate net fiscal surpluses; these fiscal surpluses allow tax rates to be lowered, resulting in positive labor supply effects. It is unclear what the net effects of these labor supply effects are in the long-term, however, as the initially higher tax rates will have feedback effects via lower GDP and lower investment rates that will have persistent adverse effects in the long-run.

The bottom line. It is impossible without much more investigation to firmly establish which of these factors are most important in driving the differences between the Bartik and Dickens estimates. My guess is that the Bartik estimates are higher than the Dickens estimates for the Abecedarian model because of the use of final education completion statistics for former child participants, extra employment rate effects for former child participants, and the extra earnings effects on mothers. For the PCHP program, the Bartik estimates may be higher due to the use of final education completion statistics for former child participants. For universal

preschool, the Dickens model use of higher education impact estimates than are used in the Bartik model is probably roughly offset by the Bartik's model use of extra employment rate effects for former child participants.

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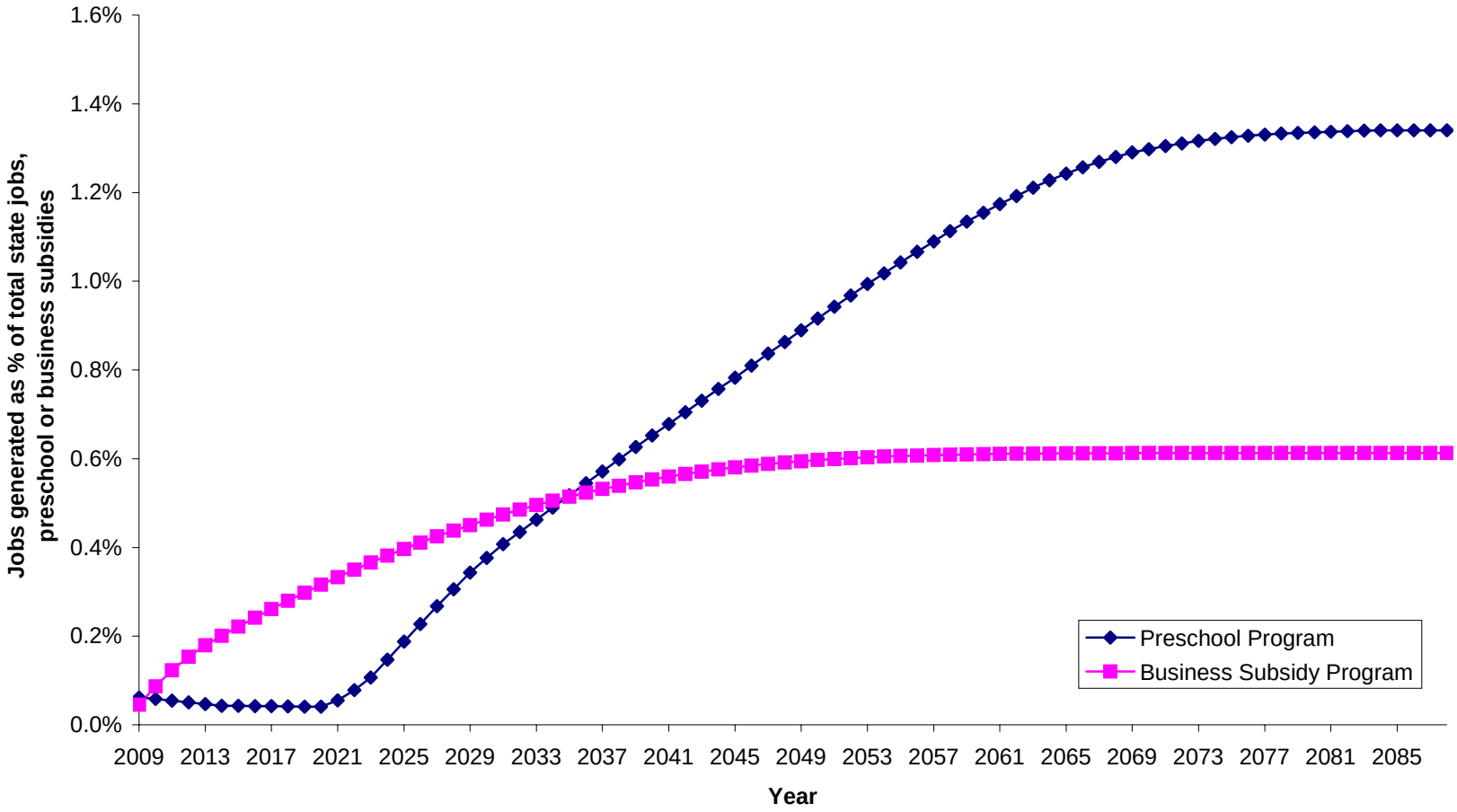
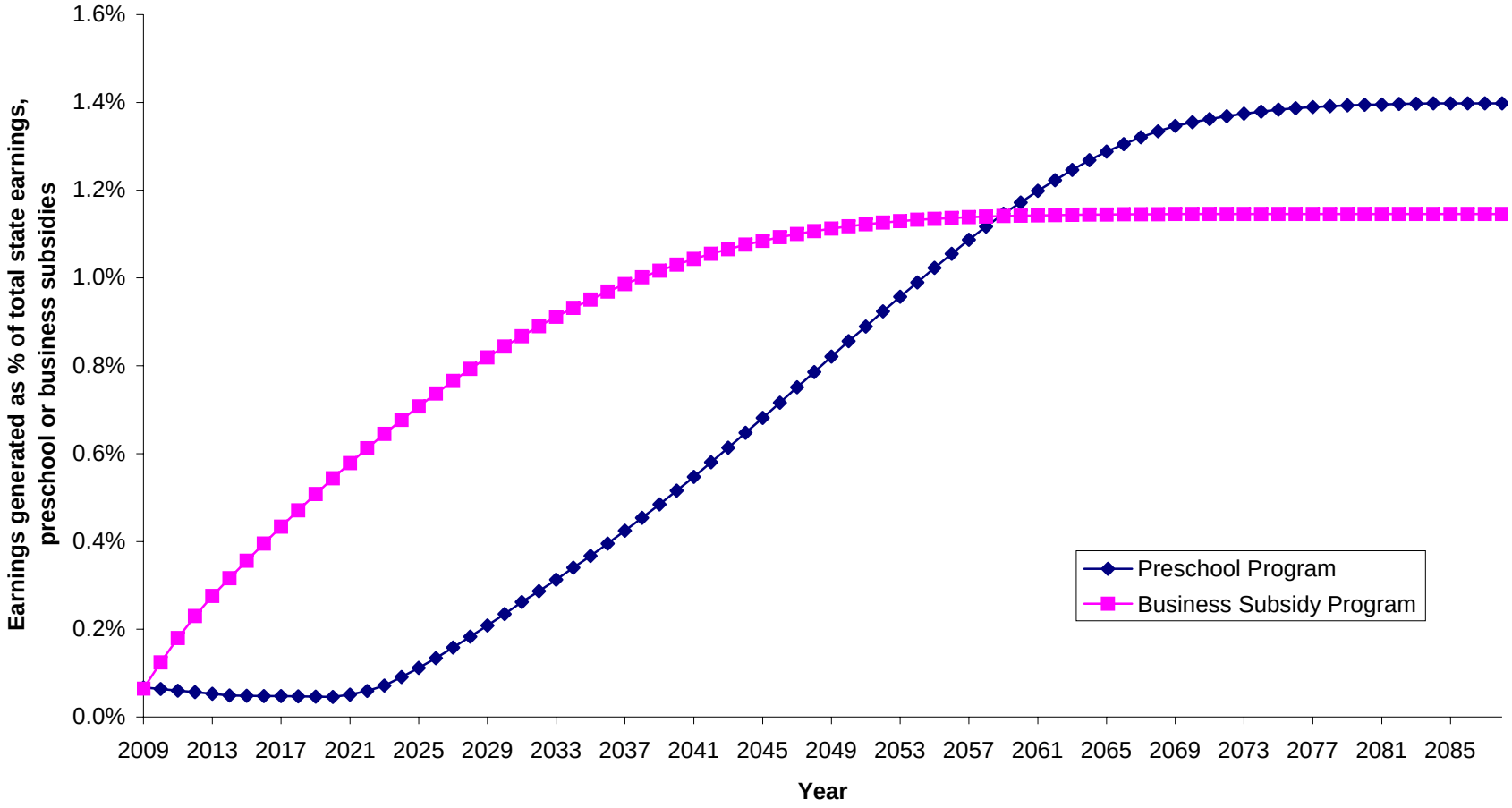
Figure 1. Jobs Generated for State Residents by Permanent Universal Preschool Program, Compared to Business Subsidy Program of Same Cost



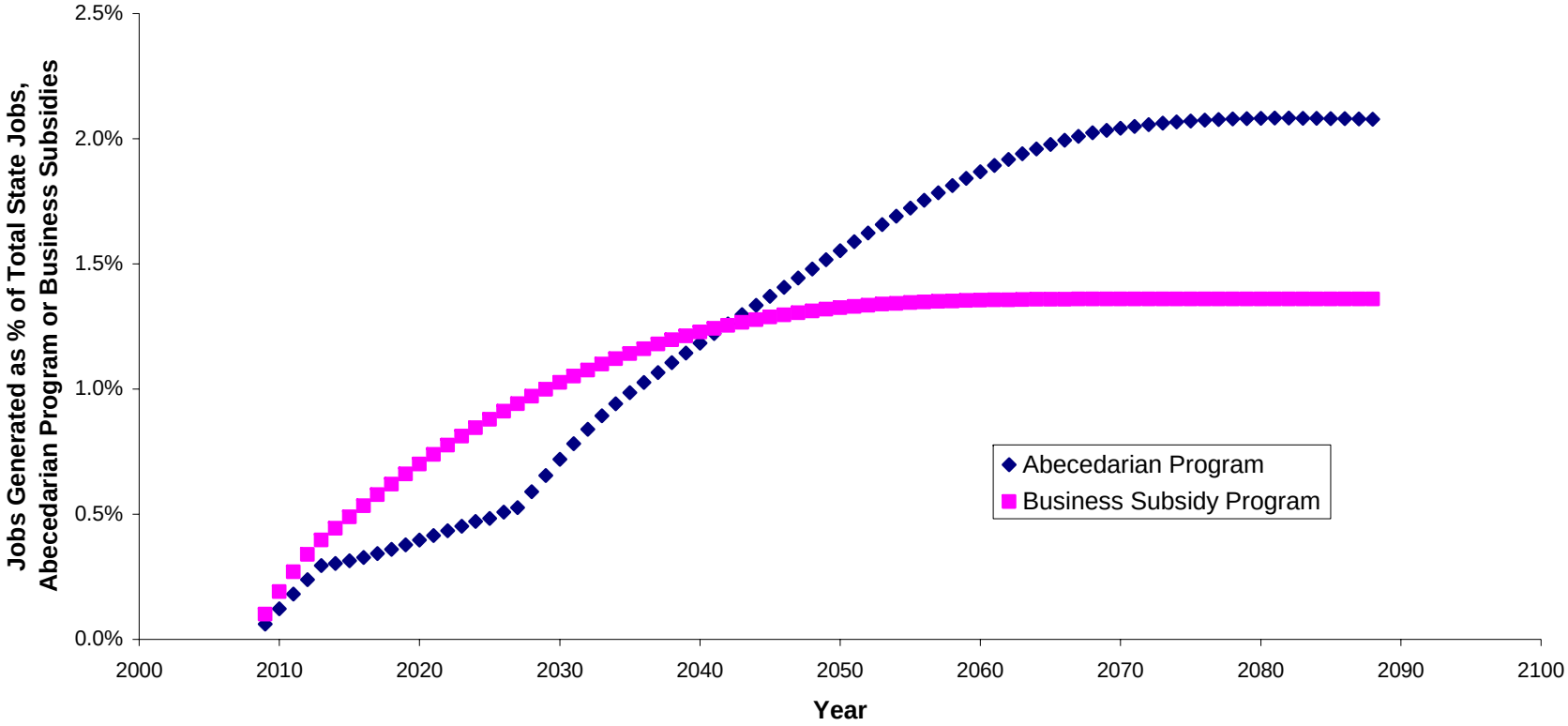
Note: Detailed numbers on which this figure is based are in Appendix B, Table B1. Estimated effects are increase in jobs of original residents who stay in state, as percentage of total state jobs. Methodology is described in text and appendix.

Figure 2. Earnings Generated for State Residents by Permanent Universal Preschool Program, Compared to Business Subsidy Program of Same Cost



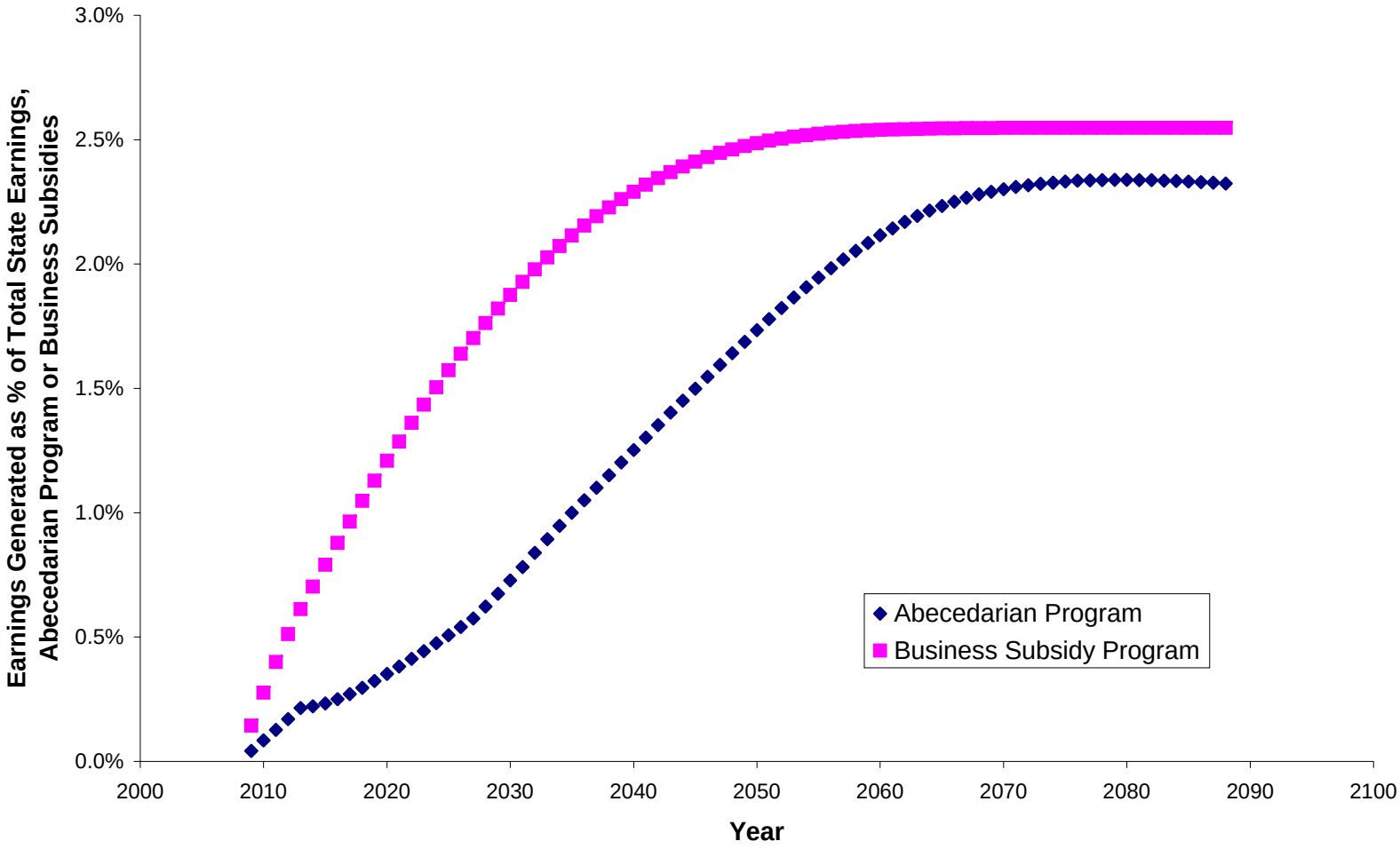
Note: Detailed numbers on which this figure is based are in Appendix B, Table B2. Estimated effects are increase in earnings of original residents who stay in state, as percentage of total state earnings. Methodology is described in text and appendix.

Figure 3. Jobs Generated for State Residents by Full-Scale Abecedarian Program, Compared to Business Subsidy Program of Same Cost



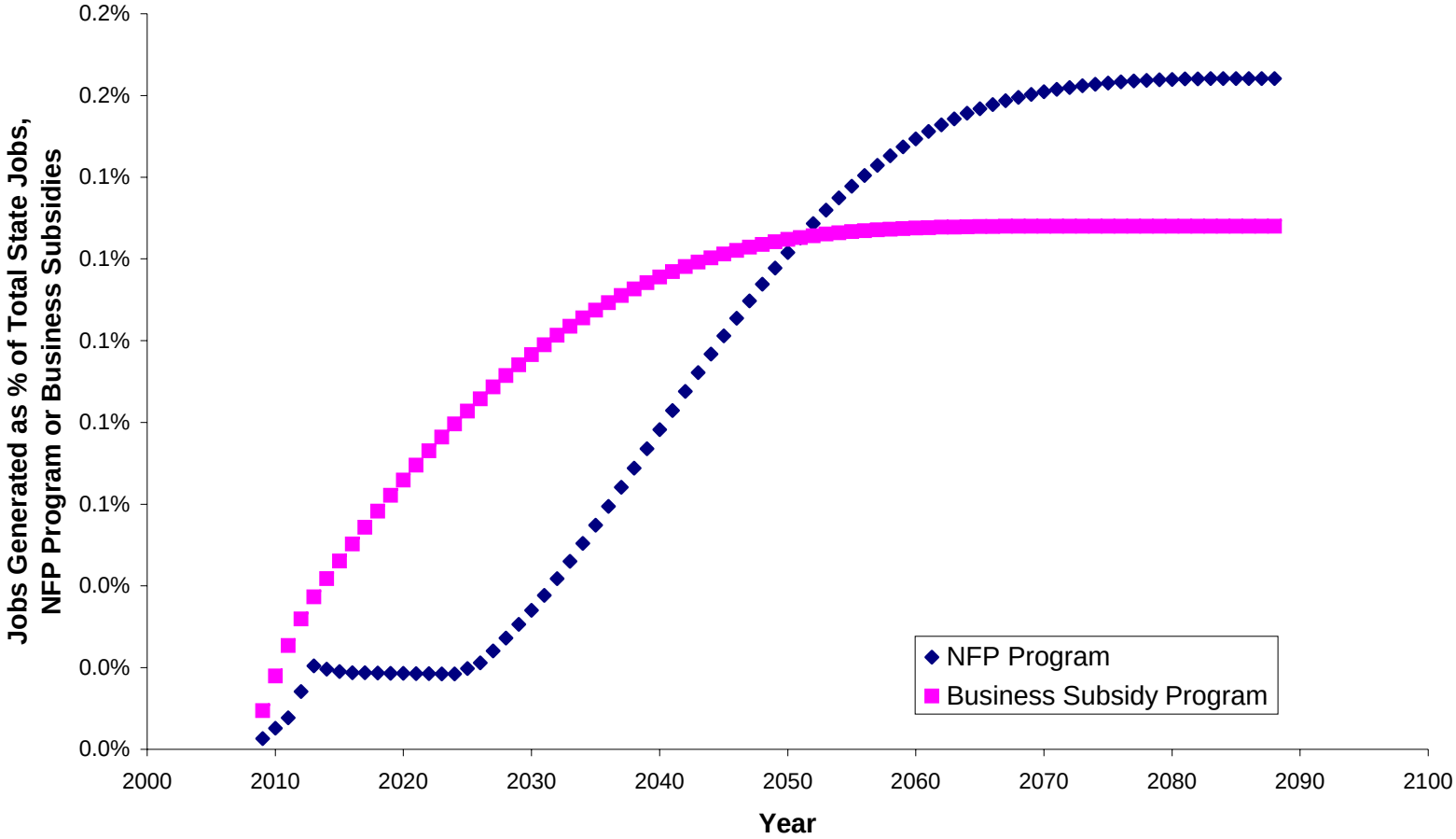
Note: Detailed numbers are in Appendix C, Table C1. Estimated effects are increase in jobs of original state residents who stay in state, as percentage of total state jobs. Methodology is described in text and appendix.

Figure 4. Earnings Generated for State Residents by Full-Scale Abecedarian Program, Compared to Earnings Generated by Business Subsidy Program of Same Cost



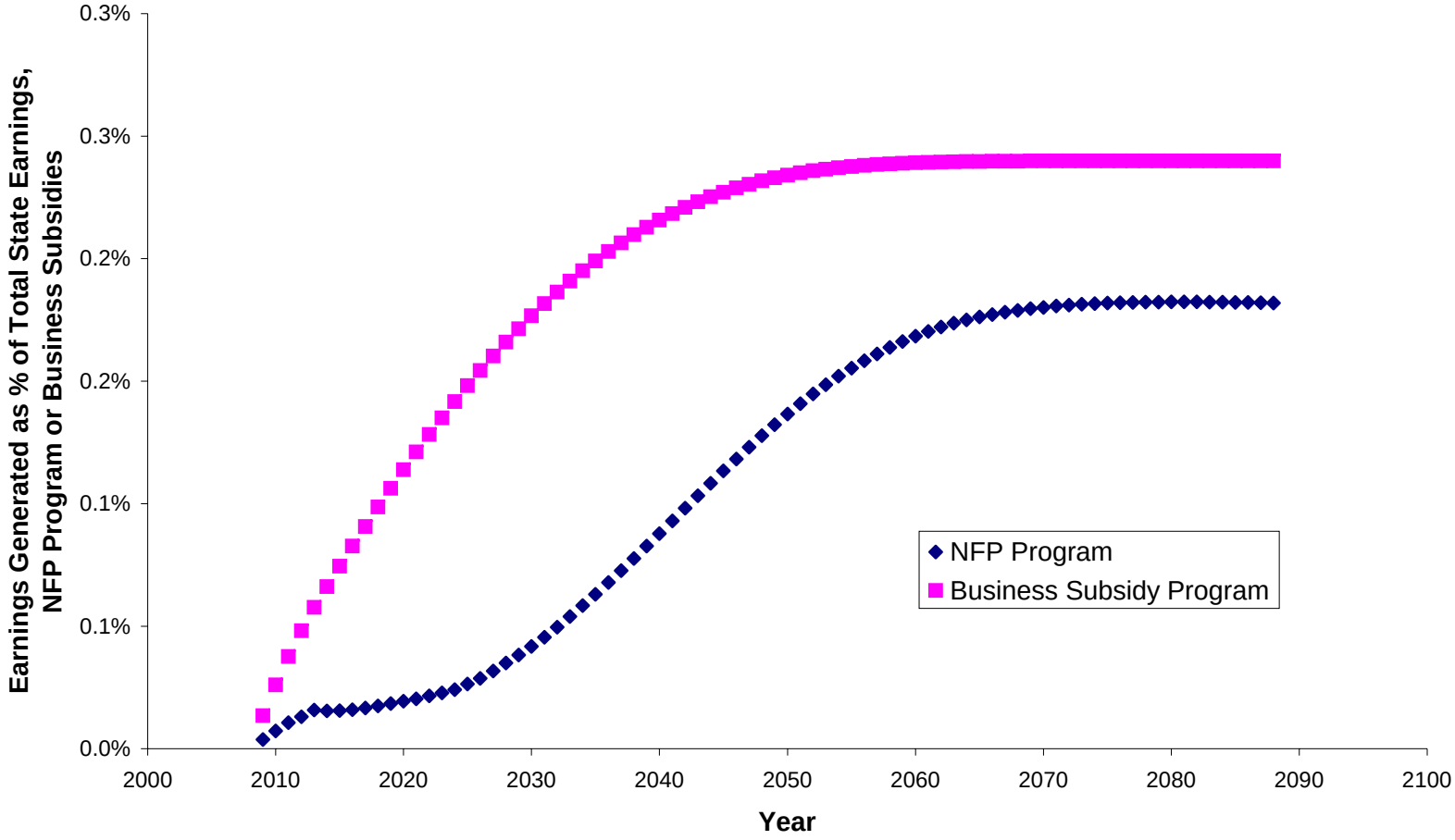
Note: Detailed numbers are in Appendix C, Table C2. Estimated effects are increases in earnings of original state residents who stay in state, as percentage of total state earnings. Methodology is described in text and appendix.

Figure 5. Jobs Generated for State Residents by Full-Scale Nurse Family Partnership Program, Compared to Jobs Generated by Business Subsidy Program of Same Cost



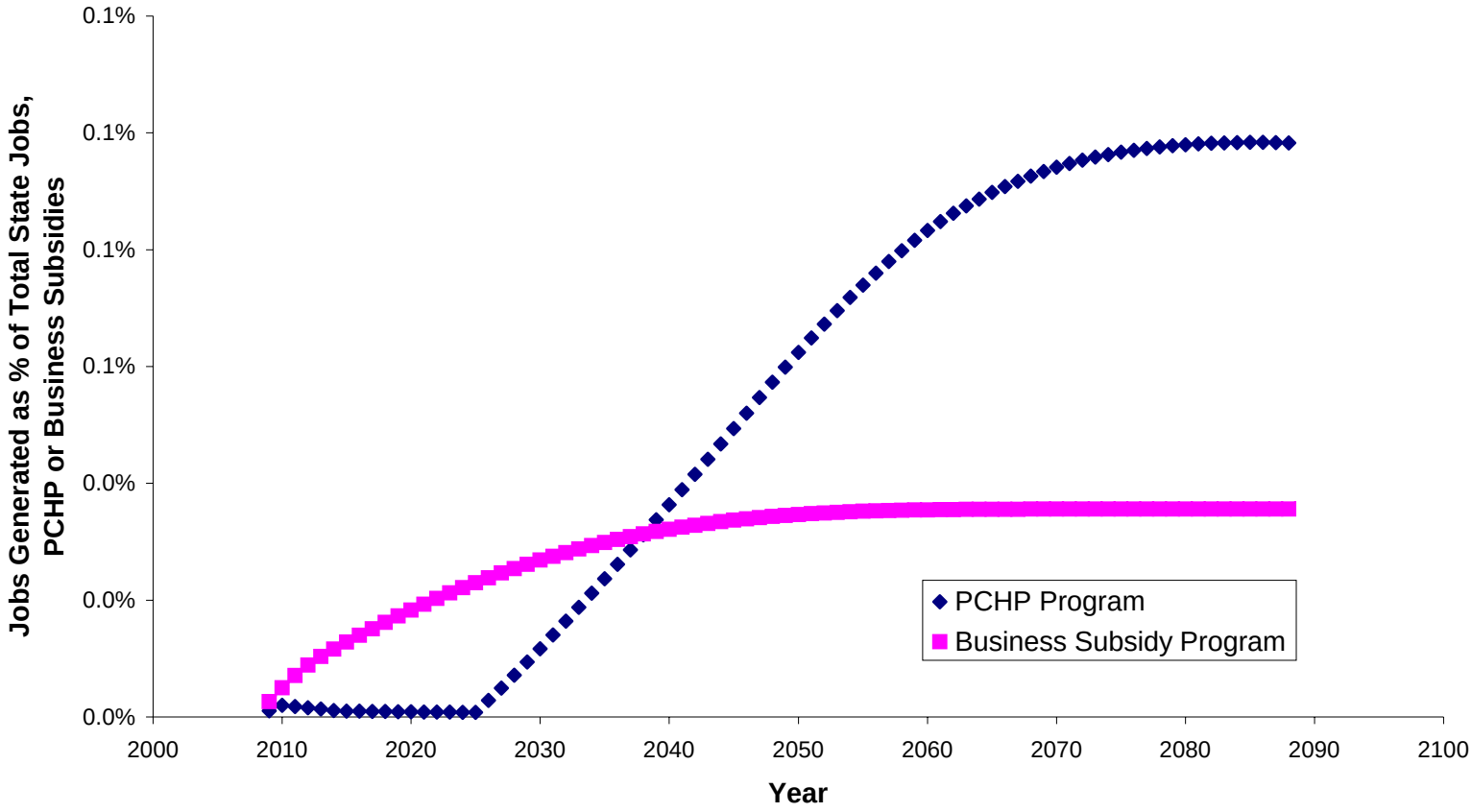
Note: Detailed numbers are in Appendix C, Table C3. Estimated effects are increases in employment rates of original state residents who stay in state, as percentage of total state jobs. Methodology is described in text and appendix.

Figure 6. Earnings Generated for State Residents by Full-Scale Nurse Family Partnership Program, Compared to Earnings Generated by Business Subsidy Program of Same Cost



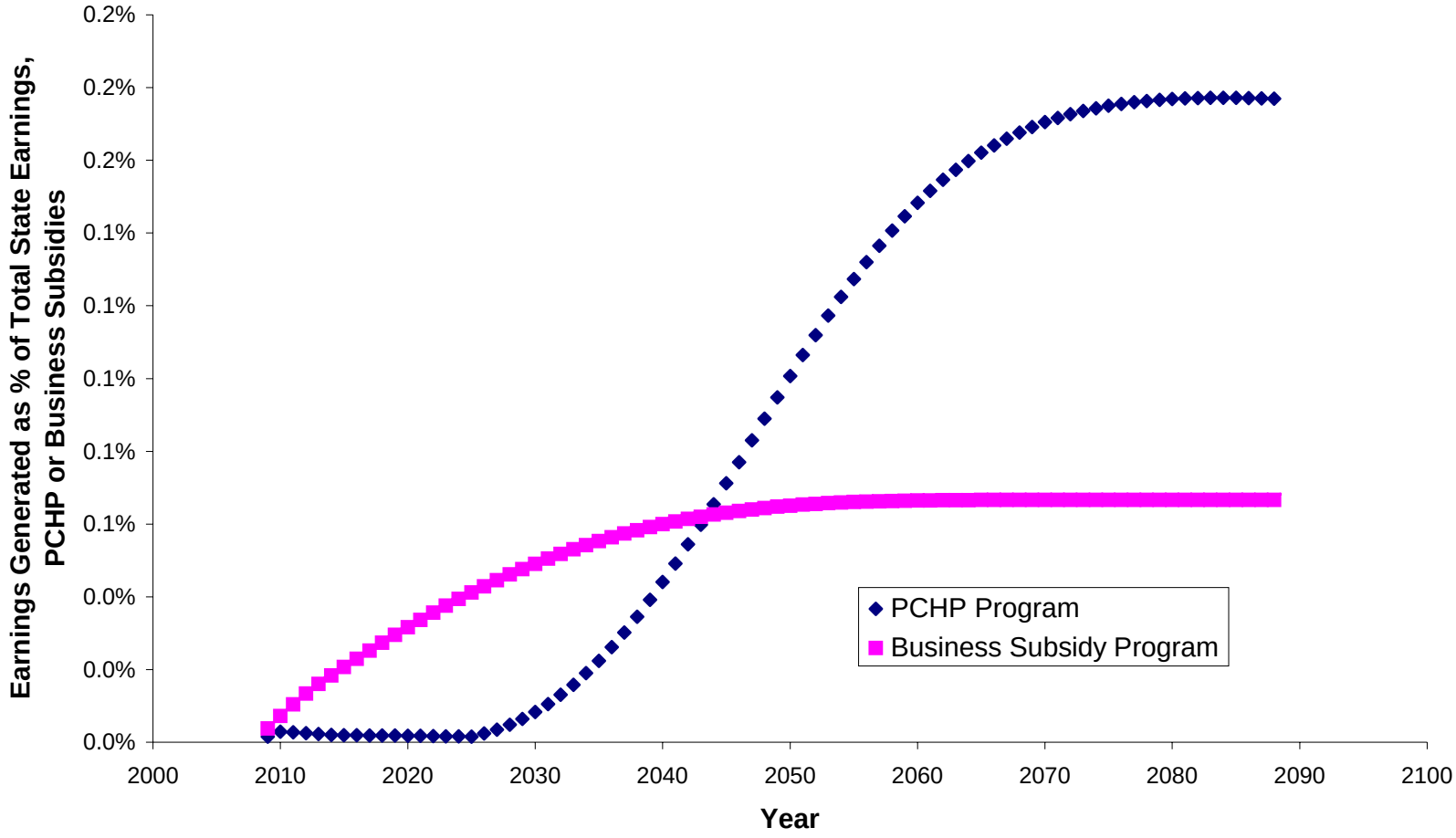
Note: Detailed numbers are in Appendix C, Table C4. Estimated effects are increases in earnings of original state residents who stay in state, as percentage of total state earnings. Methodology is described in text and appendix.

Figure 7. Jobs Generated for State Residents for Full-Scale Parent-Child Home Program (PCHP), Compared to Jobs Generated by Business Subsidy Program of Same Cost



Note: Detailed numbers are in Table C5 of Appendix. Estimated effects are increases in employment rates of original state residents who stay in state, as percentage of total state jobs. Methodology is described in text and appendix.

Figure 8. Earnings Generated for State Residents by Full-Scale Parent-Child Home Program (PCHP), Compared to Earnings Generated by Business Subsidy Program of Same Cost



Note: Detailed numbers are in Table C6 of Appendix. Estimated effects are increases in earnings of original state residents who stay in state, as percentage of total state earnings. Methodology is described in text and appendix.

Table 1. Ratio of Present Value of Earnings Effects to Costs, Early Childhood Programs and Business Subsidies, From a State Perspective

Program	Ratio of Present Value of Earnings Effects to Costs, State perspective
Business subsidies	3.14
Universal preschool	2.78
Abecedarian program	2.25
Nurse Family Partnership	1.85
Parent-Child Home Program	5.66

NOTE: Table shows present value of earnings per capita effects of the various programs, as a ratio to the present value of costs, for an ongoing permanent program. Earnings effects and costs are discounted at 3%. Methodology for estimating these effects is described in this report's text and Appendix, and in Bartik (2006a). The five entries are for each program implemented separately, with none of the other programs being implemented. All estimates only count earnings effects for state residents who originally were in the state, and who stay in the state.

Table 2: Effects on Present Value of State Residents' Earnings, Costs, and Their Difference, for Four Early Childhood Programs

Program	Present value of earnings effects of program, as percentage of present value of state earnings	Present value of costs of program, as percentage of present value of state earnings	Difference between present value of earnings minus present value of costs
Universal preschool	0.83	0.30	0.53
Abecedarian program	1.50	0.66	0.83
Nurse Family Partnership	0.12	0.06	0.05
Parent-Child Home Program	0.10	0.02	0.08

NOTES: All figures show effects on state residents who stay in a state for full-scale program operated on ongoing basis in a typical state's economy. Wages are assumed to grow at 1.2% annually, and population at 0.3% annually. All future flows of earnings effects, earnings, and program costs are converted to a present value by discounting at a 3% rate. Assumptions about the size of a full-scale program are noted in the text. Note that the ratio of the present value of earnings effects in the first column of numbers, to the present value of costs in the second column of numbers, is exactly equal to the ratios given in Table 1.

Table3: Long-Run Percentage Effects (in 2088) of Ongoing Early Childhood Programs and Business Subsidies (of Same Costs as the Early Childhood Program) on State Residents' Employment and Earnings

Program	% Effects on state residents' employ-ment of this early childhood program	% Effects on state residents' employ-ment of business subsidies of same size as this early childhood program	% Effects on state residents' earnings of this early childhood program	% Effects on state residents' earnings of business subsidies of same size as this early childhood program
Universal preschool	1.34	0.61	1.40	1.15
Abecedarian	2.08	1.36	2.32	2.55
Nurse Family Partnership	0.16	0.13	0.18	0.24
Parent-Child Home Program	0.10	0.04	0.18	0.07

NOTES: These estimated effects are for a typical state. The effects for the early childhood programs are for a full-scale ongoing program that starts in 2009, and are effects as of 2088, by which point the percentage effects have leveled off to some long-run effect. The business subsidy effects are for the same type of tax subsidies to business in each case, but are scaled so that the present value of these business subsidies are the same as the present value of the ongoing full-scale early childhood program

Table 4. Division of Benefits of Early Childhood Programs Among Different Mechanisms for Producing Benefits

Program	Spending: Earnings effects due to higher spending and taxes	Parents: Earnings effects due to labor supply effects on parents	Children: Earnings effects due to labor supply effects on former child participants	Total: Total earnings effects, expressed as ratio of PV of earnings effects to PV of costs
Universal preschool for 4-year-olds	0.04	0.05	2.69	2.78
Abecedarian	0.04	1.33	0.88	2.25
Nurse Family Partnership (NFP)	0.04	0.88	0.93	1.85
Parent-Child Home Program (PCHP)	0.04	0.00	5.62	5.66

NOTE: Table shows ratio of present value of earnings effects to present value of costs for each of mechanisms by which early childhood programs might yield economic development benefits. Present value of costs in denominator is always the total present value of costs for the program; I do not attempt to divide up program costs among these different mechanisms for having effects, which would be quite difficult to do as many program elements have multiple effects on different groups. Report text and Appendix provide more details on methodology. All ratios calculated here are from state perspective.

Table 5. Timing of Earnings Effects of Early Childhood Programs vs. Business Subsidies

	Ratio of Present Value of Earnings Effects to Present Value of Costs:			
Program	After 5 years	After 10 years	After 15 years	Long-term ratio
Business subsidies	1.75	1.59	1.69	3.14
Universal preschool for 4-year-olds	0.20	0.18	0.18	2.78
Abecedarian	0.31	0.35	0.42	2.25
Nurse Family Partnership	0.20	0.23	0.26	1.85
Parent-Child Home Program	0.15	0.13	0.12	5.66

Note: Effects shown are effects for state residents of ongoing early childhood programs or business subsidies. Table shows cumulative ratio of present value of earnings effects to costs that would occur after various time periods if all further earnings effects and costs ceased after that time period. All ratios are calculated from state perspective. Long-term ratio figures are same as those previously presented in Table 1, and are effects considering all future time periods.

Table 6: National vs. State Perspective on the Ratio of the Present Value of Earnings Effects to Costs, Early Childhood Programs and Business Subsidies

Program	Ratio of Present Value of Earnings Effects to Costs, State perspective	Ratio of Present Value of Earnings Effects to Costs, National perspective
Business subsidies	3.14	0.65
Universal preschool	2.78	3.79
Abecedarian	2.25	3.03
Nurse Family Partnership	1.85	2.47
Parent-Child Home Program	5.66	8.42

NOTE: Table shows present value of earnings per capita effects of the various programs, as a ratio to the present value of costs, for an ongoing permanent program. Earnings effects and costs are discounted at 3%. Methodology for estimating these effects is described in this report's text and appendices, and in Bartik (2006a). The entries are for each program implemented separately, with none of the other programs being implemented. The state perspective only includes effects on the earnings of that state's residents; the national perspective includes earnings effects on residents of any state.

Table 7: Effects on Present Value of National Earnings, Costs, and Their Difference, for Four Early Childhood Programs

Program	Present value of earnings effects of program, as percentage of present value of national earnings	Present value of costs of program, as percentage of present value of national earnings	Difference between present value of earnings minus present value of costs
Universal preschool	1.13	0.30	0.83
Abecedarian program	2.02	0.66	1.35
Nurse Family Partnership	0.15	0.06	0.09
Parent-Child Home Program	0.15	0.02	0.13

NOTES: All figures show effects on residents throughout the U.S. for full-scale programs operated on an ongoing basis. Wages are assumed to grow at 1.2% annually, and population at 0.3% annually. All future flows of earnings effects, earnings, and program costs are converted to a present value by discounting at a 3% rate. Assumptions about the size of a full-scale program are noted in the text. Note that the ratio of the present value of earnings effects in the first column of numbers, to the present value of costs in the second column of numbers, is exactly equal to the ratios given in Table 6 for the national perspective.

Table 8. Long-run Impact (in 2088) on U.S. Economy of Full-Scale Implementation of Various Early Childhood Programs

	Jobs created		Earnings generated		GDP		Long-run annual government revenue	Long-run annual program costs	Present value of net costs for 2009 cohort	Size of 2009 cohort
Program	%	millions of workers	%	billions of dollars	%	trillions of dollars	billions of dollars	billions of dollars	billions of dollars	millions of persons
Universal preschool for 4-year-olds	1.8	3.3	1.9	365	1.9	1.171	292	58	17.9	2.879
Abecedarian	2.9	5.3	3.3	645	3.3	2.067	515	133	39.8	0.619
Nurse Family Partnership	0.2	0.4	0.3	49	0.3	0.157	39	12	3.7	0.373
Parent-Child Home Program	0.1	0.3	0.3	53	0.3	0.169	42	3	1.0	0.228

NOTES: See text and Appendix for methodology for deriving these numbers. All dollar figures are in year 2007 dollars, that is they adjust for inflation, however they do not discount effects back to 2007. Jobs, earnings, GDP, and long-run revenue and costs figures are annual effects in 2088 of on-going full scale programs. Present value of net costs for 2009 cohort are presented for comparison; programs grow in real costs between 2009 and 2088 based on assumptions about population growth and real wage growth. Percentage effects for jobs, earnings, and GDP are as percentage of total national jobs, earnings, and GDP.

Table 9: Including Interaction Effects in Calculating the Ratio of Present Value of Earnings Effects to Costs, Early Childhood Programs and Business Subsidies, From Both a State Perspective and a National Perspective

Program	Ratio of Present Value of Earnings Effects to Costs, State perspective	Ratio of Present Value of Earnings Effects to Costs, National perspective
Business subsidies	3.14	0.65
Universal preschool	2.78	3.79
Abecedarian	2.25	3.03
NFP	1.85	2.47
PCHP	5.66	8.42
Preschool conditional on Abecedarian	1.52	2.08
Abecedarian conditional on preschool	1.69	2.28
Both preschool and Abecedarian	2.05	2.78

NOTE: Table shows present value of earnings per capita effects of the various programs, as a ratio to the present value of costs, for an ongoing permanent program. Earnings effects and costs are discounted at 3%. Methodology for estimating these effects is described in this report's text and an appendix, and in Bartik (2006a). The first five entries are for each program implemented separately, with none of the other programs being implemented. Because universal preschool and the Abecedarian program provide overlapping services, the effect of implementing one of these programs probably depends upon whether the other program already exists. Using a methodology described in an appendix, the last three rows show effects of universal preschool and the Abecedarian program when these two programs are both implemented. The last row shows the overall effects of the two programs together. The previous two rows show effects of each program being added if the other program already exists.

Table 10. Incorporating Program Interaction Effects into Long-run Impact (in 2088) on U.S. Economy of Full-Scale Implementation of Various Early Childhood Programs

	Jobs created		Earnings generated		GDP		Long-run annual government revenue	Long-run annual program costs	Present value of net costs for 2009 cohort	Size of 2009 cohort
Program	%	millions of workers	%	billions of dollars	%	trillions of dollars	billions of dollars	billions of dollars	billions of dollars	millions of persons
Universal preschool for 4-year-olds	1.8	3.3	1.9	365	1.9	1.171	292	58	17.9	2.879
Abecedarian	2.9	5.3	3.3	645	3.3	2.067	515	133	39.8	0.619
Nurse Family Partnership	0.2	0.4	0.3	49	0.3	0.157	39	12	3.7	0.373
Parent-Child Home Program	0.1	0.3	0.3	53	0.3	0.169	42	3	1.0	0.228
Abecedarian and universal preschool together	3.7	6.8	4.2	809	4.2	2.595	647	181	54.4	2.879
All four programs together	4.1	7.4	4.7	911	4.7	2.921	728	196	59.2	2.879+

NOTES: See text and Appendix for methodology for deriving these numbers. All dollar figures are in year 2007 dollars. Jobs, earnings, GDP, and long-run revenue and costs figures are annual effects in 2088 of on-going full scale programs. Present value of net costs for 2009 cohort are presented for comparison; programs grow in real costs between 2009 and 2088 based on assumptions about population growth and real wage growth.

Table B1. Universal Preschool Effects on State Job Creation: Effects as a Percentage of Total State Employment for Ongoing Full-Scale Program Started in 2009, Compared to Business Subsidy Program of Same Cost

	Universal Preschool			Total for Universal	Total for Business
Year	Spending (%)	Parents (%)	Children (%)	Preschool (%)	Subsidy Program (%)
2009	0.036	0.026	0.000	0.062	0.045
2010	0.033	0.026	0.000	0.058	0.087
2011	0.029	0.026	0.000	0.054	0.123
2012	0.025	0.026	0.000	0.051	0.154
2013	0.021	0.026	0.000	0.047	0.180
2014	0.017	0.026	0.000	0.043	0.201
2015	0.017	0.026	0.000	0.043	0.221
2016	0.017	0.026	0.000	0.042	0.241
2017	0.016	0.026	0.000	0.042	0.261
2018	0.016	0.026	0.000	0.041	0.280
2019	0.015	0.026	0.000	0.041	0.298
2020	0.015	0.026	0.000	0.041	0.316
2021	0.015	0.026	0.015	0.055	0.333
2022	0.014	0.026	0.038	0.078	0.350
2023	0.014	0.026	0.067	0.107	0.366
2024	0.013	0.026	0.108	0.147	0.382
2025	0.013	0.026	0.149	0.188	0.397
2026	0.012	0.026	0.190	0.228	0.411
2027	0.012	0.026	0.230	0.267	0.425
2028	0.012	0.026	0.269	0.306	0.438
2029	0.011	0.026	0.307	0.343	0.450
2030	0.011	0.026	0.340	0.376	0.463
2031	0.010	0.026	0.371	0.407	0.474
2032	0.010	0.026	0.399	0.435	0.485
2033	0.009	0.026	0.427	0.463	0.495
2034	0.009	0.026	0.455	0.490	0.505
2035	0.009	0.026	0.483	0.518	0.515
2036	0.008	0.026	0.511	0.545	0.523
2037	0.008	0.026	0.538	0.572	0.532
2038	0.007	0.026	0.565	0.598	0.539
2039	0.007	0.026	0.593	0.626	0.547
2040	0.007	0.026	0.620	0.652	0.553
2041	0.006	0.026	0.647	0.678	0.560
2042	0.006	0.026	0.673	0.704	0.565
2043	0.006	0.026	0.699	0.731	0.571
2044	0.005	0.026	0.726	0.757	0.576
2045	0.005	0.026	0.752	0.783	0.580
2046	0.005	0.026	0.780	0.810	0.584
2047	0.004	0.026	0.807	0.837	0.588
2048	0.004	0.026	0.833	0.863	0.591
2049	0.004	0.026	0.860	0.889	0.594
2050	0.004	0.026	0.887	0.916	0.597
2051	0.003	0.026	0.913	0.942	0.599
2052	0.003	0.026	0.939	0.968	0.601
2053	0.003	0.026	0.965	0.993	0.603

Table B1. (Continued)

Year	Universal Preschool			Total for Universal Preschool (%)	Total for Business Subsidy Program (%)
	Spending (%)	Parents (%)	Children (%)		
2054	0.003	0.026	0.990	1.018	0.605
2055	0.003	0.026	1.014	1.042	0.606
2056	0.002	0.026	1.038	1.066	0.607
2057	0.002	0.026	1.062	1.090	0.608
2058	0.002	0.026	1.085	1.113	0.609
2059	0.002	0.026	1.107	1.135	0.610
2060	0.002	0.026	1.127	1.154	0.610
2061	0.002	0.026	1.146	1.174	0.611
2062	0.002	0.026	1.165	1.192	0.611
2063	0.002	0.026	1.183	1.210	0.612
2064	0.002	0.026	1.200	1.228	0.612
2065	0.002	0.026	1.216	1.243	0.612
2066	0.002	0.026	1.229	1.257	0.612
2067	0.002	0.026	1.242	1.269	0.612
2068	0.002	0.026	1.253	1.280	0.612
2069	0.002	0.026	1.263	1.290	0.613
2070	0.002	0.026	1.271	1.298	0.613
2071	0.001	0.026	1.278	1.305	0.613
2072	0.001	0.026	1.283	1.311	0.613
2073	0.001	0.026	1.289	1.316	0.613
2074	0.001	0.026	1.293	1.321	0.613
2075	0.001	0.026	1.297	1.324	0.613
2076	0.001	0.026	1.301	1.328	0.613
2077	0.001	0.026	1.304	1.331	0.613
2078	0.001	0.026	1.306	1.333	0.613
2079	0.001	0.026	1.307	1.334	0.613
2080	0.001	0.026	1.309	1.336	0.613
2081	0.001	0.026	1.310	1.337	0.613
2082	0.001	0.026	1.311	1.338	0.613
2083	0.001	0.026	1.312	1.339	0.613
2084	0.001	0.026	1.313	1.340	0.613
2085	0.001	0.026	1.313	1.340	0.613
2086	0.001	0.026	1.313	1.340	0.613
2087	0.001	0.026	1.313	1.340	0.613
2088	0.001	0.026	1.313	1.340	0.613

NOTES: See Appendix or Bartik (2006a) for methodology. These effects are for typical state with typical out-migration patterns, baseline wages and employment rates, etc. Effects reflect cumulative job creation measured as cumulative increase in employment rates of original residents who stay in state as of that year, as percent of total state employment. Spending column shows impacts that take place due to increased taxing and spending for full-scale universal preschool. Parents column shows effects due to effects of program on parents of children enrolled in universal preschool. Children column shows effects associated with changes in educational attainment and economic status when former child participants become adults. These three types of effects added together equal total effects for the universal preschool program. Effects for business subsidy program are for business subsidy program described in appendix A and Bartik (2006a) of the same cost as a full-scale universal preschool program. All these figures can also be found in Bartik (2006a), but here the ongoing program is assumed to start in 2009.

Table B2. Universal Preschool's Effects on State Earnings Creation: Effects as a Percentage of Total State Wage and Salary Earnings for Ongoing Full-Scale Program Started in 2009, Compared to Business Subsidy Program of Same Cost

	Universal Preschool			Total for Universal	Total for Business
Year	Spending (%)	Parents (%)	Children (%)	Preschool (%)	Subsidy Program (%)
2009	0.052	0.016	0.000	0.067	0.065
2010	0.048	0.016	0.000	0.064	0.125
2011	0.044	0.016	0.000	0.060	0.180
2012	0.041	0.016	0.000	0.056	0.230
2013	0.037	0.016	0.000	0.053	0.276
2014	0.033	0.016	0.000	0.049	0.316
2015	0.033	0.016	0.000	0.048	0.356
2016	0.032	0.016	0.000	0.048	0.395
2017	0.032	0.016	0.000	0.047	0.433
2018	0.031	0.016	0.000	0.047	0.471
2019	0.031	0.016	0.000	0.046	0.508
2020	0.030	0.016	0.000	0.046	0.544
2021	0.029	0.016	0.006	0.051	0.578
2022	0.028	0.016	0.016	0.060	0.612
2023	0.028	0.016	0.028	0.072	0.645
2024	0.027	0.016	0.049	0.091	0.677
2025	0.026	0.016	0.071	0.112	0.707
2026	0.025	0.016	0.094	0.135	0.737
2027	0.024	0.016	0.118	0.158	0.765
2028	0.024	0.016	0.144	0.183	0.793
2029	0.023	0.016	0.170	0.208	0.819
2030	0.022	0.016	0.197	0.235	0.844
2031	0.021	0.016	0.225	0.262	0.867
2032	0.020	0.016	0.251	0.287	0.890
2033	0.019	0.016	0.278	0.313	0.911
2034	0.018	0.016	0.306	0.340	0.932
2035	0.018	0.016	0.334	0.367	0.951
2036	0.017	0.016	0.363	0.395	0.969
2037	0.016	0.016	0.393	0.425	0.986
2038	0.015	0.016	0.423	0.454	1.002
2039	0.014	0.016	0.454	0.484	1.016
2040	0.013	0.016	0.486	0.515	1.030
2041	0.013	0.016	0.518	0.547	1.043
2042	0.012	0.016	0.552	0.580	1.055
2043	0.011	0.016	0.586	0.613	1.066
2044	0.010	0.016	0.621	0.647	1.076
2045	0.010	0.016	0.656	0.681	1.085
2046	0.009	0.016	0.691	0.716	1.093
2047	0.008	0.016	0.727	0.751	1.100
2048	0.008	0.016	0.762	0.786	1.107
2049	0.007	0.016	0.798	0.821	1.113
2050	0.007	0.016	0.834	0.856	1.118
2051	0.006	0.016	0.867	0.889	1.122
2052	0.006	0.016	0.903	0.924	1.126
2053	0.005	0.016	0.936	0.957	1.130

Table B2. (Continued)

Year	Universal Preschool			Total for Universal Preschool (%)	Total for Business Subsidy Program (%)
	Spending (%)	Parents (%)	Children (%)		
2054	0.005	0.016	0.969	0.990	1.132
2055	0.005	0.016	1.003	1.023	1.135
2056	0.004	0.016	1.035	1.055	1.137
2057	0.004	0.016	1.067	1.087	1.138
2058	0.004	0.016	1.098	1.117	1.140
2059	0.004	0.016	1.127	1.146	1.141
2060	0.003	0.016	1.153	1.172	1.142
2061	0.003	0.016	1.179	1.198	1.143
2062	0.003	0.016	1.204	1.223	1.143
2063	0.003	0.016	1.227	1.246	1.144
2064	0.003	0.016	1.249	1.268	1.144
2065	0.003	0.016	1.269	1.287	1.144
2066	0.003	0.016	1.286	1.305	1.145
2067	0.003	0.016	1.302	1.320	1.145
2068	0.003	0.016	1.315	1.334	1.145
2069	0.003	0.016	1.328	1.346	1.145
2070	0.003	0.016	1.337	1.355	1.145
2071	0.003	0.016	1.344	1.362	1.145
2072	0.003	0.016	1.350	1.368	1.145
2073	0.003	0.016	1.356	1.374	1.145
2074	0.003	0.016	1.361	1.379	1.145
2075	0.003	0.016	1.365	1.383	1.145
2076	0.003	0.016	1.368	1.387	1.145
2077	0.003	0.016	1.371	1.389	1.145
2078	0.003	0.016	1.373	1.391	1.145
2079	0.003	0.016	1.375	1.393	1.145
2080	0.003	0.016	1.376	1.394	1.145
2081	0.003	0.016	1.377	1.395	1.145
2082	0.003	0.016	1.378	1.397	1.145
2083	0.003	0.016	1.379	1.397	1.145
2084	0.003	0.016	1.379	1.398	1.145
2085	0.003	0.016	1.379	1.398	1.145
2086	0.003	0.016	1.379	1.398	1.145
2087	0.003	0.016	1.379	1.398	1.145
2088	0.003	0.016	1.379	1.398	1.145
Present value of total earnings effects per $ of present value net program costs	0.04	0.05	2.69	2.78	3.14

NOTE: See Appendix B or Bartik (2006a) for methodology. These effects are for a typical state with typical out-migration patterns, baseline wages and employment rates, etc. Effects reflect cumulative earnings creation measured as cumulative increase in annual earnings rates of original residents who stay in state as of that year, as percent of total state earnings. Spending column shows impacts that take place due to increased taxing and spending for full-scale universal preschool. Parents column shows effects due to effects of program on parents of children enrolled in preschool. Children column shows effects associated with changes in educational attainment and economic status when former child participants become adults. Total effects for preschool are sum of these three types of effects. Total effects for business subsidy program are for business subsidy program with same present value of costs as a full-scale universal preschool program. Present value calculations use 3% discount rate, and project earnings effects forward after 2088. Original figures are found in Bartik (2006a); here they are updated to a program starting in 2009.

Table C1. Abecedarian Program Effects on State Job Creation: Effects as a Percentage of Total State Employment for Ongoing Full-Scale Program Started in 2009, Compared to Business Subsidy Program of Same Cost

	Abecedarian Program			Total for Abecedarian Program (%)	Total for Business Subsidy Program (%)
Year	Spending (%)	Parents (%)	Children (%)		
2009	0.017	0.045	0.000	0.062	0.101
2010	0.032	0.090	0.000	0.122	0.191
2011	0.045	0.136	0.000	0.181	0.270
2012	0.056	0.182	0.000	0.238	0.339
2013	0.066	0.229	0.000	0.294	0.397
2014	0.057	0.246	0.000	0.303	0.444
2015	0.050	0.264	0.000	0.314	0.489
2016	0.044	0.283	0.000	0.327	0.534
2017	0.040	0.302	0.000	0.342	0.577
2018	0.038	0.322	0.000	0.359	0.620
2019	0.037	0.341	0.000	0.378	0.660
2020	0.036	0.360	0.000	0.396	0.700
2021	0.035	0.380	0.000	0.415	0.738
2022	0.034	0.400	0.000	0.434	0.776
2023	0.033	0.419	0.000	0.452	0.811
2024	0.032	0.439	0.000	0.471	0.846
2025	0.031	0.452	0.000	0.483	0.879
2026	0.030	0.477	0.000	0.508	0.911
2027	0.029	0.497	0.000	0.527	0.942
2028	0.028	0.517	0.045	0.590	0.971
2029	0.027	0.536	0.091	0.655	0.999
2030	0.026	0.556	0.138	0.720	1.026
2031	0.025	0.575	0.182	0.782	1.052
2032	0.025	0.594	0.221	0.840	1.076
2033	0.024	0.613	0.257	0.893	1.099
2034	0.023	0.630	0.288	0.941	1.121
2035	0.022	0.648	0.316	0.985	1.142
2036	0.021	0.665	0.340	1.026	1.161
2037	0.020	0.682	0.364	1.066	1.179
2038	0.019	0.698	0.389	1.105	1.197
2039	0.018	0.714	0.413	1.144	1.213
2040	0.017	0.729	0.437	1.183	1.228
2041	0.016	0.744	0.461	1.221	1.242
2042	0.015	0.758	0.486	1.260	1.255
2043	0.015	0.772	0.511	1.297	1.266
2044	0.014	0.784	0.536	1.334	1.277
2045	0.013	0.796	0.561	1.371	1.287
2046	0.012	0.808	0.587	1.407	1.296
2047	0.011	0.819	0.613	1.444	1.305
2048	0.011	0.829	0.640	1.480	1.312
2049	0.010	0.839	0.667	1.516	1.319
2050	0.009	0.850	0.694	1.552	1.325
2051	0.009	0.859	0.720	1.588	1.330
2052	0.008	0.868	0.747	1.623	1.335

Table C1. (Continued)

Year	Abecedarian Program			Total for Abecedarian Program (%)	Total for Business Subsidy Program (%)
	Spending (%)	Parents (%)	Children (%)		
2053	0.008	0.877	0.773	1.657	1.339
2054	0.007	0.885	0.798	1.691	1.342
2055	0.007	0.893	0.823	1.723	1.345
2056	0.006	0.901	0.847	1.754	1.348
2057	0.006	0.908	0.870	1.784	1.350
2058	0.005	0.915	0.893	1.813	1.352
2059	0.005	0.922	0.914	1.841	1.353
2060	0.005	0.928	0.935	1.868	1.355
2061	0.005	0.934	0.955	1.894	1.356
2062	0.004	0.940	0.973	1.918	1.357
2063	0.004	0.945	0.990	1.939	1.357
2064	0.004	0.950	1.005	1.959	1.358
2065	0.004	0.954	1.019	1.978	1.358
2066	0.004	0.958	1.032	1.994	1.359
2067	0.004	0.961	1.045	2.010	1.359
2068	0.004	0.965	1.055	2.024	1.359
2069	0.004	0.964	1.065	2.033	1.360
2070	0.004	0.964	1.074	2.042	1.360
2071	0.003	0.963	1.083	2.049	1.360
2072	0.003	0.963	1.090	2.056	1.360
2073	0.003	0.962	1.096	2.062	1.360
2074	0.003	0.962	1.102	2.067	1.360
2075	0.003	0.961	1.106	2.071	1.360
2076	0.003	0.961	1.110	2.074	1.360
2077	0.003	0.960	1.114	2.077	1.360
2078	0.003	0.960	1.116	2.079	1.360
2079	0.003	0.959	1.118	2.081	1.360
2080	0.003	0.959	1.120	2.082	1.360
2081	0.003	0.958	1.121	2.082	1.360
2082	0.003	0.957	1.122	2.082	1.360
2083	0.003	0.957	1.122	2.082	1.360
2084	0.003	0.956	1.122	2.082	1.360
2085	0.003	0.956	1.122	2.081	1.360
2086	0.003	0.955	1.122	2.080	1.360
2087	0.003	0.954	1.122	2.079	1.360
2088	0.003	0.954	1.121	2.078	1.360

NOTES: See Appendix C for methodology. These effects are for typical state with typical out-migration patterns, baseline wages and employment rates, etc. Effects reflect cumulative job creation measured as cumulative increase in employment rates of original residents who stay in state as of that year, as percent of total state employment. Spending column shows impacts that take place due to increased taxing and spending for full-scale Abecedarian program. Parents column shows effects due to effects of program on parents of children enrolled in Abecedarian program. Children column shows effects associated with changes in educational attainment and economic status when former child participants become adults. These three types of effects added together equal total effects for the Abecedarian program. Effects for business subsidy program are for business subsidy program described in Bartik (2006a) of the same cost as a full-scale Abecedarian program.

Table C2. Abecedarian Program Effects on State Earnings Creation: Effects as a Percentage of Total State Wage and Salary Earnings for Ongoing Full-Scale Program Started in 2009, Compared to Business Subsidy Program of Same Cost

	Abecedarian program			Total for Abecedarian	Total for Business Subsidy
Year	Spending (%)	Parents (%)	Children (%)	Program (%)	Program (%)
2009	0.024	0.019	0.000	0.042	0.144
2010	0.046	0.039	0.000	0.084	0.277
2011	0.066	0.061	0.000	0.127	0.400
2012	0.085	0.086	0.000	0.170	0.512
2013	0.101	0.114	0.000	0.215	0.613
2014	0.093	0.129	0.000	0.222	0.703
2015	0.086	0.148	0.000	0.233	0.791
2016	0.080	0.170	0.000	0.250	0.878
2017	0.076	0.195	0.000	0.271	0.964
2018	0.073	0.223	0.000	0.296	1.047
2019	0.072	0.251	0.000	0.323	1.129
2020	0.071	0.281	0.000	0.352	1.209
2021	0.070	0.312	0.000	0.381	1.286
2022	0.068	0.344	0.000	0.412	1.362
2023	0.067	0.377	0.000	0.443	1.435
2024	0.065	0.410	0.000	0.475	1.505
2025	0.063	0.444	0.000	0.508	1.573
2026	0.061	0.479	0.000	0.541	1.639
2027	0.060	0.515	0.000	0.575	1.702
2028	0.058	0.551	0.014	0.623	1.763
2029	0.056	0.586	0.032	0.674	1.821
2030	0.054	0.622	0.051	0.727	1.876
2031	0.052	0.658	0.071	0.781	1.929
2032	0.050	0.693	0.095	0.838	1.979
2033	0.048	0.728	0.118	0.894	2.027
2034	0.046	0.761	0.140	0.947	2.072
2035	0.044	0.794	0.161	0.999	2.114
2036	0.042	0.826	0.182	1.050	2.155
2037	0.040	0.856	0.203	1.100	2.192
2038	0.038	0.887	0.226	1.151	2.227
2039	0.036	0.916	0.249	1.201	2.260
2040	0.034	0.944	0.274	1.252	2.291
2041	0.033	0.971	0.299	1.303	2.319
2042	0.031	0.997	0.325	1.353	2.346
2043	0.029	1.021	0.352	1.403	2.370
2044	0.027	1.043	0.381	1.451	2.392
2045	0.026	1.064	0.410	1.499	2.412
2046	0.024	1.083	0.440	1.547	2.430
2047	0.022	1.101	0.470	1.594	2.447
2048	0.021	1.118	0.502	1.641	2.461
2049	0.020	1.134	0.534	1.688	2.474
2050	0.018	1.149	0.567	1.734	2.486
2051	0.017	1.163	0.599	1.779	2.496
2052	0.016	1.175	0.633	1.823	2.505

Table C2. (Continued)

Year	Abecedarian program			Total for Abecedarian Program (%)	Total for Business Subsidy Program (%)
	Spending (%)	Parents (%)	Children (%)		
2053	0.014	1.186	0.666	1.866	2.512
2054	0.013	1.196	0.697	1.906	2.518
2055	0.012	1.204	0.729	1.946	2.524
2056	0.011	1.212	0.760	1.983	2.528
2057	0.011	1.219	0.790	2.019	2.532
2058	0.010	1.224	0.819	2.053	2.535
2059	0.009	1.229	0.847	2.085	2.537
2060	0.009	1.233	0.873	2.115	2.539
2061	0.008	1.237	0.898	2.144	2.541
2062	0.008	1.240	0.922	2.170	2.542
2063	0.008	1.242	0.944	2.194	2.544
2064	0.007	1.244	0.964	2.215	2.545
2065	0.007	1.245	0.982	2.234	2.545
2066	0.007	1.245	0.998	2.251	2.546
2067	0.007	1.246	1.014	2.266	2.546
2068	0.007	1.246	1.027	2.280	2.547
2069	0.007	1.245	1.039	2.291	2.547
2070	0.007	1.245	1.050	2.301	2.547
2071	0.006	1.244	1.059	2.310	2.547
2072	0.006	1.243	1.067	2.317	2.547
2073	0.006	1.242	1.075	2.323	2.547
2074	0.006	1.241	1.080	2.328	2.547
2075	0.006	1.240	1.085	2.332	2.547
2076	0.006	1.239	1.089	2.335	2.547
2077	0.006	1.238	1.092	2.337	2.547
2078	0.006	1.237	1.095	2.338	2.547
2079	0.006	1.236	1.096	2.338	2.547
2080	0.006	1.235	1.098	2.338	2.547
2081	0.006	1.233	1.098	2.338	2.547
2082	0.006	1.232	1.098	2.337	2.547
2083	0.006	1.231	1.098	2.335	2.547
2084	0.006	1.230	1.097	2.334	2.547
2085	0.006	1.229	1.097	2.332	2.547
2086	0.006	1.227	1.096	2.329	2.547
2087	0.006	1.226	1.094	2.327	2.547
2088	0.006	1.225	1.093	2.324	2.547
Present value of total earnings effects per dollar of present value net program costs	0.04	1.33	0.88	2.25	3.14

NOTES: See Appendix C for methodology. These effects are for typical state with typical out-migration patterns, baseline wages and employment rates, etc. Effects reflect cumulative earnings creation measured as cumulative increase in annual earnings rates of original residents who stay in state as of that year, as percent of total state earnings. Spending column shows impacts that take place due to increased taxing and spending for full-scale Abecedarian program. Parents column shows effects due to effects of program on parents of children enrolled in Abecedarian program. Children column shows effects associated with changes in educational attainment and economic status when former child participants become adults. Total effects for Abecedarian program are sum of these three types of effects. Total effects for business subsidy program are for business subsidy program with same present value of costs as a full-scale Abecedarian program. Present value calculations use 3% discount rate, and project earnings effects forward after 2088.

Table C3. Nurse Family Partnership (NFP) Program Effects on State Job Creation: Effects as a Percentage of Total State Employment for Ongoing Full-Scale Program Started in 2009, Compared to Business Subsidy Program of Same Cost

	NFP Program			Total for NFP	Total for Business
Year	Spending (%)	Parents (%)	Children (%)	Program (%)	Subsidy Program (%)
2009	0.003	0.000	0.000	0.003	0.009
2010	0.005	0.000	0.000	0.005	0.018
2011	0.007	0.001	0.000	0.008	0.025
2012	0.006	0.008	0.000	0.014	0.032
2013	0.005	0.015	0.000	0.020	0.037
2014	0.004	0.015	0.000	0.020	0.042
2015	0.004	0.015	0.000	0.019	0.046
2016	0.004	0.015	0.000	0.019	0.050
2017	0.004	0.015	0.000	0.019	0.054
2018	0.003	0.015	0.000	0.019	0.058
2019	0.003	0.015	0.000	0.019	0.062
2020	0.003	0.015	0.000	0.019	0.066
2021	0.003	0.015	0.000	0.019	0.070
2022	0.003	0.015	0.000	0.019	0.073
2023	0.003	0.015	0.000	0.018	0.076
2024	0.003	0.016	0.000	0.018	0.080
2025	0.003	0.017	0.000	0.020	0.083
2026	0.003	0.018	0.000	0.021	0.086
2027	0.003	0.020	0.002	0.024	0.089
2028	0.003	0.021	0.003	0.027	0.091
2029	0.002	0.023	0.005	0.031	0.094
2030	0.002	0.025	0.007	0.034	0.097
2031	0.002	0.026	0.009	0.038	0.099
2032	0.002	0.028	0.012	0.042	0.101
2033	0.002	0.029	0.015	0.046	0.103
2034	0.002	0.031	0.018	0.050	0.106
2035	0.002	0.032	0.021	0.055	0.107
2036	0.002	0.033	0.024	0.059	0.109
2037	0.002	0.035	0.028	0.064	0.111
2038	0.002	0.036	0.031	0.069	0.113
2039	0.002	0.037	0.035	0.074	0.114
2040	0.002	0.039	0.038	0.078	0.116
2041	0.001	0.040	0.042	0.083	0.117
2042	0.001	0.041	0.045	0.088	0.118
2043	0.001	0.042	0.049	0.092	0.119
2044	0.001	0.043	0.053	0.097	0.120
2045	0.001	0.044	0.056	0.101	0.121
2046	0.001	0.045	0.060	0.105	0.122
2047	0.001	0.045	0.063	0.110	0.123
2048	0.001	0.046	0.067	0.114	0.124
2049	0.001	0.047	0.070	0.118	0.124
2050	0.001	0.047	0.073	0.122	0.125
2051	0.001	0.048	0.076	0.125	0.125
2052	0.001	0.049	0.079	0.129	0.126

Table C3. (Continued)

Year	NFP Program			Total for NFP Program (%)	Total for Business Subsidy Program (%)
	Spending (%)	Parents (%)	Children (%)		
2053	0.001	0.049	0.082	0.132	0.126
2054	0.001	0.050	0.085	0.135	0.126
2055	0.001	0.050	0.087	0.138	0.127
2056	0.001	0.050	0.090	0.140	0.127
2057	0.001	0.051	0.092	0.143	0.127
2058	0.000	0.051	0.094	0.145	0.127
2059	0.000	0.051	0.096	0.147	0.127
2060	0.000	0.051	0.098	0.149	0.128
2061	0.000	0.051	0.099	0.151	0.128
2062	0.000	0.052	0.101	0.153	0.128
2063	0.000	0.052	0.102	0.154	0.128
2064	0.000	0.052	0.104	0.156	0.128
2065	0.000	0.052	0.105	0.157	0.128
2066	0.000	0.052	0.106	0.158	0.128
2067	0.000	0.052	0.107	0.159	0.128
2068	0.000	0.052	0.107	0.160	0.128
2069	0.000	0.052	0.108	0.160	0.128
2070	0.000	0.052	0.109	0.161	0.128
2071	0.000	0.052	0.109	0.161	0.128
2072	0.000	0.052	0.110	0.162	0.128
2073	0.000	0.052	0.110	0.162	0.128
2074	0.000	0.052	0.111	0.163	0.128
2075	0.000	0.052	0.111	0.163	0.128
2076	0.000	0.052	0.112	0.163	0.128
2077	0.000	0.051	0.112	0.164	0.128
2078	0.000	0.051	0.112	0.164	0.128
2079	0.000	0.051	0.112	0.164	0.128
2080	0.000	0.051	0.112	0.164	0.128
2081	0.000	0.051	0.112	0.164	0.128
2082	0.000	0.051	0.113	0.164	0.128
2083	0.000	0.051	0.113	0.164	0.128
2084	0.000	0.051	0.113	0.164	0.128
2085	0.000	0.051	0.113	0.164	0.128
2086	0.000	0.051	0.113	0.164	0.128
2087	0.000	0.051	0.113	0.164	0.128
2088	0.000	0.051	0.113	0.164	0.128

NOTES: See Appendix C for methodology. These effects are for typical state with typical out-migration patterns, baseline wages and employment rates, etc. Effects reflect cumulative job creation measured as cumulative increase in employment rates of original residents who stay in state as of that year, as percent of total state employment. Spending column shows impacts that take place due to increased taxing and spending for full-scale NFP program. Parents column shows effects due to effects of program on parents of children enrolled in NFP program. Children column shows effects associated with changes in educational attainment and economic status when former child participants become adults. Total for NFP program is sum of these three types of effects. Business subsidy effects are for business subsidy program with same present value of costs as NFP program.

Table C4. Nurse Family Partnership (NFP) Program Effects on State Earnings Creation: Effects as a Percentage of Total State Wage and Salary Earnings for Ongoing Full-Scale Program Started in 2009, Compared to Business Subsidy Program of Same Cost

	NFP Program				
Year	Spending (%)	Parents (%)	Children (%)	Total for NFP Program (%)	Total for Business Subsidy Program (%)
2009	0.004	0.000	0.000	0.004	0.014
2010	0.007	0.000	0.000	0.007	0.026
2011	0.010	0.000	0.000	0.011	0.038
2012	0.009	0.004	0.000	0.013	0.048
2013	0.009	0.007	0.000	0.016	0.058
2014	0.008	0.008	0.000	0.016	0.066
2015	0.007	0.008	0.000	0.016	0.074
2016	0.007	0.009	0.000	0.016	0.083
2017	0.007	0.010	0.000	0.017	0.091
2018	0.007	0.011	0.000	0.018	0.099
2019	0.007	0.012	0.000	0.018	0.106
2020	0.006	0.013	0.000	0.019	0.114
2021	0.006	0.014	0.000	0.020	0.121
2022	0.006	0.015	0.000	0.022	0.128
2023	0.006	0.017	0.000	0.023	0.135
2024	0.006	0.018	0.000	0.024	0.142
2025	0.006	0.021	0.000	0.026	0.148
2026	0.006	0.023	0.000	0.029	0.154
2027	0.005	0.026	0.001	0.032	0.160
2028	0.005	0.029	0.001	0.035	0.166
2029	0.005	0.031	0.002	0.038	0.171
2030	0.005	0.034	0.003	0.042	0.177
2031	0.005	0.037	0.004	0.046	0.182
2032	0.004	0.040	0.005	0.050	0.186
2033	0.004	0.043	0.007	0.054	0.191
2034	0.004	0.045	0.009	0.058	0.195
2035	0.004	0.048	0.011	0.063	0.199
2036	0.004	0.051	0.013	0.068	0.203
2037	0.004	0.053	0.016	0.073	0.206
2038	0.003	0.056	0.019	0.078	0.210
2039	0.003	0.058	0.021	0.083	0.213
2040	0.003	0.060	0.024	0.088	0.216
2041	0.003	0.062	0.028	0.093	0.218
2042	0.003	0.064	0.031	0.098	0.221
2043	0.003	0.066	0.034	0.103	0.223
2044	0.002	0.068	0.038	0.108	0.225
2045	0.002	0.070	0.042	0.113	0.227
2046	0.002	0.071	0.045	0.118	0.229
2047	0.002	0.072	0.049	0.123	0.230
2048	0.002	0.073	0.053	0.128	0.232
2049	0.002	0.074	0.056	0.132	0.233
2050	0.002	0.075	0.060	0.137	0.234
2051	0.001	0.076	0.063	0.141	0.235
2052	0.001	0.077	0.066	0.145	0.236

Table C4. (Continued)

Year	NFP Program			Total for NFP Program (%)	Total for Business Subsidy Program (%)
	Spending (%)	Parents (%)	Children (%)		
2053	0.001	0.078	0.070	0.149	0.237
2054	0.001	0.078	0.072	0.152	0.237
2055	0.001	0.079	0.075	0.155	0.238
2056	0.001	0.079	0.078	0.158	0.238
2057	0.001	0.080	0.080	0.161	0.238
2058	0.001	0.080	0.083	0.164	0.239
2059	0.001	0.080	0.085	0.166	0.239
2060	0.001	0.081	0.087	0.168	0.239
2061	0.001	0.081	0.089	0.170	0.239
2062	0.001	0.081	0.090	0.172	0.239
2063	0.001	0.081	0.092	0.174	0.239
2064	0.001	0.081	0.093	0.175	0.240
2065	0.001	0.081	0.094	0.176	0.240
2066	0.001	0.081	0.096	0.177	0.240
2067	0.001	0.081	0.096	0.178	0.240
2068	0.001	0.081	0.097	0.179	0.240
2069	0.001	0.081	0.098	0.180	0.240
2070	0.001	0.081	0.099	0.180	0.240
2071	0.001	0.081	0.099	0.181	0.240
2072	0.001	0.081	0.100	0.181	0.240
2073	0.001	0.081	0.100	0.181	0.240
2074	0.001	0.081	0.100	0.182	0.240
2075	0.001	0.081	0.101	0.182	0.240
2076	0.001	0.080	0.101	0.182	0.240
2077	0.001	0.080	0.101	0.182	0.240
2078	0.001	0.080	0.101	0.182	0.240
2079	0.001	0.080	0.102	0.182	0.240
2080	0.001	0.080	0.102	0.182	0.240
2081	0.001	0.080	0.102	0.182	0.240
2082	0.001	0.080	0.102	0.182	0.240
2083	0.001	0.080	0.102	0.182	0.240
2084	0.001	0.080	0.102	0.182	0.240
2085	0.001	0.080	0.102	0.182	0.240
2086	0.001	0.079	0.102	0.182	0.240
2087	0.001	0.079	0.102	0.182	0.240
2088	0.001	0.079	0.102	0.182	0.240
Present value of total earnings effects per dollar of present value net program costs	0.04	0.88	0.93	1.85	3.14

NOTES: See Appendix C for methodology. These effects are for typical state with typical out-migration patterns, baseline wages and employment rates, etc. Effects reflect cumulative earnings creation measured as cumulative increase in annual earnings rates of original residents who stay in state as of that year, as percent of total state earnings. Spending column shows impacts that take place due to increased taxing and spending for full-scale NFP program. Parents column shows effects due to effects of program on parents of children enrolled in NFP program. Children column shows effects associated with changes in educational attainment and economic status when former child participants become adults. Total for NFP is sum of these three types of effects. Total for business subsidy program is effect of business subsidy program of same present value of costs as full-scale NFP program. Present value calculations use 3% discount rate, and project earnings effects forward after 2088.

Table C5. Parent-Child Home Program (PCHP) Effects on State Job Creation: Effects as a Percentage of Total State Employment for Ongoing Full-Scale Program Started in 2009, Compared to Business Subsidy Program of Same Cost

Year	PCHP		Total for PCHP (%)	Total for Business Subsidies (%)
	Spending (%)	Children (%)		
2009	0.001	0.000	0.001	0.003
2010	0.002	0.000	0.002	0.005
2011	0.002	0.000	0.002	0.007
2012	0.002	0.000	0.002	0.009
2013	0.001	0.000	0.001	0.010
2014	0.001	0.000	0.001	0.012
2015	0.001	0.000	0.001	0.013
2016	0.001	0.000	0.001	0.014
2017	0.001	0.000	0.001	0.015
2018	0.001	0.000	0.001	0.016
2019	0.001	0.000	0.001	0.017
2020	0.001	0.000	0.001	0.018
2021	0.001	0.000	0.001	0.019
2022	0.001	0.000	0.001	0.020
2023	0.001	0.000	0.001	0.021
2024	0.001	0.000	0.001	0.022
2025	0.001	0.000	0.001	0.023
2026	0.001	0.002	0.003	0.024
2027	0.001	0.004	0.005	0.025
2028	0.001	0.006	0.007	0.025
2029	0.001	0.009	0.009	0.026
2030	0.001	0.011	0.012	0.027
2031	0.001	0.013	0.014	0.028
2032	0.001	0.016	0.016	0.028
2033	0.001	0.018	0.019	0.029
2034	0.001	0.021	0.021	0.029
2035	0.001	0.023	0.024	0.030
2036	0.000	0.026	0.026	0.030
2037	0.000	0.028	0.029	0.031
2038	0.000	0.031	0.031	0.031
2039	0.000	0.033	0.034	0.032
2040	0.000	0.036	0.036	0.032
2041	0.000	0.039	0.039	0.032
2042	0.000	0.041	0.042	0.033
2043	0.000	0.044	0.044	0.033
2044	0.000	0.046	0.047	0.033
2045	0.000	0.049	0.049	0.034
2046	0.000	0.052	0.052	0.034
2047	0.000	0.054	0.055	0.034
2048	0.000	0.057	0.057	0.034
2049	0.000	0.060	0.060	0.035
2050	0.000	0.062	0.062	0.035
2051	0.000	0.065	0.065	0.035
2052	0.000	0.067	0.067	0.035

Table C5. (Continued)

Year	PCHP Spending (%)	PCHP Children (%)	Total for PCHP (%)	Total for Business Subsidies (%)
2053	0.000	0.069	0.070	0.035
2054	0.000	0.072	0.072	0.035
2055	0.000	0.074	0.074	0.035
2056	0.000	0.076	0.076	0.035
2057	0.000	0.078	0.078	0.035
2058	0.000	0.080	0.080	0.035
2059	0.000	0.081	0.082	0.035
2060	0.000	0.083	0.083	0.035
2061	0.000	0.085	0.085	0.035
2062	0.000	0.086	0.086	0.036
2063	0.000	0.087	0.087	0.036
2064	0.000	0.089	0.089	0.036
2065	0.000	0.090	0.090	0.036
2066	0.000	0.091	0.091	0.036
2067	0.000	0.092	0.092	0.036
2068	0.000	0.093	0.093	0.036
2069	0.000	0.093	0.093	0.036
2070	0.000	0.094	0.094	0.036
2071	0.000	0.095	0.095	0.036
2072	0.000	0.095	0.095	0.036
2073	0.000	0.096	0.096	0.036
2074	0.000	0.096	0.096	0.036
2075	0.000	0.097	0.097	0.036
2076	0.000	0.097	0.097	0.036
2077	0.000	0.097	0.097	0.036
2078	0.000	0.098	0.098	0.036
2079	0.000	0.098	0.098	0.036
2080	0.000	0.098	0.098	0.036
2081	0.000	0.098	0.098	0.036
2082	0.000	0.098	0.098	0.036
2083	0.000	0.098	0.098	0.036
2084	0.000	0.098	0.098	0.036
2085	0.000	0.098	0.098	0.036
2086	0.000	0.098	0.098	0.036
2087	0.000	0.098	0.098	0.036
2088	0.000	0.098	0.098	0.036

NOTES: See Appendix C for methodology. These effects are for typical state with typical out-migration patterns, baseline wages and employment rates, etc. Effects reflect cumulative job creation measured as cumulative increase in employment rates of original residents who stay in state as of that year, as percent of total state employment. Spending column shows impacts that take place due to increased taxing and spending for full-scale PCHP. Children column shows effects associated with changes in educational attainment and economic status when former child participants become adults. Unlike the Abecedarian program and the NFP program, no parents column is included, as there are no available estimates of the effects of PCHP on parents. PCHP total sums spending and child effects. Business subsidy total is for business subsidy program of same present value of costs as a full-scale PCHP.

Table C6. Parent-Child Home Program (PCHP) Effects on State Earnings Creation: Effects as a Percentage of Total State Earnings for Ongoing Full-Scale Program Started in 2009, Compared to Business Subsidy Program of Same Cost

Year	PCHP		Total for PCHP (%)	Total for Business Subsidy Program (%)
	Spending (%)	Children (%)		
2009	0.002	0.000	0.002	0.004
2010	0.003	0.000	0.003	0.007
2011	0.003	0.000	0.003	0.010
2012	0.002	0.000	0.002	0.013
2013	0.002	0.000	0.002	0.016
2014	0.002	0.000	0.002	0.018
2015	0.002	0.000	0.002	0.021
2016	0.002	0.000	0.002	0.023
2017	0.002	0.000	0.002	0.025
2018	0.002	0.000	0.002	0.027
2019	0.002	0.000	0.002	0.030
2020	0.002	0.000	0.002	0.032
2021	0.002	0.000	0.002	0.034
2022	0.002	0.000	0.002	0.036
2023	0.002	0.000	0.002	0.038
2024	0.002	0.000	0.002	0.039
2025	0.002	0.000	0.002	0.041
2026	0.002	0.001	0.002	0.043
2027	0.001	0.002	0.003	0.045
2028	0.001	0.003	0.005	0.046
2029	0.001	0.005	0.006	0.048
2030	0.001	0.007	0.008	0.049
2031	0.001	0.009	0.011	0.050
2032	0.001	0.012	0.013	0.052
2033	0.001	0.015	0.016	0.053
2034	0.001	0.018	0.019	0.054
2035	0.001	0.021	0.022	0.055
2036	0.001	0.025	0.026	0.056
2037	0.001	0.029	0.030	0.057
2038	0.001	0.034	0.035	0.058
2039	0.001	0.038	0.039	0.059
2040	0.001	0.043	0.044	0.060
2041	0.001	0.048	0.049	0.061
2042	0.001	0.054	0.054	0.061
2043	0.001	0.059	0.060	0.062
2044	0.001	0.065	0.065	0.063
2045	0.001	0.071	0.071	0.063
2046	0.001	0.076	0.077	0.064
2047	0.001	0.082	0.083	0.064
2048	0.000	0.088	0.089	0.064
2049	0.000	0.094	0.095	0.065
2050	0.000	0.100	0.101	0.065
2051	0.000	0.106	0.106	0.065

Table C6. (Continued)

Year	PCHP Spending (%)	PCHP Children (%)	Total for PCHP (%)	Total for Business Subsidy Program (%)
2052	0.000	0.112	0.112	0.066
2053	0.000	0.117	0.117	0.066
2054	0.000	0.122	0.122	0.066
2055	0.000	0.127	0.127	0.066
2056	0.000	0.132	0.132	0.066
2057	0.000	0.136	0.136	0.066
2058	0.000	0.140	0.141	0.066
2059	0.000	0.144	0.145	0.066
2060	0.000	0.148	0.148	0.066
2061	0.000	0.151	0.152	0.066
2062	0.000	0.154	0.155	0.067
2063	0.000	0.157	0.157	0.067
2064	0.000	0.160	0.160	0.067
2065	0.000	0.162	0.162	0.067
2066	0.000	0.164	0.164	0.067
2067	0.000	0.166	0.166	0.067
2068	0.000	0.167	0.168	0.067
2069	0.000	0.169	0.169	0.067
2070	0.000	0.170	0.171	0.067
2071	0.000	0.172	0.172	0.067
2072	0.000	0.173	0.173	0.067
2073	0.000	0.173	0.174	0.067
2074	0.000	0.174	0.174	0.067
2075	0.000	0.175	0.175	0.067
2076	0.000	0.175	0.176	0.067
2077	0.000	0.176	0.176	0.067
2078	0.000	0.176	0.176	0.067
2079	0.000	0.176	0.177	0.067
2080	0.000	0.177	0.177	0.067
2081	0.000	0.177	0.177	0.067
2082	0.000	0.177	0.177	0.067
2083	0.000	0.177	0.177	0.067
2084	0.000	0.177	0.177	0.067
2085	0.000	0.177	0.177	0.067
2086	0.000	0.177	0.177	0.067
2087	0.000	0.177	0.177	0.067
2088	0.000	0.177	0.177	0.067
Present value of earnings effects of program per present value dollar of costs	0.04	5.62	5.66	3.14

NOTES: See Appendix C for methodology. These effects are for typical state with typical out-migration patterns, baseline wages and employment rates, etc. Effects reflect cumulative earnings creation measured as cumulative increase in annual earnings of original residents who stay in state as of that year, as percent of total state earnings. Spending column shows impacts that take place due to increased taxing and spending for full-scale PCHP. Children column shows effects associated with changes in educational attainment and economic status when former child participants become adults. Unlike the Abecedarian program and the NFP program, no parents column is included, as there are no available estimates of effects of PCHP on parents. The total effects for PCHP sum the spending effects and child effects. Total for business subsidy program is effect of business subsidy program of same present value of costs as full-scale PCHP. Present value calculations use 3% discount rate, and project earnings effects forward after 2088.

Table D1: Effects of Alternative Discount Rate Assumptions on Ratio of Present Value of Program Earnings Effects to Costs, Business Subsidies and Four Early Childhood Programs, State Perspective

	Discount rate assumption of this author:				
	Stern	Moore et al.	This report	Nordhaus	Weitzman
Implied discount rate on aggregate future earnings (%)	1.6	2.2	3.0	3.9	4.4
Ratio of Present value of earnings effects to costs for:					
Business subsidies	4.01	3.60	3.14	2.72	2.52
Universal preschool	4.46	3.62	2.78	2.10	1.82
Abecedarian	1.59	2.54	2.25	1.88	1.71
Nurse Family Partnership	1.88	2.23	1.85	1.49	1.33
Parent-Child Home Program	6.29	7.31	5.66	4.17	3.53

NOTES: See Appendix D for methodology and references. All ratios here are from state perspective.

Table D2: Annual Rate of Return to Business Subsidies, Four Early Childhood Programs, and Various Combinations of These Programs, From Both a State and National Perspective

Program	Annual Rate of Return, State Perspective	Annual Rate of Return, National Perspective
Business subsidies	12.6	0.7
Universal preschool	6.7	7.7
Abecedarian	7.7	9.1
Nurse Family Partnership	5.7	6.9
Parent-Child Home Program	8.6	9.9
Preschool conditional on Abecedarian	4.4	5.4
Abecedarian conditional on preschool	6.5	8.1
Both preschool and Abecedarian	6.6	7.9

NOTE: This table shows the highest interest rate at which the present value of earnings effects of the program exceeds the present value of program costs. The last row shows the rate of return to adopting both preschool and the Abecedarian program. The two previous rows show effects of adopting one of these programs, conditional on the other program already existing.