2009

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Timothy J. Bartik
W.E. Upjohn Institute, bartik@upjohn.org

Upjohn Institute Working Paper No. 09-150

****Published Version****

In Investing in Kids: Early Childhood Programs and Local Economic Development, Timothy J. Bartik. 2011. Kalamazoo, MI: W.E. Upjohn Institute for Employment Research, pp. 175-217. Under title Bringing the Future into the Present: How Policymakers Should Deal with the Delayed Benefits of Early Childhood Programs

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Timothy J. Bartik
Senior Economist
The W.E. Upjohn Institute for Employment Research
e-mail: bartik "at" upjohn.org

June 2009

ABSTRACT

This chapter is a draft of Chapter 7 of a planned book, *Preschool and Jobs: Human Development as Economic Development, and Vice Versa*. This book analyzes early childhood programs' effects on regional economic development. Four early childhood programs are considered: 1) universally accessible preschool for four-year-olds of similar quality to the Chicago Child Parent Center program; 2) the Abecedarian program, which provides disadvantaged children with high-quality child care and preschool from infancy to age five; 3) the Nurse Family Partnership, which provides low-income first-time mothers with nurse home visitors from the prenatal period until the child is age two; and 4) the Parent Child-Home program, which provides home visits and educational toys and books to disadvantaged families when the child is between the ages of 2 and 3.

The book considers the main benefit of state economic development to be the resulting increase in earnings of the original residents who stay in that state. Early childhood programs increase residents' earnings largely by increasing the quantity and quality of local labor supply. These programs will increase the employability and wages of former child participants in these programs. The book compares the effects on local earnings of early childhood programs with the effects of business incentives (e.g., property tax abatements). Business incentives increase local residents' earnings by increasing the quantity and/or quality of local labor demand.

This chapter considers a problem with early childhood programs: their effects on earnings are mostly long-delayed. The delay occurs because most earnings effects are on former child participants. The chapter considers appropriate discounting of benefits. The chapter considers how the upfront costs of early childhood programs can be delayed or reduced. The chapter considers how the long-run benefits of early childhood programs can be moved up or increased.

JEL Classification Codes: J13, J24, I21, R23, R31, R30

I thank Wei-Jang Huang, Claire Black, and Linda Richer for assistance with this book. I also thank the Pew Charitable Trusts for financial assistance for some of the research that led to this book. The findings and opinions of this book are those of the author, and should not be construed as reflecting official views of Pew or the Upjohn Institute.

As discussed in Chapter 4, early childhood education programs have a different timing of economic development benefits than business incentives. Business incentives deliver sizable economic development benefits almost immediately. Jobs are attracted, which immediately increases employment rates and upgrades many state residents to better jobs. In contrast, most benefits of early childhood programs are long delayed. There are some economic development benefits in the short term. Free child care and other services to parents increase parental labor supply. Spending more money stimulates the state economy. But these short-term economic development benefits are modest. During the years right after these programs are begun, earnings of state residents go up by only 20 to 30 percent of program costs. Annual earnings effects of these programs do not exceed annual costs until at least 20 years later. (Figure 7.1, which reproduces Figure 4.2, shows the time pattern of effects.) These delays in benefits occur because so much of the benefits are due to the improved the adult labor supply of former child participants. Better child development's benefits are only achieved in the long run.

The delayed benefits from early childhood programs raise two issues. First, how should policymakers weight future benefits versus current costs? I will argue that policymakers should not discount future benefits too much. However, policymakers often do drastically discount or disregard social benefits that are in the future. This leads to the second issue. Given that policymakers discount the future too much, what can be done to encourage policymakers to adopt early childhood programs? How can we get policymakers to adopt programs that are socially beneficial but politically unattractive because their benefits are delayed? Various approaches will be discussed to making such programs more attractive. We can work on costs. Short-run costs can be postponed or reduced. Alternatively, we can work on benefits. Long-run benefits can be shifted towards the present. Short-run benefits can be increased.

DISCOUNTING

What social discount rate should be used for evaluating public policies? This question has been extensively debated in the economics literature. Recently, the debate over discount rates has been re-ignited in discussing environmental issues. Environmental issues such as global warming often involve trade-offs between short-run costs and long-run environmental benefits. The discount rate used to compare future benefits with current costs makes a big difference in whether specific policies pass a benefit cost test. Low social discount rates support stringent environmental policies. High social discount rates support lax environmental policies.

For this book, I assume we are determining a discount rate for comparing consumption over time. What is the value of a dollar of consumption a year from now, or 10 or 30 years from now, compared to a dollar of consumption today?[1]

The relative value of future consumption versus current consumption should depend on several factors. First, it should depend on how fast one expects per capita consumption to increase. If per capita consumption will increase more rapidly over time, then people in the future will have higher per capita consumption. Other things equal, this reduces the social value of an extra dollar of consumption in the future versus a dollar today. Extra consumption for relatively rich future persons is not worth as much as extra consumption for relatively poor current persons. Second, the value of future versus current consumption should depend on how one assumes the social value of extra consumption declines with higher per capita consumption. Most economic models assume some growth of per capita consumption over time. If one assumes that the value of an extra dollar of consumption dramatically declines as per capita consumption declines, then future changes in consumption should be downweighted more heavily. Third, it is possible that there is some inherent bias toward current consumption over future consumption. Even if per capita consumption did not increase over time, it is possible that many people would value a dollar of consumption today more than a dollar of consumption in the future.[2]

The discount rates used in this book should be compatible with the growth rate of per capita consumption that I assume. For this book, I assumed a rate of growth of real wages (and hence per capita consumption) of 1.2 percent per year. We could assume different rates of per capita consumption growth. But then we would need to adjust future earnings flows as well. For this discussion, I hold real wage growth and per capita consumption growth constant at 1.2 percent per year.

However, there are many possible assumptions about how rapidly the social value of consumption declines as per capita consumption increases. There are also different assumptions about how much the present should be inherently preferred to the past, even if per capita consumption were the same.

The debate over global warming has involved different assumptions about these determinants of discount rates. Sir Nicholas Stern, the lead author of the well-known Stern Review prepared for the British government on policy toward global warming, adopted assumptions that led to a relatively low discount rate. Some of the American critics of the Stern Review, such as economists William Nordhaus and Martin Weitzman, adopted assumptions that led to somewhat higher discount rates.

In addition, the lead American academic journal on public policy recently published an article that made other assumptions about discount rates. The article was titled "Just Give Me a Number! Practical Values for the Social Discount Rate" (Moore et al. 2004). The article tries to provide assumptions that would lead to some consensus on the social discount rate.

For the current book, I explored how it makes a difference to follow all these varying assumptions about discount rates. However, I adjusted all these discount rates to this book's assumption of a 1.2 percent annual growth rate in real wages. Under that wage growth scenario, the Stern Review's assumptions imply a social discount rate of less than 2 percent. The Nordhaus and Weitzman assumptions imply social discount rates of 3.9 percent and 4.4 percent. The Moore et al. assumptions imply a social discount rate of 2.2 percent. Finally, this book's baseline estimates assumed a social discount rate of 3 percent.

How do these discount rates affect the benefits and costs of business incentives and early childhood programs? Table 7.1 shows ratios of benefits to costs for these programs under various discount rates. Two points about these results: first, as one would expect, the higher discount rates of Nordhaus or Weitzman make the early childhood programs look somewhat worse relative to business incentives. Higher discount rates mean that the future adult earnings of former child participants are not weighted as highly. Second, under all these discount rates, the present value of increased earnings for state residents exceeds the cost of the program. Therefore, even under assumptions that yield relatively high discount rates, these early childhood education programs still make sense. Benefits for former child participants are so large that even high discount rates do not make these benefits unimportant.

Another possible way to analyze these different policies is in terms of their "rate of return." The "rate of return" of a proposed public policy is the maximum discount rate at which the project is still worth pursuing. This maximum rate of return helps reveal whether the project would be worth doing under more extreme assumptions about appropriate discount rates. As is well-known in benefit cost analysis, this "rate of return" should not be used to rank projects. The present value, calculated using the correct discount rate, should be used to rank projects. The discount rate's purpose is to give the correct value of consumption at different points of time.

Table 7.2 shows these rate of return calculations. Business incentives and early childhood programs are all worth doing unless social discount rates exceed 6 percent or so. Such high discount rates are implausible.

This discussion focuses on what policymakers should do. Research on the social discount rate suggests that policymakers should discount the future, but not too much. Therefore, policymakers should be willing to implement early childhood programs, even though much of their benefits are far in the future.

Unfortunately, this is probably not the way many state, local, and federal policymakers actually view the world. These early childhood education programs do not have benefits exceeding costs for the

remaining political career of most policymakers. In the short run, while the policymakers considering these programs are in office, these early childhood programs have benefits that fall far short of costs.

It is quite possible that many policymakers have implicit discount rates that exceed 10 percent. Research by Larry Summers and James Poterba in 1994 suggests that corporate executives have discount rates when they evaluate investment projects of 12 percent. Government policymakers might be at least as short-sighted. If policymakers' discount rates are 10 percent or greater, the value of the earnings benefits from early childhood programs will fall short of these programs' costs.

Can anything be done to change the net benefits of early childhood programs, as perceived by policymakers? We could simply argue for adopting a long-term perspective. However, changing such underlying attitudes is difficult. Political pressures encourage policymakers to worry about reelection.

A more politically feasible alternative is to adjust the benefits and costs of early childhood programs to increase their short-term payoff. Short-term costs can be postponed or otherwise reduced. Long-term benefits can be shifted toward the short term, or short-term benefits can be otherwise increased. The rest of this chapter considers the options for increasing the short-term economic development payoff of early childhood programs.

REDUCING SHORT-RUN COSTS: POSTPONING COSTS THROUGH BORROWING

One obvious way to reduce short-run costs of early childhood programs is to finance the programs through borrowing. Borrowing delays program costs, allowing the timing of costs to better match the timing of economic development benefits.

Borrowing is generally accepted as a way for the government to pay for "physical capital": roads, public buildings, prisons. The rationale for this borrowing is that it allows the costs of building or rehabilitating physical capital to be better matched to the stream of benefits from such capital. For

example, building a new highway has large up-front costs. Yet its benefits will be received for many years to come.

Allowing borrowing for early childhood programs would put these programs on a more level playing field with business incentives. Business incentive programs can postpone many of their costs by promising future incentives to business. Because these programs can postpone costs, they become more attractive to policymakers.

However, most state constitutions severely restrict public borrowing, except for the building or redevelopment of tangible physical capital. In most states, it would be illegal for the government to sell a 30-year bond to pay for early childhood education.

State and local governments have come up with creative ways of borrowing to get around these constitutional restrictions. States have sometimes securitized streams of revenues they will receive from dedicated sources. For example, states have sold off revenues they will receive from the settlement with tobacco companies to finance public programs (Sindelar and Falba 2004; Scheppach 2003). Some states have sold off the rights to collect tolls on a public highway to finance public programs (Burwell and Puentes 2009).

In economic development policy, one common program is tax increment financing (TIF) (Dye and Merriman 2006). In a TIF, the increase in property tax revenue in a particular geographic area is dedicated to a special TIF fund. For example, this geographic area might be a downtown area. This dedicated revenue can only be used for purposes determined by the authority overseeing the TIF district. It is common to use TIF revenues as backing for bonds that are sold to finance various public improvements in the TIF district. For example, in a downtown area, the TIF revenues might be used to finance parking ramps, or for marketing the downtown.

TIFs are being used in more creative ways. Of particular relevance here is that TIFs are starting to be used for educational programs. Michigan recently passed a “Promise Zone” law, which was inspired by the Kalamazoo Promise. Under the Kalamazoo Promise, private donors guaranteed to pay up to four

years of tuition at Michigan public universities and community colleges for all graduates of Kalamazoo Public Schools. The Michigan "Promise Zone" law allows for TIF zones to be created to help finance similar programs in other areas of Michigan. A school district or some other local government can develop a plan to provide free college tuition to all students within the district or government jurisdiction. If this plan is approved by the state of Michigan, the plan can in part be funded by TIFs. The tax increment received by a school district or other local government jurisdiction would be diverted from the state education property tax in that designated area. The plan would receive the state education property tax revenue from the increase in property values in the designated area.

Similar TIFs could be created to finance early childhood education. Some portion of the increment in a tax's revenue could be dedicated to a fund to support early childhood education. The incremental tax revenue would not have to necessarily be property tax revenue. Early childhood TIFs could be financed with incremental revenue from the sales tax or income tax. The dedicated revenue in that fund could be used to support bond issues to pay the upfront costs of early childhood education.

What objections might be raised to borrowing for early childhood education? One is that borrowing only makes sense if the early childhood education does produce sizable future benefits. If the early childhood program does not produce sizable long-run benefits, then it would be a mistake to borrow to pay its costs.

A second objection is that allowing borrowing for operating costs of public programs, even highly desirable programs, might lead to abuses. There are good historical reasons why state constitutions often restrict public borrowing. In the early nineteenth century, American states were extraordinarily active in borrowing. This borrowing was often used to support corporations that promoted state economic development, such as investments in canals, railroads, and banks. However, this large-scale borrowing led to eight states defaulting on their debts during the economic downturn of the 1840s. Subsequent state constitutional amendments put significant limitations on state debt issuance and investment in corporations (Wallis 2000).

A third objection is that the current period does not seem the most favorable time to expand any entity's ability to issue debt. The recession that began in 2008 is widely attributed to excessive promotion of overly risky debt by many different financial institutions and government agencies. The financial system might not be ready for new forms of government financing. The political winds might not support such government borrowing.

It is somewhat disconcerting that a few years ago, Citigroup was promoting financing early childhood education with debt financing. In October 2006, the managing director of the Student Loan Group of Citigroup made a presentation to a group of early childhood advocates on this topic (Sheldon 2006). According to the meeting summary, the Citigroup director pointed out that "because early care education spending is a capital formation expenditure …, an optimal way for society to pay for ECE costs would be to match the repaying of cash to the time when benefits are received … He proposed this might be accomplished via a financing mechanism similar to the federal government's student loan program … [U]nder such an arrangement, the same entities (parents, federal, and state governments) that currently pay for early education would be responsible to pay under [this new financing] proposal" (Invest in Kids/PAES 2006). These are all cogent points. However, now does not seem the best time for new creative financing schemes.

REDUCING SHORT-RUN COSTS: POSSIBLE OFFSETS FROM REDUCED SPECIAL ED COSTS

One significant short-run cost offset to early childhood programs is reduced special education costs. High-quality early childhood education programs have been shown to significantly reduce the percentage of students in K–12 special education. For example, the Perry Preschool Program reduced special ed. assignments for mental impairment from 35 percent in the control group to 15 percent in the treatment group (Schweinhart et al. 2005). Reductions of about half as much in special ed. assignments were found in the Chicago Child Parent Center program: 25 percent to 14 percent (Reynolds et al. 2002).

The more intensive and more expensive Abecedarian program had somewhat larger effects on special ed. assignments: 48 percent to 25 percent (Masse and Barnett 2002).[3]

Reducing special ed. assignments even modestly can yield significant cost savings. Special education is expensive. It is estimated that special ed. assignment costs an average of over $10,000 per year per special ed. student. This is an extra $10,000 cost above regular education costs (Parrish et al. [2004, Part II]; updated to 2007 dollars using the CPI). These special education costs can extend over many years, from kindergarten through high school (and even beyond in some cases). Because special education costs so much per year and extends for many years, the cost savings from reducing special education assignments can be large.

Early childhood education might also cause other savings for the education system, social welfare system and criminal justice system. However, in the present context, we are focusing on cost savings that are short term. Reducing grade retention saves costs only in the long run. The savings from reduced criminal activity also take many years to be realized. Savings in child welfare costs from reduced abuse and neglect cases may be more immediate. However, the evidence suggests that such savings for the child welfare system are small relative to special education cost savings. For example, for the Chicago Child Parent Center program, cost savings for the child welfare system are only 11 percent of estimated cost savings from reduced special education costs (Reynolds et al. 2002). Estimates for the Nurse Family Partnership also suggest modest fiscal savings from reduced child welfare system costs (Aos et al. 2004, Technical Appendix, p. 96).

I added reduced special education costs into my simulation model of universal preschool and a full-scale Abecedarian program. I used this revised simulation model to recalculate the flows of benefits versus costs of these programs over time. This revised simulation model calculates "net costs" of these early childhood programs for each time period. These net costs subtract out the reduced special education costs.[4]

Figures 7.2 and 7.3 show the results.[5] As the figures show, the ratio of economic development benefits to net costs increase significantly. Calculations suggest that the ratio of the present value of earnings benefits for state residents, to net fiscal costs, increases from 2.78 to 4.24 for universal preschool. For the Abecedarian program, this ratio increases from 2.25 to 3.21.

However, the short-term perspective on these programs only modestly improves. For example, under these revised calculations which consider reduced special education costs, it takes 20 years after universal preschool is implemented for annual economic development benefits to exceed annual net costs. (In terms of the figure, this happens when the ratio of annual economic development benefits to net costs exceeds one.) This is an improvement over the baseline calculations. In the baseline calculations, it took 24 years for economic development benefits to exceed costs. However, 20 years is still a long time for economic development benefits to dominate costs.

In addition, during the first 10 years or so, the ratio of benefits to net costs only modestly improves due to considering special ed. cost savings. For example, 10 years after the universal preschool program is begun, annual benefits are 17 percent of net costs, up from 16 percent in the original simulation.

For the Abecedarian program, under these revised calculations, it takes 16 years for annual economic development benefits to exceed annual net costs. In the baseline calculations, it took 21 years. Sixteen years is a long time to wait for annual economic development benefits to exceed costs.

In addition, 10 years after a full-scale Abecedarian program is begun, annual economic development benefits are 54 percent of net costs. This is only up modestly from the 47 percent figure calculated before, which did not consider special education cost savings.

In sum, even when special ed. cost savings are considered, early childhood programs are only attractive to policymakers with the patience needed to take a long-term perspective.

REDUCING SHORT-RUN GOVERNMENT COSTS: FINANCING PRESCHOOL OUT OF THE K–12 SCHOOL BUDGET

Obviously universal preschool or other early childhood programs could be financed without increasing taxes or borrowing. Some other spending category could be reduced. This budget reallocation would promote state economic development if this other spending category has lower economic development benefits than high-quality preschool.

Politically, the most likely spending cut to finance universal preschool would be cutting K–12 spending. Local school districts are likely sponsors of preschool. If they choose to finance universal preschool, and voters are not inclined to increase taxes, then the universal preschool's costs are implicitly being financed by reduced K–12 spending. At the state level, state governments frequently have special funds for support for public education spending. In addition, public education spending proposals are often considered together as part of a particular appropriation bill. Public education spending proposals often are considered together by the same committee. In this political process, achieving increased funding for high-quality preschool may involve some reduction in K–12 spending. This reduction may be explicit or it may be implicit. Because of expanded preschool spending, K–12 spending may not increase as fast as it otherwise would. However, it would be politically naive to deny the possibility of a political trade-off between preschool funding and K–12 funding.

This political trade-off does not reflect any necessary logical consequence of increased preschool spending. Increased preschool spending can logically be financed by cutting any spending category, not just K–12 spending. We can increase preschool spending without increasing taxes or government borrowing by cutting such budget categories as prisons, Medicaid, state employee benefits, etc. However, these logical possibilities are less politically likely than financing universal preschool through reduced K–12 spending.

Suppose we did finance 100 percent of the costs of universal preschool through reduced K–12 spending. Then this budget reallocation would have no net government spending cost. The short-term tax

costs of increasing preschool spending are eliminated. State policymakers need not worry about proposing tax increases to pay for universal preschool.

But what would be the consequences of this budget reallocation for state economic development? Universal preschool increases state economic development largely by increasing the earnings of former child participants. K–12 education has similar types of effects on state economic development. The quality of K–12 education affects the earnings of former students. The quantity and quality of the labor supply of former K–12 students who stay in the state will affect the state's economic development. A cut in K–12 spending may damage the quality of K–12 education, which will adversely affect state economic development. If universal preschool is funded, but K–12 spending is cut, which of these policy changes will dominate the state's future economic development? Will state residents' earnings increase or decrease?

To address these questions, I used this book's simulation model to estimate the economic development benefits from reallocating K–12 spending to universal preschool. To do so, I needed an estimate of how reductions in K–12 spending will affect the earnings of former students.

For the initial simulations, I used extreme estimates of how large the effects of cutting K–12 spending could be. I used estimates derived from economist Alan Krueger's estimates of how spending on reduced class size in grades K–2 affected future earnings (Krueger 2003).

Krueger's estimates are derived from the Tennessee Class Size Study. This study was a random assignment study in which students were randomly assigned to either "normal" K–2 classes that averaged 22 students or "experimental" lower class sizes that averaged 15 students. The study estimated effects of this lower class size on early elementary test scores. Krueger used these test score effects to estimate effects on future earnings. For his benefit-cost analysis, he also estimated what percentage increase in K–2 spending was needed to achieve these results. Under reasonable assumptions, lower K–2 class sizes clearly passed a benefit-cost test. For example, under discount rate and wage growth assumptions similar

to this book's assumptions, the present value of future earnings benefits are about three times the extra K–12 spending costs.[6]

Suppose we use Krueger's estimates to estimate the earnings effects of all changes in K–12 spending. Krueger's estimates imply that a 1 percent decrease (increase) in K–12 spending that occurs for one year of a student's K–12 career will decrease (increase) their future earnings by 0.03 percent. This is derived by assuming the earnings effects of any change in K–12 spending will be the same as the earnings effects of changes in spending on smaller class sizes in grades K–2.[7]

I regard this as an extreme estimate of the effects of lower K–12 spending for several reasons. First, not everyone accepts Krueger's estimates. For example, there is an ongoing dispute between Krueger and other education researchers such as Eric Hanushek about whether K–12 class size and spending has effects as large as those estimated by Krueger (Krueger 2002; Hanushek 2002). Second, even if we accept Krueger's estimates, it is unlikely that most changes in K–12 spending have as large an effect on student learning and future earnings as K–2 class size. Therefore, there are less damaging ways to cut the K–12 budget than increasing K–2 class size. As a result, we would expect the future earnings effects of an optimal cut in the K–12 budget to be less than the effects estimated by Krueger for K–2 class size.

Financing universal preschool is estimated to cost 3.5 percent of the K–12 budget.[8] Therefore, the simulations consider the economic development effects of implementing universal preschool by cutting the K–12 budget by 3.5 percent.

Many effects of reduced K–12 spending are long delayed. In the first year, the spending cut only reduces the quality of education of students leaving K–12 for one year. Based on the Krueger estimates, a cut of 3.5 percent in K–12 spending experienced for only one year will reduce future earnings by only 0.1 percent (= 3.5 * 0.0296). After two years, this impact doubles. It keeps going up for each successive cohort of students for the next 13 years. After 13 years, we have students who have experienced 3.5 percent lower school funding from kindergarten through 12th grade. Using the Krueger estimates, the 13

years of lower school funding is estimated to reduce earnings by 1.35 percent. After 13 years, each successive cohort of students leaving public schools is estimated to have their lifetime earnings reduced by 1.35 percent.[9]

These effects on students' earnings are entered into this book's simulation model. As was done with early childhood programs, I make assumptions, based on reasonable estimates, on how many former K–12 students will survive to various ages and how many will stay in their home state. I also make similar assumptions that one-third of this change in the state's labor supply is offset by displacement effects. Students leaving the K–12 labor supply have lower labor force participation and job skills. This increases job opportunities for other state residents. These increased job opportunities offset one-third of the direct negative effects on state earnings due to students who remain in the state.[10]

The reduced K–12 education spending also has some immediate economic development effects. Reduced education spending reduces demand for labor in the K–12 sector and also reduces the need for taxes to finance the expanded preschool. The reduced K–12 spending offsets 1-for-1 the balanced budget multiplier stimulative effects of the original universal preschool simulation.

Figure 7.4 shows the estimated economic development effects of financing universal preschool through reduced K–12 spending. The chart shows the effects of the preschool by itself on the earnings of state residents, as a percentage of total state wage and salary earnings. The chart also shows the negative effects on state residents' earnings of reducing K–12 spending. Finally, the chart shows the net effects of both changes combined.

As the figure shows, at first this budget reallocation has little or no net effects on state residents' earnings. However, after about 16 years, this budget reallocation begins to have positive effects on state economic development. These positive effects steadily increase until they max out, as a percentage of the state economy, at about a 0.85 percent boost to the economy, after about 60 years.

The negative effects of reduced K–12 spending are estimated to offset about two-fifths of the positive effects of universal preschool.[11] Why are there gains from this budget reallocation? These gains

occur because the estimated effects of universal preschool on child development and adult success are significantly greater than the effects of later intervention. One can explain this as due to the inherent advantages of earlier intervention. One could also hypothesize that allocating educational dollars to increase the *time* that children spend in school may be somewhat more productive than allocating dollars to increase the *quality* of that time.

None of this should be construed as meaning that this budget reallocation is the best alternative. All the estimates say is that *if* we assume that the total K–12 plus preschool budget is fixed, reallocating funds from K–12 to preschool seems to have net positive effects on state economic development. But increasing total spending on preschool and K–12 may also pay off. Recall that Krueger's estimates show a positive benefit-cost ratio for increasing K–12 spending. In the present scenario, earnings benefits are scaled back, as I only count earnings effects due to former students who stay in the state, and I assume that extra quality of labor supply has some displacement effects. But I still conclude that reducing K–12 spending has negative economic development effects that are 24 percent greater than the resulting budget savings. In this simulation, cutting K–12 spending is a bad idea from a state economic development perspective.

Therefore, the best alternative would be to increase spending for universal preschool and finance this in some way other than cutting K–12 spending. Cutting K–12 spending is definitely a "second-best" way of financing universal preschool.

What limitations are there of this simulation? One obvious limitation is that the simulation does not allow for any interaction between the universal preschool and reduced K–12 spending. The simulation assumes the effects of universal preschool and reduced K–12 spending are additive. But what if the effects of universal preschool depend on the level of K–12 spending? Then the effect of the budget reallocation will differ from simply adding the two effects.

It has sometimes been argued that early childhood interventions will have stronger long-term effects if these interventions are coupled with a quality K–12 school system. For example, some believe

that the effects of the Abecedarian program were enhanced by the relatively high quality of the Chapel Hill school system. According to Galinsky, the public school system in Chapel Hill at the time of experiment was considered one of the two best public school systems in the state. 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.

Therefore, it is possible that the estimated impacts of universal preschool will be reduced if the quality of subsequent K–12 education is reduced, beyond the prediction from adding up the separate effects of these two interventions. In that case, Figure 7.4 may overstate the net benefits of this budget reallocation.

On the other hand, perhaps universal preschool has greater impacts on children when K–12 school quality is lower. In that case, the combined impact of the budget reallocation will be more positive than shown in Figure 7.4.

Another issue is whether reducing K–12 spending will have the earnings effects estimated by Krueger. As mentioned above, it seems plausible that there are better ways to cut the K–12 school budget than increasing K–2 class size. For example, in 2006, Mark Tucker and his colleagues at the National Center on Education and the Economy advocated that we consider getting rid of at least the senior year in high school for most students, as the senior year often seems unproductive. This is just one of many possible K–12 changes that could cut spending at lower costs to student achievement and earnings than raising early elementary class sizes.

Appendix 7C to this chapter considers scenarios where the simulation is repeated, but reduced K–12 spending is assumed to have less adverse achievement effects than assumed by Krueger. As one would expect, the resulting net benefits of this budget reallocation then increase.

Finally, although funding universal preschool through cutting K–12 spending avoids short-run tax increases, it does not produce short-run economic development benefits. As the figure shows, under this

scenario, there are little economic development benefits for 25 years. This budget reallocation is only attractive to a policymaker with great patience.

INCREASING SHORT-RUN BENEFITS: SHIFTING BENEFITS FORWARD THROUGH CAPITALIZATION

Benefits of early childhood programs would be realized earlier if some of these benefits were "capitalized" into higher property values. A state or local government that implements at full-scale a high-quality early childhood program is providing a service that is valuable to families. The increased future earnings of former child participants should be valued by parents. Parents should be willing to pay more to obtain access for these future benefits. This willingness to pay could be reflected in a willingness to pay more to buy a house or rent an apartment in the state or local area that offers these services. This willingness to pay more for housing should increase property values. This increase in property values may occur as soon as buyers and sellers of property fully understand the future benefits provided by early childhood education. These increased property values do not have to wait for these future benefits to occur if sufficient numbers of buyers and sellers of property believe that they will. Therefore, capitalization of future earnings benefits into property values could increase the up-front benefits of early childhood programs.[12]

Of course, the value of property should also reflect the taxes associated with that property. However, the economic development argument for early childhood education is that these future earnings benefits significantly exceed the costs of financing these programs. Furthermore, as other authors have pointed out, early childhood programs provide many medium-run and long-run fiscal benefits. These fiscal benefits include the lower special education costs mentioned above. They also include other reductions in spending, such as lower criminal justice system costs and lower costs for welfare and Medicaid. Fiscal benefits also include increases in taxes due to the increased earnings in the state economy. Some simulations suggest that fiscal benefits greatly outweigh the costs of these programs

(Bartik 2006; Dickens and Baschnagel 2007; Lynch 2007). The medium-run and long-run fiscal benefits are great enough that at modest discount rates such as 3 percent, the adoption of these programs has a positive net present fiscal value, not a cost.

How buyers and sellers of property value these short-run fiscal costs versus long-run fiscal benefits is uncertain. This may depend in part on how short-run fiscal costs are paid for. If all short-run fiscal costs are reflected in higher property taxes, costs may loom larger in property owners' minds. If short-run fiscal costs are financed in ways that are less visible, less tied to property purchases, or less a burden on the general taxpayer, then these short-run costs may have less influence on how typical buyers and sellers value property. For example, if these short-run costs are financed through higher sales taxes, they may be less visible to many households and therefore not affect property bids much. If short-run costs are financed through an increase in the top rate on a graduated state income tax, then these costs may not affect property bids that much.[13]

Will buyers and sellers of property perceive the benefits of early childhood programs as benefits that should increase their valuation of property? This seems much more likely for programs such as universal preschool than those that provide widespread benefits to many households. On the other hand, it seems less likely that property values will go up if early childhood programs only provide benefits to relatively few households. Some early childhood programs by design are targeted at relatively few households by being targeted at disadvantaged households. This includes programs such as the Abecedarian program. It also includes many home visiting programs, such as the Nurse Family Partnership or the Parent Child Home Program.

Whether universal preschool will affect property valuation depends in part on whether it provides benefits that are visible to prospective property owners in the state or local area. Some benefits of universal preschool do manifest themselves in the short run in a way that we know is visible enough to affect property valuation. Specifically, high-quality preschool will affect elementary school test scores.

We know from previous research that elementary school test scores *are* visible enough and tied enough to property ownership to affect property values.

Studies suggest that universal preschool will increase average test scores in 3rd, 4th, and 5th grades by about 0.08 in "effect size" units. This "effect size" jargon of educational researchers means that average test scores will increase by eight-hundredths of the typical standard deviation across students in test scores.[14] Based on previous studies of the housing market, an increase in average test scores in 3rd, 4th, and 5th grade of one standard deviation probably increases property values by 5 percent to 10 percent.[15] Therefore, due to its effects on average elementary school test scores, universal preschool should increase a state or local area's residential property values by 0.4 to 0.8 percent. This calculation assumes that buyers and sellers of property value the increase in test scores, but ignore the possible fiscal consequences of universal preschool. As outlined above, fiscal consequences might be ignored because these fiscal consequences are on net positive in the long-run, or because these short-run fiscal costs are not salient to their property valuation decision.

Based on typical U.S. property values, if universal preschool raises residential property values by 0.4 to 0.8 percent, the capital gain from universal preschool will be 5.1 to 10.2 times the annual gross budgetary costs of universal preschool.[16] If property valuations are unaffected until test scores actually improve, then this property value gain will begin to occur when the original preschoolers reach 3rd grade, four years after the universal preschool program is adopted. At average U.S. property tax rates, such an increased valuation of property would raise property tax revenues of 7 to 14 percent of the annual gross costs of the universal preschool program.[17]

Universal preschool valuation would have much larger effects on property valuation if buyers and sellers of property fully valued its effects on future earnings. This book's simulations allow a calculation of universal preschool's effects on state residents' earnings. I can also calculate the effects on the earnings of former preschoolers who leave the state. These effects should also be relevant to parents' property

valuation decisions. Combining these calculations, we can calculate the net present value of the increase in earnings that can be accessed by buying property in this state.[18]

This net present value obviously depends upon the discount rate typically used by buyers and sellers of property. What discount rate might actually be used by prospective buyers and sellers of property to value earnings effects that occur for their children? The honest answer is, we don't know. However, we can come up with some plausible alternatives. I consider four alternatives. First, perhaps households and prospective homebuyers might act as policymakers are supposed to optimally act according to social discount rate theory. For this alternative, I use a discount rate of 3 percent, as this book has consistently done for the optimal policy perspective. A second alternative is to rely on evidence of how parents behave in making investments in children. A study of parental investments in children's health estimated a parental discount rate of 4.70 percent (Agee and Crocker 1996). A third alternative is to estimate what discount rate is compatible with the finding that a one standard deviation in test scores raises property values by 5 to 10 percent. I calculated what discount rate would make this property value effect reasonable. I estimated discount rates of 7.50 percent (5 percent property value effect) and 6.06 percent (10 percent property value effect). Finally, as argued by Barrow and Rouse (2004), we might use the average 30 year real interest rate on mortgages. They calculate this to be 7.33 percent. This mortgage rate is quite close to the estimated discount rate associated with a 5 percent property value effect. I combine these two possible discount rates together in the analysis.

Table 7.3 uses these plausible discount rates to calculate effects of universal preschool on property values and property taxes. I consider two scenarios. Under one scenario, I only consider the property value effects of the gross economic development benefits provided by universal preschool. This scenario ignores the fiscal effects of universal preschool. It implicitly assumes that the short-run taxes to support universal preschool aren't relevant to property buyers and sellers. Perhaps the taxes are not paid by the decisive property buyer or seller. Or perhaps these short-run taxes are perceived as being outweighed by the long-run fiscal benefits of preschool in lowering special education costs, criminal

justice system costs, and welfare system costs. Under the second scenario, I consider the property value effects of universal preschool after subtracting out 100 percent of the program costs for universal preschool. No fiscal benefits from universal preschool are considered. In the real world, it seems likely that the truth is between these two scenarios.

These property value effects vary widely. However, these results do support several conclusions. First, property value effects of universal preschool are potentially about four times as great as predicted by effects on elementary test scores. This estimate is derived by comparing the elementary test score effects with the effects of gross economic development benefits using the comparable discount rate. This reflects that universal preschool has considerably greater effects on the future earnings of former child participants than would be predicted from effects on elementary test scores.

Second, effects of universal preschool on property values are often large under plausible discount rates. Effects are many multiples of annual program costs. The property taxes raised from these higher property values are often significant fractions of annual program costs.

Third, whether such capitalization effects will actually occur obviously depends greatly on how property buyers and sellers value universal preschool. This depends in part on whether property buyers and sellers have accurate information about the quality of universal preschool. It also depends on whether property buyers and sellers understand fully the potential long-run effects of high-quality universal preschool. Finally, this valuation depends on how heavily these buyers and sellers discount these benefits to children.

At present, I doubt whether most property buyers and sellers directly value preschool quality in their property valuation decisions. I doubt this because information on preschool quality is often weak. Furthermore, many property buyers and sellers may not sufficiently understand the effects of preschool quality on future earnings of former child participants. Therefore, to the extent that universal preschool currently has a property value effect, it is probably mostly indirect, through effects on elementary test

scores. Elementary test scores are more widely known by prospective home buyers. Parents do believe that such test scores are related to future life prospects for their children.

However, these valuations of universal preschool by property buyers and sellers may potentially be affected by policymakers. Preschool advocates might consider promoting better information for prospective homeowners on the quality, availability, and cost of preschool in different states and metropolitan areas. Some beginning attempts to provide such information include the State of Preschool yearbook by the National Institute for Early Education Research.

Policymakers might also consider further measures to inform the public about the future earnings effects of universal preschool. A fuller understanding of these effects might increase household valuations of these earnings effects.

Finally, public relations efforts that stress how children are affected by early childhood programs might alter parental discounting of these effects. Stressing effects on children in public discourse may reduce parental discounting of such effects.

The rationale for increasing parental valuations of preschool's effects is in part to improve parental choice options with better information. But public relations efforts to increase parental valuations will also change the incentives facing state policymakers. If preschool quality, availability, and cost become more salient to prospective homebuyers, the effects of these factors on property values and property tax revenues will increase. This will increase the attractiveness of high-quality universal preschool to state and local policymakers who wish to boost their state or local area in the short run. Short-run boosts in property values and property tax revenues may be more of an incentive to policymakers than long-term boosts to earnings.

One trade-off with increased capitalization is that it transfers some of the benefits of universal preschool education to property owners. This will be further discussed in the chapter on distributional effects.

Capitalization effects are relevant when universal preschool is analyzed from a state perspective. These capitalization effects reflect the relative attractiveness of a given state, versus other states, due to the state offering high-quality universal preschool. At the national level, we would not expect nationwide universal preschool to lead to capitalization effects. This is further discussed in the chapter on the national perspective.

INCREASING SHORT-TERM BENEFITS: INCORPORATING PARENTAL EMPLOYMENT PROGRAMS INTO EARLY CHILDHOOD PROGRAMS

Short-run benefits of early childhood programs may also be increased by program modifications. What program components might be added to significantly increase short-run benefits?

It seems reasonable to focus on program add-ons that might have some synergy with the early childhood programs. Otherwise, short-run benefits could be increased by adding any arbitrary program X that has a high ratio of short-run benefits to costs. But if program X's social returns do not depend on the existence of the early childhood programs, and vice versa, then it is unclear why we would consider the early childhood programs plus program X as a package. For example, perhaps some antipollution regulation would have large short-run benefits relative to costs. But it would seem strange to claim that we have "solved" the problem of delayed benefits to early childhood programs by adding an antipollution regulation to the policy package.

One program add-on that might have some synergy with early childhood programs is an employment and training program for the parents of the child participants. It seems possible that early childhood programs that provide some free child care, such as universal preschool and the Abecedarian program, might make employment and training services for the parents more effective.

Employment and training services for parents may provide more short-run economic development benefits than the benefits for the child participants in early childhood programs. Increases in

parental employment and wages will occur immediately, while improvements for former child participants have to wait until the children grow up.

What are plausible returns to high-quality employment and training programs for the parents of the child participants in universal preschool or the Abecedarian program? How might adding on parental employment and training programs affect the short-run benefits from an early childhood program package?

We don't know the answer. There has not been much experimentation to explore the social returns to adding parental employment programs to early childhood programs.

I wanted to gauge the potential for adding on parental programs. To do so, I considered what would happen if the add-on parental employment program had a rate of return that matched the highest that have been observed for rigorously evaluated employment and training programs. Specifically, I assumed the parental employment and training program had returns as high as the estimated effects of Job Training Partnership Act (JTPA) programs on disadvantaged adults.

JTPA was the main federally funded job training program from 1982 to 1998. It was evaluated by a random assignment experiment in the late 1980s and early 1990s.

The random assignment experiment indicated that JTPA had extremely high rates of return for adults. The experiment indicated modest effects per trainee on average earnings. Annual earnings for trainees increased by over $1,200 (Friedlander et al. 1997, updated to 2007 dollars). The evidence suggests that these earnings increases persisted without much change for at least five years after training (GAO 1996).[19] These increased earnings were achieved at a cost per adult trainee of about $2,000 for women and $1,400 for men (Friedlander et al. 1997). The real rate of return to society from JTPA training for adults exceeds 70 percent per year under any reasonable assumptions (Friedlander et al. 1997).

Why not consider a training program that had more dramatic effects on annual earnings than $1,200? Research suggests that few if any training programs have persistent annual earnings effects for

broad groups that exceed the $1,000 to $2,000 range (Bartik 2001, Chapter 4). The annual earnings effects for training programs, once they exceed some minimum threshold services per trainees, do not significantly increase with program spending per trainee (Greenberg et al. 2003). Therefore, we do not know how to reliably produce a training program with dramatically "large" effects on annual earnings per trainee, even if we are willing to spend a great deal of money per trainee. The JTPA program does as well as any program in producing high rates of return at modest costs.

I resimulated the economic development benefits and costs of universal preschool and the Abecedarian program with an add-on training program for parents. To do these simulations, I assumed that the program had costs per trainee and earnings effects per trainee that were similar to the JTPA program's effects for adult women. I assumed that 75 percent of the families involved with the Abecedarian program would enroll in training, as the Abecedarian program targets disadvantaged families. I assume that 75 percent of the "high-risk" families enrolled in universal preschool would enroll in training, along with 25 percent of "medium-risk" families. This assumption means that 26.3 percent of all participants in universal preschool would enroll in training. In calculating increased earnings of state residents, I make my usual adjustments to include only survivors who stay in the state, and to adjust for labor market displacement.

Figures 7.5 and 7.6 show the annual ratio of economic development benefits to costs for universal preschool and the Abecedarian program, with an adult training add-on. For comparison, the figures also show the annual ratios without the adult training add-on. The numbers behind the figures are in Appendix 7D.

As shown in Figure 7.5, adding training to universal preschool has the potential for moderately improving the short-term and medium-term economic development benefits of preschool. The original program had annual economic development benefits of about 15–23 percent of costs for the first 13 years or so after the program was initiated. With the add-on adult training, economic development benefits steadily increase during those first 13 years. For example, 10 years after the original program is initiated,

annual economic development benefits are only 15 percent of annual costs. With the add-on training, by 10 years after program initiation, annual economic development benefits are 45 percent of annual costs, or three times as great. Annual economic development benefits of the original program did not exceed annual costs until 24 years after program start. With the training add-on, annual economic development benefits exceed costs after 19 years, five years earlier.[20]

The potential for greater short-term ratios of benefits to costs is limited in a universal program because of the assumption that training benefits will be restricted to disadvantaged families. A more targeted preschool program would have its short-term benefits to cost ratio boosted more by adult training add-ons. Alternatively, a training program that had high returns to more advantaged workers could increase the short-term benefits to cost ratio.

As Figure 7.6 shows, adding adult training to the Abecedarian program does not much affect the time pattern of the ratio of benefits to costs. The lack of effect reflects the large costs of the Abecedarian program. The modest earnings benefits provided by adult training do not loom large compared to the large costs per child participant in the Abecedarian program.[21]

These potential effects of short-term training are hypothetical. It would seem important to do some demonstration projects and experimentation with adding training and employment services for adults to early childhood programs.

It is particularly important to do such experimentation because there may be synergies between early childhood programs and adult training and employment programs. High-quality early childhood services may increase the return to adult training and employment programs by providing free child care and "peace of mind" to parents. Improved parental employment and earnings may increase the rate of return to early childhood programs. Higher family income may reduce stresses of poverty that harm child development and adult outcomes for those children. For example, research by Duncan et al. (2008) suggests that among families with less than $25,000 in annual income, increasing a family's income by $1,000 per year increases the future earnings of children in that family by 6 percent.[22] The calculations

here do not reflect these potential synergies, which may be important. It should be an important research priority to investigate the potential for programs that integrate services to children and their parents.

CONCLUSION

The economic development benefits from high-quality early childhood program are mostly long term. This is a problem for policymakers with short-time horizons. What can be done about this problem?

Based on this chapter, a variety of solutions seem possible:

- Do calculations demonstrating the likely cost savings in special education costs from early childhood programs.
- Establish systems of regularly rating the scope, quality, and costs of state and local preschool programs in a comparable way. Promote these quality rating systems to potential property owners. Also, promote the importance of preschool to potential property owners. Such rating systems and promotion efforts would improve family awareness of the importance and quality of preschool. As a result, high-quality universal preschool programs would be more likely to increase property values in the short run.
- Do demonstration projects and experiments that add adult employment and training programs to early childhood programs. See what works and what doesn't work, and what potential synergies there are in combining such efforts.
- If policymakers are reluctant to raise taxes to improve early childhood programs, urge policymakers to finance such programs with reductions in other government spending that has lower rates of return.
- Once the current U.S. financial crisis has passed, explore options such as tax increment financing to fund expansion of high-quality early childhood programs.

Of all these options, I believe an initiative to increase capitalization by increasing information on preschool programs is the most promising. This option directly addresses the central problem: policymakers undervalue the most important benefits of universal preschool, the future benefits for former child participants. If parents have sufficient information that these benefits for children are reflected in property valuations, then these future benefits become visible to policymakers in the short run. Furthermore, greater parent knowledge and valuation of preschool is also likely to affect how parents vote. Such a change in voting behavior would certainly affect state policymakers. Finally, a sustained

effort to promote better information on preschool across states is relatively cheap compared to its potential benefits.

This chapter has focused on the distribution of the benefits of early childhood programs over time. The next chapter focuses on the distribution of the benefits of early childhood programs and business incentive programs across different income groups.

NOTES

1. Savings and investment issues may complicate the discussion. Suppose the policy affects savings and investment flows. Suppose further that the social value of a dollar of savings or investment exceeds the social value of a dollar of consumption. Under these assumptions, we need to determine some shadow prices of savings and investment to adjust the different dollar flows to consumption equivalents.

The financing of the policy's costs may affect savings and investment in several ways. The financing may affect incomes, which will affect savings. Borrowing may affect interest rates. Extra taxes may affect the returns to savings and investment.

But the benefits of the project may also affect savings and investment in several ways. Project benefits may also affect incomes. The project may also create a fiscal surplus. This may reduce borrowing's burden on interest rates, or affect the need for taxes that distort the returns to savings and investment.

The shadow price of savings and investment may exceed one due to tax wedges between the private before-tax return to investment and the private after-tax return to savings. In addition, the shadow price of savings and investment may exceed one due to the social return to investment exceeding the private before-tax return to investment. For example, if there are agglomeration economies, then investment may have external benefits for the economy.

As mentioned in Chapter 4, I avoid in this book taking account of these long-run dynamic effects of changes in savings and investment. I avoid these dynamic investment effects because I think there is no consensus among economists on the magnitude of such effects. Dynamic investment effects can lead to unbounded effects of policies under certain assumptions, but not under other also plausible assumptions. Dickens and his co-authors have models of early childhood programs that incorporate dynamic investment effects (Dickens et al. 2006, Dickens and Baschnagel 2007).

2. Appendix 7A provides a more technical discussion. This includes an equation for the discount rate. It also includes discussing plausible values in that equation.

3. This compares the Abecedarian control group to the entire Abecedarian treatment group. Ramey et al. (2000) point out that the Abecedarian group that received preschool school services only, without extra K–2 support services, only had a special education services receipt rate of 12 percent. They argue that the extra K–2 services may have increased the recognition of special education service needs. However, the preschool-only group has a sample size of 23. Therefore, to be conservative, I decided to use the comparison between the overall Abecedarian treatment group and the control group to calculate the special ed. cost savings for the Abecedarian program.

4. The simulation was done in the following way: I assumed that the reduced special education percentage due to universal preschool would be 2.3 percent of all participants. This is 23 percent of the approximately 10 percent effect found in the Chicago Child Parent Center (CPC) program. This same 23 percent factor was used to scale back the CPC effects for all earnings effects of the program, and reflects the assumption that a universal program will have somewhat smaller effects on more middle class children and on children already in preschool.

For the Abecedarian program, I assumed that special ed. assignments would be reduced by 23 percent of all participants. This 23 percent has nothing to do with the CPC scaleback factor. The Abecedarian 23 percent is based on experimental evaluations of the Abecedarian program that show a reduction in special ed. assignments from 48 percent in the control group to 25 percent in the treatment group.

Increased special ed. costs were initially assumed to be $10,054 in 2007 dollars. This is based on Parrish et al. (2004, Part II) figures on special ed. costs for 1999–2000 of $8,080 (p. 22). These special ed. costs are updated to 2007 dollars using the CPI-U. I assume that only 10 percent of special education costs are paid by the federal government and 90 percent by state and local governments. This seems

consistent with the figures in Parrish et al. I only count as cost savings the state and local cost savings, as in this book I am focusing on the state perspective.

It is assumed that the cost savings from reduced special education assignments accrue for all 13 years from kindergarten through 12th grade. This implies that special education cost savings for a given cohort of early childhood participants begin accruing one year after the universal preschool program, and five years after the Abecedarian program begins for each cohort. For each cohort, it is assumed that special ed. costs after 2011 increase in real terms by 1.2 percent per year, which is this simulation model's assumptions about average real wage increases. As in the regular simulation models, each subsequent cohort is assumed to be 0.3 percent bigger, as this is the population growth assumption of these models. In addition, each subsequent cohort is assumed to have 1.2 percent higher special education costs per students, to reflect wage growth. These assumptions about increasing real special ed. cost trends are modest, given that data from Parrish et al. suggest that special education costs have increased in real terms by 1.6 percent per year from 1977–1978 to 1999–2000.

The simulations also allowed for reduced balanced budget multiplier effects from the reduced special education spending. This reduced economic development benefits. However, this reduction in benefits is less than the reduction in net costs. Reduced balanced budget multiplier effects were calculated the same way balanced budget multiplier effects were calculated for the original simulations.

5. Appendix 7B presents the numbers behind these figures.

6. This comes from the scenario in Krueger where the social discount rate is 3 percent and the annual productivity growth rate is 1 percent. I use the same social discount rate and a wage growth rate of 1.2 percent. Under Krueger's assumptions, the present value cost of this intervention per student is $7,660 in 1998 dollars, and the present value of future earnings benefits is $21,667 (Krueger 2003, Table 5, p. F56). The resulting ratio of the present value of benefits to the present value of costs is 2.83.

7. Krueger estimates that earnings will go up by 3.2 percent due to smaller class sizes. These smaller class sizes require a 47 percent increase (e.g., 22 over 15 = 1.47) in funding. This estimate

assumes that when class sizes are lower, all elements of per pupil spending must increase proportionately, not just the ratio of teachers to students. The average experimental student in the Tennessee class size study experienced these smaller class sizes for 2.3 years. If we divide 3.2 percent by the product of 47 percent and 2.3 years, we get an earnings effect of 0.0296 percent for a 1 percent change in spending for one year of a student's K–12 experience.

8. This is based on estimates originally made for implementing universal preschool in 2009 (Bartik 2006). In 2007 dollars, this is estimated to have a net cost nationally of $17.9 billion. According to the Digest of Education Statistics, total public K–12 operating spending in the 2004–2005 school year was $424.6 billion. Updating to year 2007 prices yields a cost of $459.2 billion. According to projections from the Institute of Education Statistics, real education spending for public elementary and secondary schools is expected to increase by 32 percent from 2004–2005 to 2017–2018, which is an increase of 2.16 percent per year. Applying this annual rate of increase, we get projected K–12 spending for the 2009–2010 school year of $510.9 billion. Preschool spending of $17.9 billion divided by $510.9 billion is 3.5 percent.

9. The actual simulation calculation is slightly more complicated. Because I am focusing on state residents and state earnings, I adjust these impacts down slightly to account for in or out-migration during the K–12 school years. Therefore, of students leaving the K–12 school system at age 18, not everyone will have experienced their entire K–12 education in the state that is reducing its K–12 spending by 3.5 percent. This consideration lowers the average effect on earnings after 13 years from 1.35 percent to 1.20 percent.

10. I also have to make assumptions about how many public school students will annual exit the public school system via graduating or dropping out. For graduates, I start with public school graduates for 2005–2006 from the Digest of Education Statistics. For dropouts, I use Heckman's figure that the true four-year graduation rate is 77 percent (Heckman and LaFontaine 2008). (Reported high school dropout rates are probably too low.) I calculate from this figure an annual dropout rate. I apply this dropout rate to

total public high school enrollment in the fall of 2005 to get the number of dropouts exiting the high schools at that time. These 2005–2006 figures for annual numbers of both graduates and dropouts are adjusted to 2009 by using projections that public school graduates will grow at 0.59 percent per year (*Projections of Education Statistics* report by Hussar and Bailey 2008). These 2009 figures are compatible with the 2009 starting date for the original preschool projections. For 2011 starting numbers, I assume that all effects are the same percentage of total earnings.

11. The long-run positive effects of universal preschool are a 1.40 percent boost to earnings. The long-run negative effects of reduced K–12 spending in this scenario are −0.55 percent. The ratio of this negative effect to the positive effect is 0.39.

12. In the model of this developed by Roback (1982), and used by many subsequent researchers, increased household amenities at the interstate or intermetropolitan level could also in theory be reflected in lower wages. However, as pointed out in Bartik and Smith (1987), for an increase in an amenity that is just valued by households, and not businesses, the percentage increase in property values should be much greater than the percentage reduction in wages. Labor is a much larger share of business costs than land, and therefore only very small reductions in wages are compatible with keeping profits the same after an increase in land prices. Furthermore, it could be argued that business will also place some direct value on the "amenity" of better early childhood programs. Any direct benefit to businesses from this amenity will further drive up both property values and wages.

13. These remarks are somewhat speculative. We really don't know the true incidence of many tax and spending programs at the state and local level. Economists seem to believe that higher property taxes will be capitalized into lower property values. There is less agreement about what will happen due to other changes in state and local taxes and spending. The text passage suggests that the incidence may depend in part on how many households mentally classify a particular tax or service as being tied to property ownership. Property taxes are clearly tied to property ownership. By longstanding tradition, the quality of public education is also tied to where a household lives, and so is mentally considered to be part

of the property purchase. The question is whether households think of early childhood programs as being tied to property ownership. The issue that this section of the chapter explores is whether such a connection either naturally is made (through effects of early childhood programs on school test scores) or can be made through the right marketing of preschool.

14. This is based upon estimates from the Chicago Child Parent Center program that the program increased participant average test scores in 3rd , 4th, and 5th grades by an average effect size of 0.22 (Reynolds 1995). I assume, as was done in the simulation, that the effects of a universal preschool program will be only 23 percent of the effects of a program such as CPC that is targeted. On the other hand, peer effects will multiply effects by 1.54 times the raw effects. Therefore, the effects on average test scores are $0.08 = 0.22 \times 0.23 \times 1.54$.

15. This statement principally relies on studies by Black (1999), Bayer et al. (2007), and Kane et al. (2006). Black found that an increase of one standard deviation in across-school average test scores increased property values by 2.2 percent. Based on studies of test score variation by Bloom (2006) and Kane et al., a one standard deviation difference in cross student test scores is probably between 2 and 5 times the standard deviation in cross-school test scores. So Black's numbers imply that a change in average test scores of one standard deviation in student test scores will increase property values by 4 percent to 11 percent. Bayer et al. find that an increase in average school test scores of one standard deviation in across-school average test scores increased property values by 1.8 percent. Multiplying by 2 to 5 yields an effect of an increase in average test scores of one standard deviation in cross-student test scores of 4 percent to 9 percent. However, Bayer et al. also find effects that are perhaps twice as great if one allows for test scores to change the demographic composition of school neighborhoods. It could be argued that the long-run effect of school test score changes should include such adjustments, which would raise the test score effects on property values to 8 to 18 percent. Finally, Kane et al. concluded that an increase in average school test scores of one student deviation across students increased property values by about 10 percent. Therefore, a range of a 5 to 10 percent effect seems reasonable.

16. This is based on figures from the Federal Reserve Board's (2009) *Flow of Funds* report that residential property values in the United States as of the fourth quarter of 2008 were 23.1 trillion dollars. (This sums the residential real estate values of the household sector and the noncorporate sector.) Multiplying this by the percentage effects on property values, and converting to 2007 dollars, and comparing to the estimated national cost of universal preschool in 2007 dollars of $17.9 billion, I get the ratio cited in the text.

17. This uses figures from the Tax Policy Center that typical property tax rates in the United States are 1.33 percent of property value (Yilmaz et al. 2006).

18. I take the total flow of earnings in the state due to universal preschool, including effects on parents, children, and spending effects. These effects are calculated including displacement effects. I then add in the flow of earnings for former child participants who leave the state. For these leavers, I do not adjust for displacement. The assumption is that prospective property buyers in the state will consider the net effect on their earnings if they stay in the state, which will include displacement effects, and also consider the net effect on their earnings if they leave the state, which will not include displacement effects because the state is assumed to be small relative to the nation.

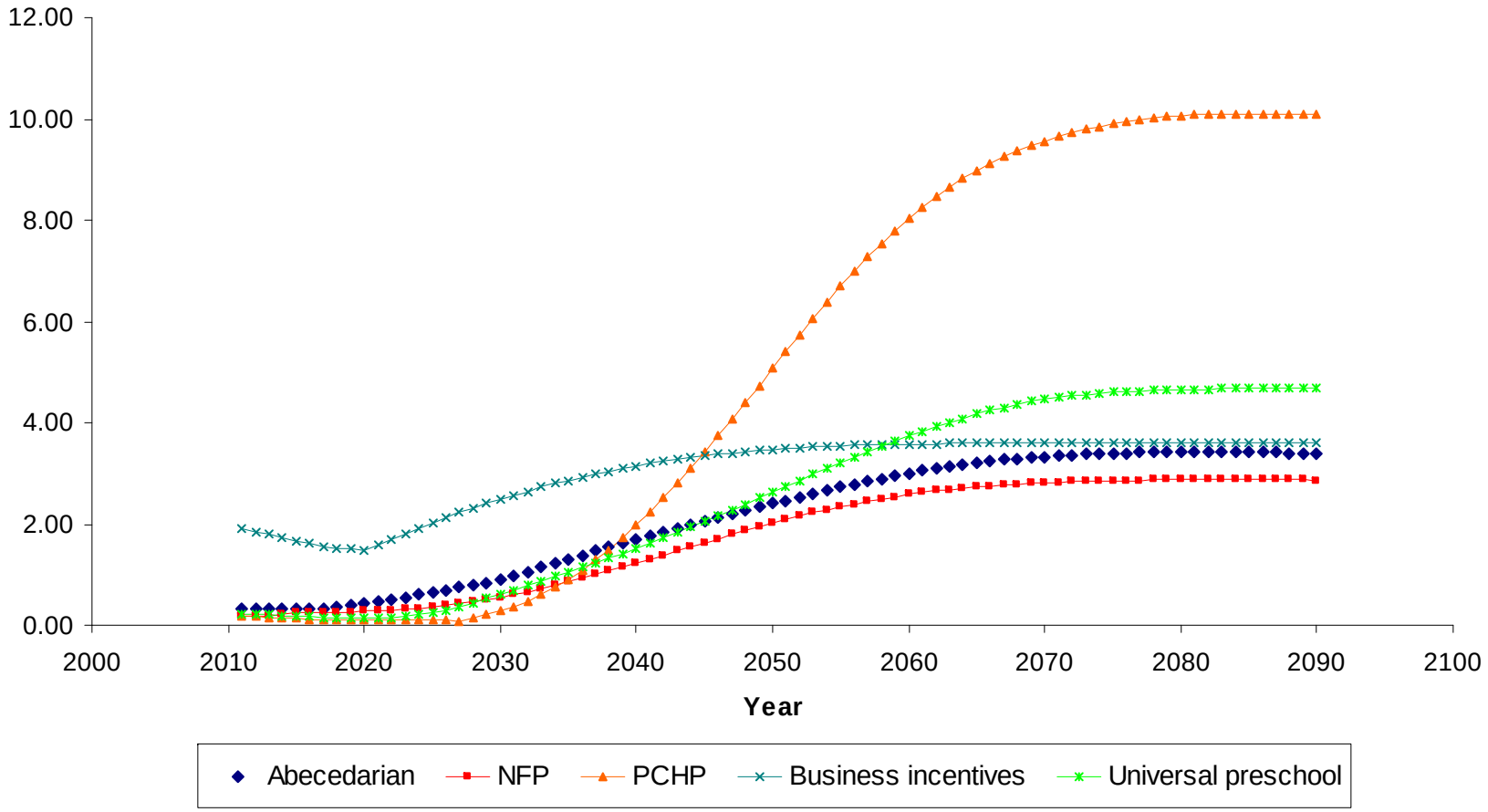
19. This is not how GAO spun the results. GAO emphasized that results became statistically insignificant some years after training. However, the results also indicated that results did not statistically significantly change over time. In any job training experiment, one would expect training effect estimates to become more imprecise with time. With more time since training, there are more random shocks to earnings that increase imprecision.

20. The ratio of the present value of benefits to costs improves from 2.78 to 3.31.

21. The ratio of the present value of economic development benefits to the present value of program costs increases from 2.25 to 2.37.

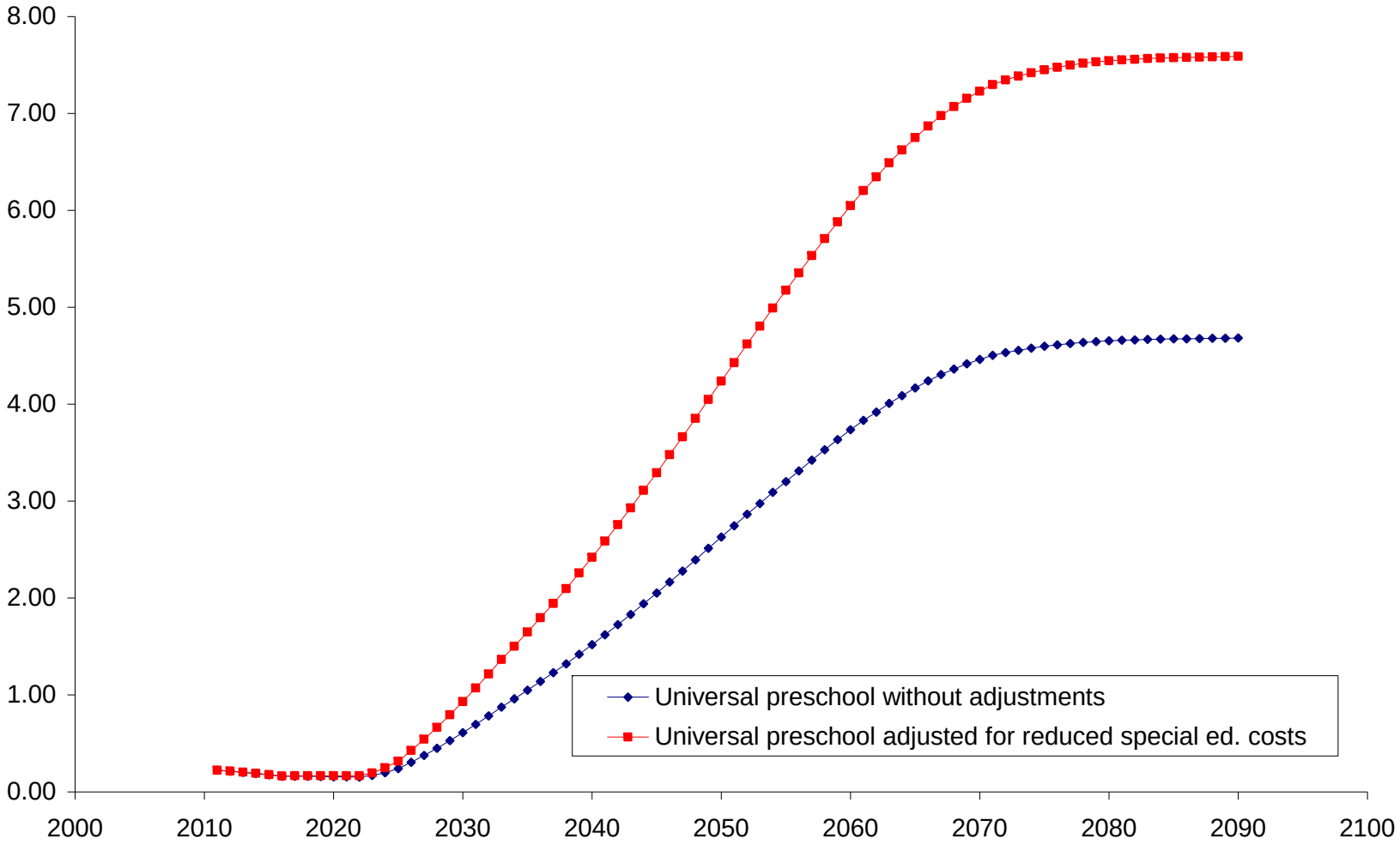
22. This calculation uses the regression coefficients from Appendix Table 3 in Duncan et al. (2008). I use the coefficient of 0.584 in predicting ln(earnings) using income measured in $10,000 units, and then translate this effect on ln(earnings) into an actual percentage effect.

Figure 7.1 Ratio of Annual Program Effects on State Residents' Earnings to Program Costs, Each Year after Permanent Program Is Begun



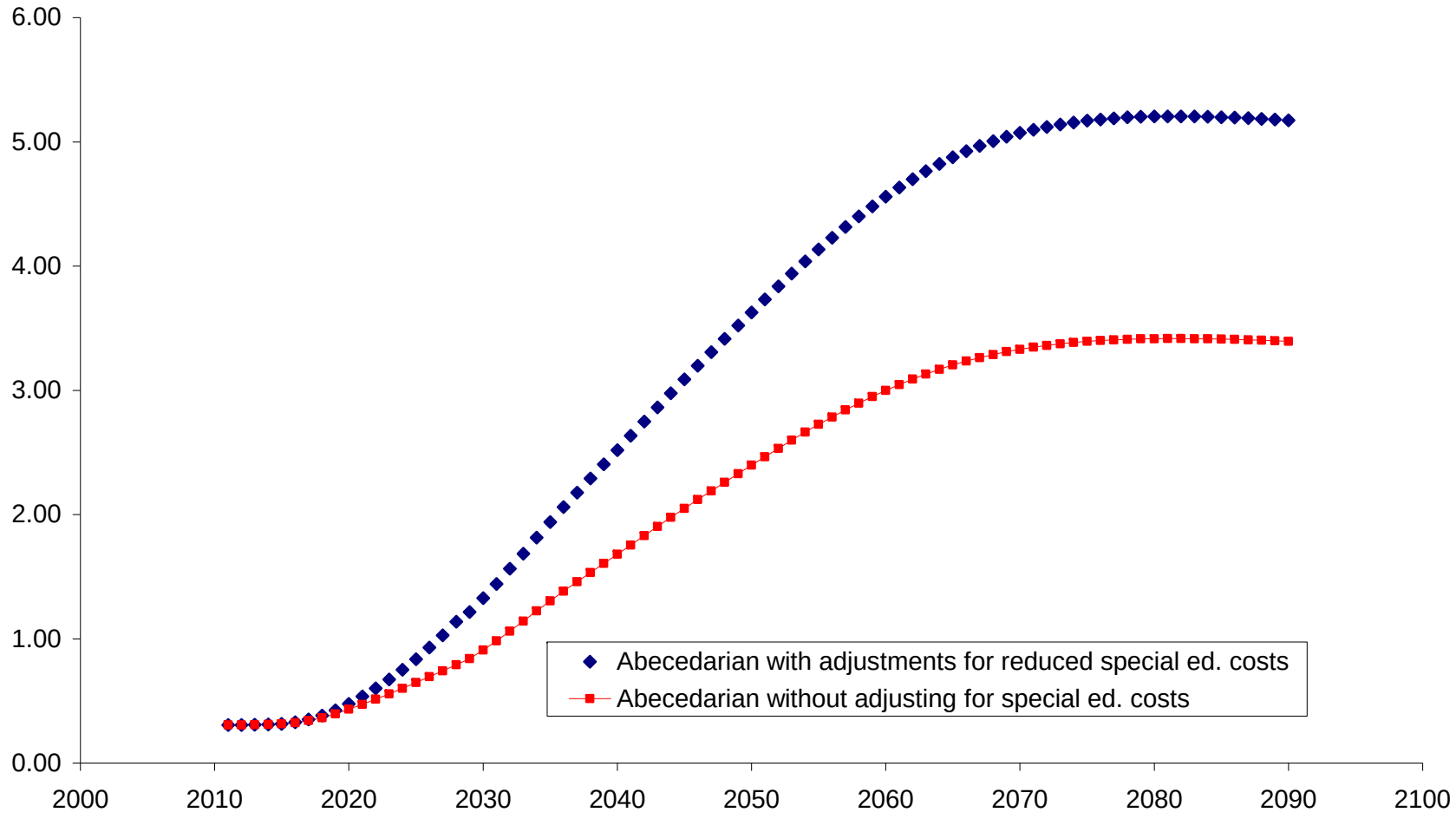
NOTE: This figure assumes that one of four early childhood programs is begun in 2011, and continued permanently. The figure reports effects on state residents' earnings due to increases in the earnings of the state's original residents who remain in the state. For comparison, the figure also shows effects for permanent program of business incentives whose scale remains at same percentage of the state economy over time. This figure is identical to Figure 4.2.

Figure 7.2 Annual Flow of Economic Development Benefits vs. Net Program Costs, after Adjusting for Reduced Special Education Costs, Universal Preschool



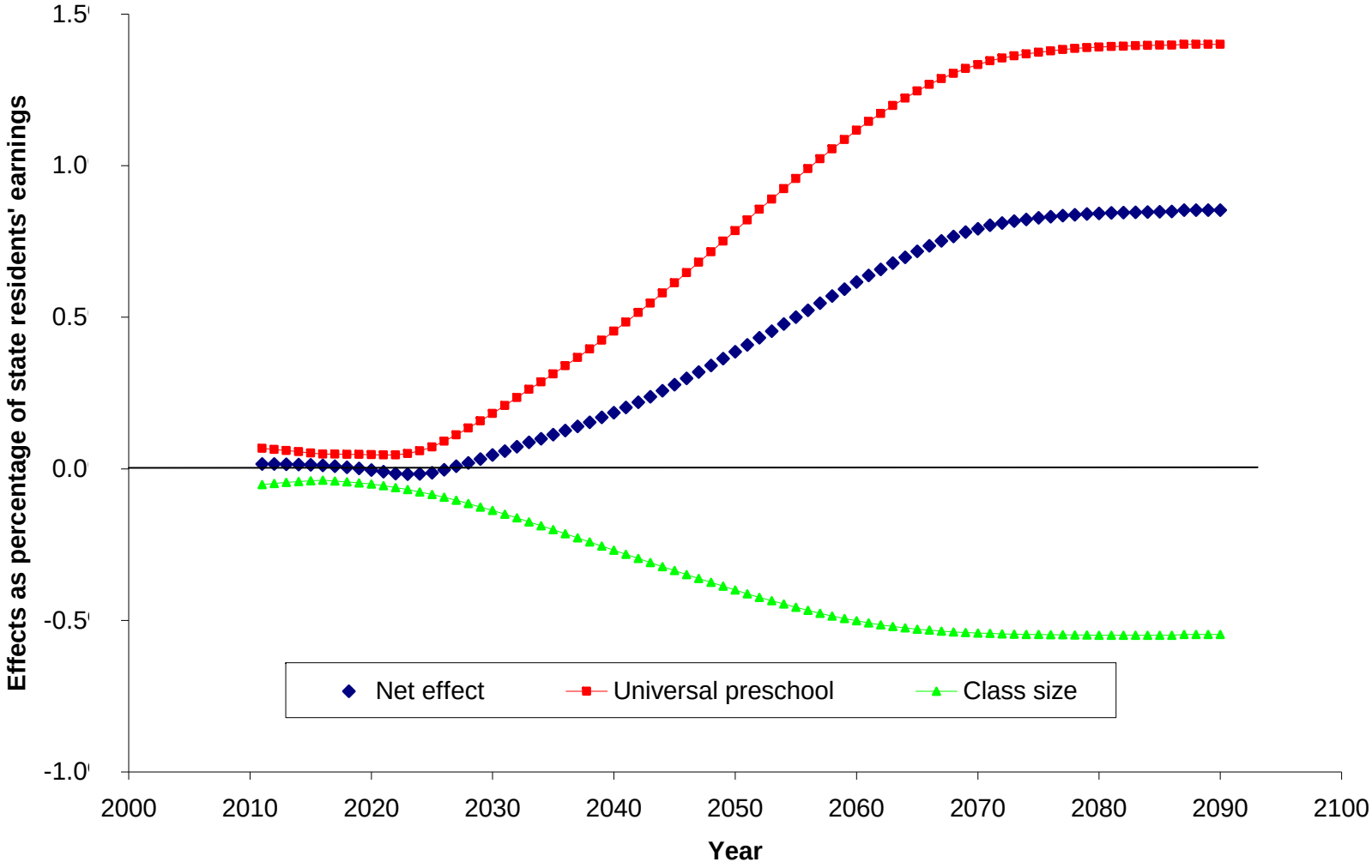
NOTE: Program is assumed to start full-scale in 2011 and continue indefinitely. Assumptions used are described in text and text endnotes. Appendix 7B shows the numbers behind this figure.

Figure 7.3 Annual Flow of Economic Development Benefits vs. Net Program Costs, after Adjusting for Reduced Special Education Costs, Abecedarian Program



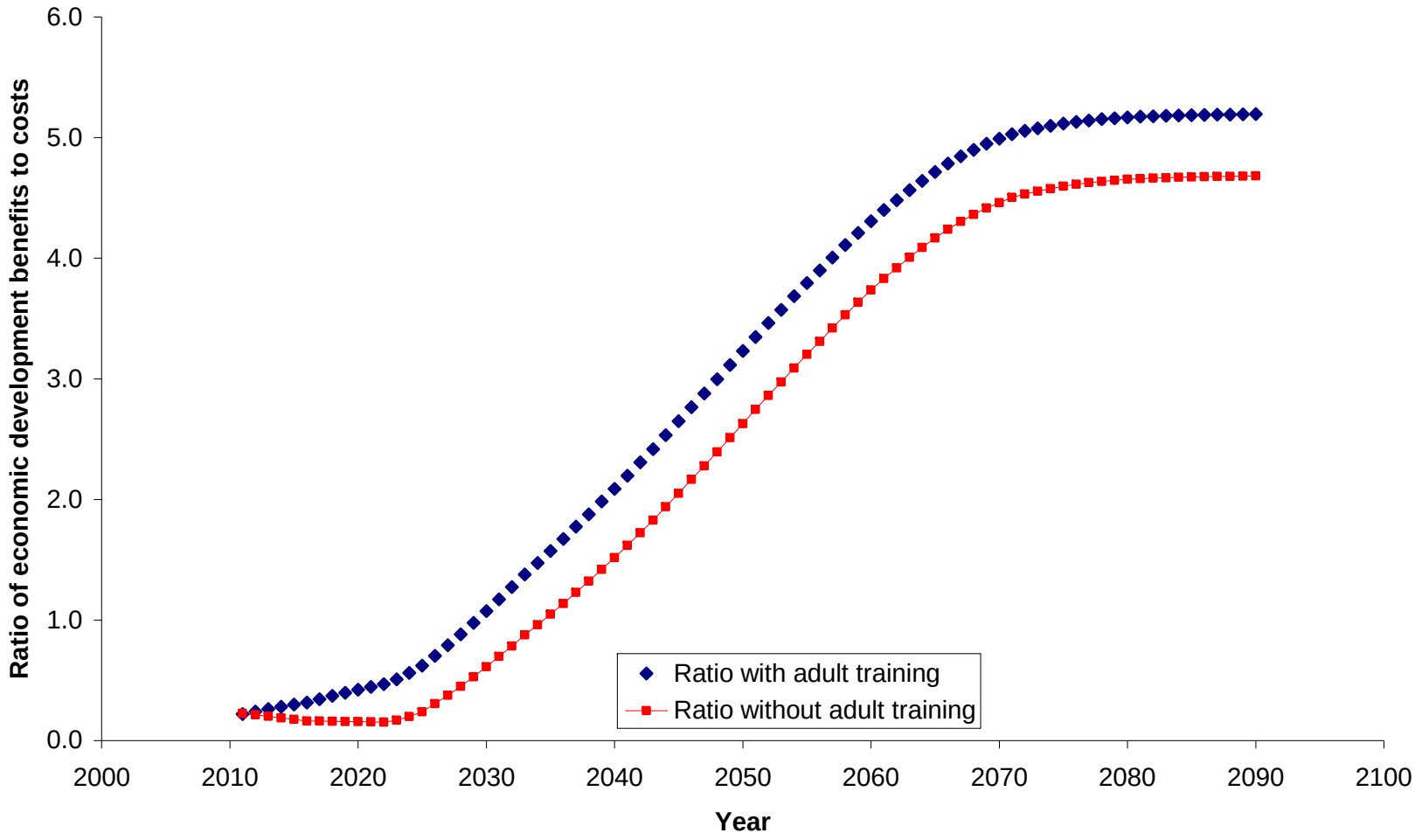
NOTE: Program is assumed to start full-scale in 2011 and continue indefinitely. Assumptions used are described in text and text endnotes. Appendix 7B shows the numbers behind this figure.

Figure 7.4 Effects on State Economic Development of Financing Universal Preschool through Reducing K–12 Spending



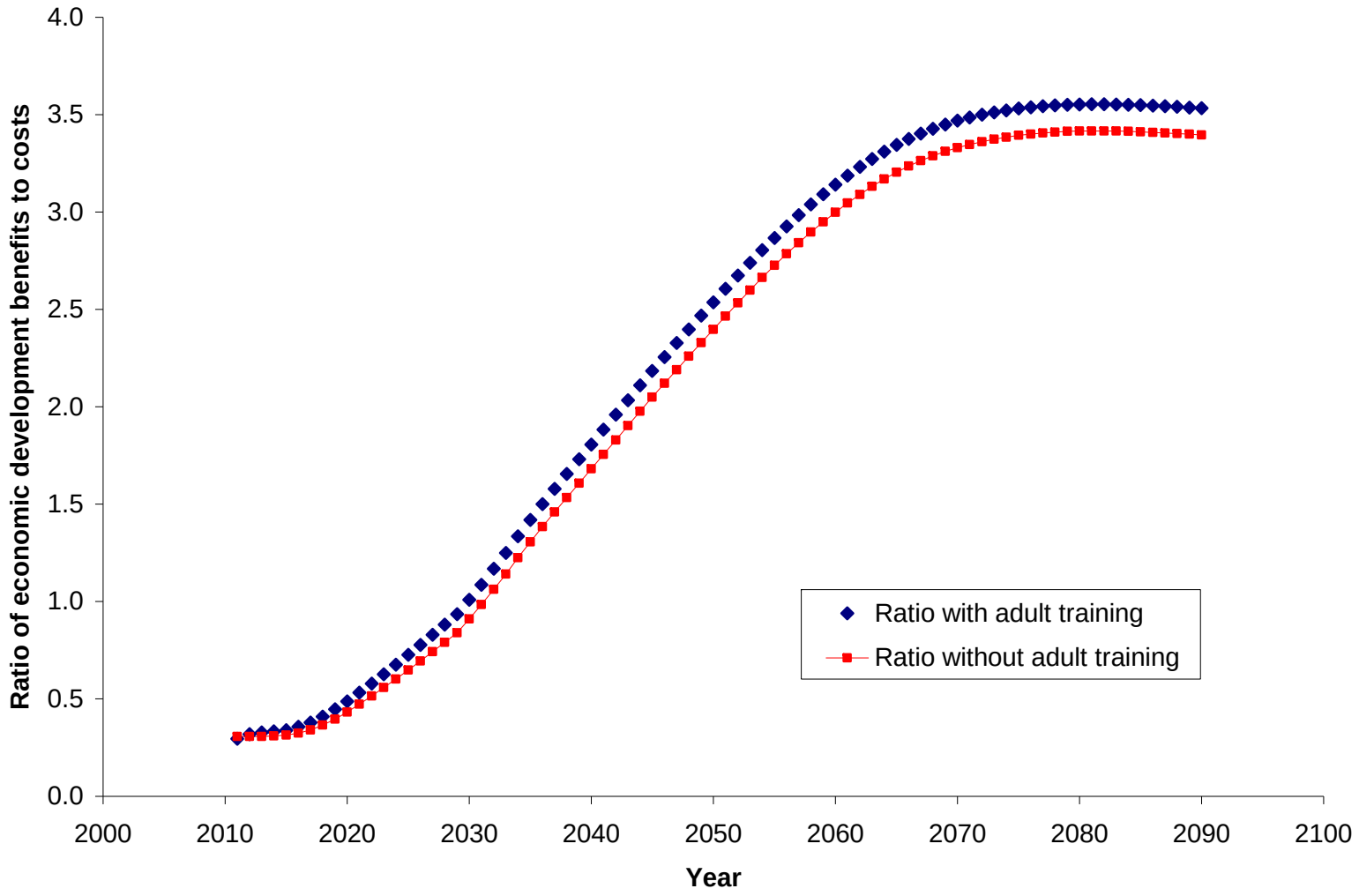
NOTE: Effects for universal preschool are as previously described in Chapter 4, and in Bartik (2006). Effects of cutting K–12 are modeled as described in chapter text, and follow estimates of Krueger (2003). The net effect is simply the difference between the two.

Figure 7.5 Ratio of Annual State Economic Development Benefits to Program Costs, Universal Preschool, with Adult Training Component, Compared to Similar Ratio without a Training Component



NOTE: Methodology is explained in chapter text and appendix. Economic development benefits are increases in earnings of state residents.

Figure 7.6 Ratio of Annual State Economic Development Benefits to Program Costs, Abecedarian Program, with Adult Training Component, Compared to Similar Ratio without a Training Component



NOTE: Methodology is explained in chapter text and appendix. Economic development benefits are increases in earnings of state residents.

Table 7.1 Effects of Alternative Discount Rate Assumptions on Ratio of Present Value of Program Earnings Effects to Costs, Business Incentives, and Four Early Childhood Programs, State Perspective

	Discount rate assumption of book				
	Stern	Moore et al.	This book	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 incentives	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

NOTE: See Appendix 7A for methodology and references. All ratios here are from state perspective.

Table 7.2 Annual Rate of Return to Business Incentives and Four Early Childhood Programs, From a State Perspective

Program	Annual rate of return, state perspective
Business incentives	12.6
Universal preschool	6.7
Abecedarian	7.7
Nurse Family Partnership	5.7
Parent-Child Home Program	8.6

NOTE: This table shows the highest real interest rate at which the present value of earnings effects of the program exceeds the present value of program costs.

Table 7.3 Possible Capitalization Effects of Universal Preschool

Discount rate used	3%	4.7%	6.06%	7.33%	Elementary test score effect for comparison
Basis	Optimal social discount rate	Parental discount rate for investment in children, inferred from investment choices regarding children's health	Discount rate compatible with estimate that one standard deviation increase in test scores increases property values by 10%	Average 30-ear real mortgage rate from Barrow and Rouse. (Also compatible with one standard deviation test score effect of about 5%)	Possible effects from effects of elementary test scores on property value, and effect of universal preschool on elementary test scores
Gross capitalization of economic development benefits					
% effect on property values	22.9	6.4	3.1	1.8	0.4–0.8
Ratio of property value effect to annual costs of universal preschool	290.8	80.9	39.3	22.6	5.1 to 10.2
Property taxes raised as proportion of annual costs of universal preschool	3.87	1.08	0.52	0.30	0.07 to 0.14
Subtracting out full program costs					
% effect on property values	17.5	4.5	1.2	0.3	
Ratio of property value effect to annual costs of universal preschool	222.1	57.3	15.6	4.2	
Property taxes raised as proportion of annual costs of universal preschool	2.95	0.76	0.21	0.06	

NOTES: The figures in the last column come from the previous section of the text, which analyzed capitalization effects expected due to universal preschool's effects on elementary test scores. The remaining columns calculate capitalization under various assumptions about discount rates and whether all of program costs are deemed relevant to property valuation. The first three rows of numbers simply consider capitalization under the assumption that only gross economic development benefits of universal preschool are capitalized. Fiscal effects are ignored under the assumption that these are not relevant, either because of many fiscal benefits (e.g., reduced special ed. costs, criminal justice system costs, welfare costs, child welfare costs) as well as costs of universal preschool, or because the marginal homebuyer may not pay much of those costs (e.g., fiscal costs may not be deemed relevant to property bids if financed by sales tax, or progressive income tax, or business tax). The final three rows of numbers consider the opposite extreme example: all of the program costs of universal preschool are capitalized, ignoring any fiscal benefits of universal preschool. Capitalization effects on property values calculate the discounted present value of economic development benefits (or economic development benefits minus program costs) under various discount rates, and gets percentage effect by dividing by estimated total residential property values, which are estimated based on data from Federal Reserve Board *Flow of Funds* data (Federal Reserve, March 2009). Property tax collections assume a real property tax rate of 1.33%, based on average national data from Yilmaz et al. (2006) of the Tax Policy Center. The discount rate assumptions are based on different plausible discount rates. 3% is the optimal social discount rate used in this book. 4.7% is an estimate of the average discount rate used by parents for making decisions about investments in their child's health. 6.06% is an estimate of the discount rate that would be needed to explain how elementary test scores affect housing prices, assuming a one standard deviation increase in test scores increases housing prices by 10%. 7.33% is an estimate from Barrow and Rouse of the average real 30-year mortgage rate. 7.33% is also close to the discount rate needed to explain how elementary test scores affects housing prices, under the assumption that a one standard deviation increase in test scores increases housing prices by 5%. (The actual discount rate for a 5% effect is 7.5%.)

APPENDIX 7A

MORE ON DISCOUNTING

This book's baseline estimates assume a real social discount rate of 3 percent. Is this the appropriate rate? What alternatives might be considered?

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 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.[1]

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 percent 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 percent without also altering the rate of wage growth assumed in the model's calculations.[2]

There are a variety of perspectives for appropriate values of d and e. The *Stern Review* (2007) assumes 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 percent.

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

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 percent. Weitzman assumes a value for *d* of 2.0 and for *e* of 2, yielding a discount rate on future consumption of 4.4 percent.

These seem to encompass the plausible range of rates for discounting future consumption under the assumptions about wage growth used here. Higher rates of annual wage growth could yield higher discount rates. But then future earnings would also be higher.

The rates implied by the *Stern Review*, the Moore et al. paper, the 3 percent figure of the current book, Nordhaus and Weitzman, are used in the table in the text. One exception is that the Stern discount rate of 1.3 percent is adjusted upward to 1.6 percent. The discount rate of 1.3 percent causes present values to blow up to infinity, as the sum of 1.2 percent wage growth plus assumed population growth of 0.3 percent yields a rate of aggregate earnings growth of over 1.5 percent. A rate of 1.6 percent avoids these infinities.

NOTES

1. 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 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).

2. For example, one could argue for using a rate of per capita consumption growth equal to 1.6 percent 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 percent per year, even though the earnings growth figure is only projected to grow at 1.2 percent per year.

APPENDIX 7B

EFFECTS OF REDUCED SPECIAL EDUCATION COSTS ON BENEFITS VS. COSTS OF UNIVERSAL PRESCHOOL AND THE ABECEDARIAN PROGRAM

This appendix presents the numbers behind Figures 7.2 and 7.3 in the text. The assumptions and methods used to generate these numbers are presented in the text and endnotes to the text. Table 7B.1 presents the numbers behind Figure 7.2. Table 7B.2 presents the numbers behind Figure 7.3. Each table compares the ratio of economic development benefits to net costs associated with early childhood programs, for each year after a permanent program is enacted in 2011. One column shows the ratio when special education cost savings are not considered. The other column shows the ratio when special education cost savings are considered. Table 7B.1 and Figure 7.2 consider universal preschool. Table 7B.2 and Figure 7.3 consider the Abecedarian program.

Table 7B.1 Ratio of Annual Economic Development Benefits to Net Program Costs, Universal Preschool, with and without Allowing for Special Education Cost Savings

Year	Universal preschool without adjustments	Ratio of universal preschool earnings to net costs (special ed. cost savings included)
2011	0.225	0.225
2012	0.213	0.215
2013	0.201	0.204
2014	0.189	0.192
2015	0.176	0.179
2016	0.163	0.165
2017	0.161	0.166
2018	0.160	0.167
2019	0.159	0.167
2020	0.157	0.167
2021	0.155	0.166
2022	0.152	0.166
2023	0.170	0.196
2024	0.199	0.249
2025	0.240	0.318
2026	0.305	0.427
2027	0.376	0.544
2028	0.450	0.667
2029	0.529	0.797
2030	0.612	0.933
2031	0.697	1.072
2032	0.785	1.216
2033	0.876	1.365
2034	0.959	1.503
2035	1.048	1.648
2036	1.137	1.795
2037	1.229	1.945
2038	1.321	2.096
2039	1.420	2.259
2040	1.518	2.419
2041	1.620	2.586
2042	1.724	2.757
2043	1.829	2.928
2044	1.940	3.110
2045	2.051	3.293
2046	2.165	3.480
2047	2.278	3.664
2048	2.393	3.853
2049	2.513	4.048
2050	2.628	4.237

Table 7B.1 (Continued)

Year	Universal preschool without adjustments	Ratio of universal preschool earnings to net costs (special ed. cost savings included)
2051	2.746	4.429
2052	2.863	4.621
2053	2.974	4.803
2054	3.090	4.993
2055	3.202	5.175
2056	3.311	5.353
2057	3.421	5.533
2058	3.529	5.709
2059	3.634	5.881
2060	3.736	6.048
2061	3.832	6.205
2062	3.919	6.346
2063	4.008	6.491
2064	4.089	6.623
2065	4.168	6.752
2066	4.241	6.871
2067	4.306	6.977
2068	4.363	7.070
2069	4.416	7.157
2070	4.461	7.230
2071	4.503	7.298
2072	4.532	7.345
2073	4.556	7.385
2074	4.576	7.418
2075	4.597	7.451
2076	4.612	7.476
2077	4.626	7.499
2078	4.637	7.517
2079	4.646	7.532
2080	4.654	7.544
2081	4.659	7.553
2082	4.663	7.559
2083	4.667	7.566
2084	4.671	7.571
2085	4.673	7.576
2086	4.675	7.579
2087	4.677	7.582
2088	4.679	7.585
2089	4.681	7.588
2090	4.682	7.591

Table 7B.2 Ratio of Annual Economic Development Benefits to Net Program Costs, Abecedarian Program, with and without Allowing for Special Education Cost Savings

Year	Ratio of benefits to gross costs (no special education cost savings)	Ratio of benefits to net costs (special education cost savings included)
2011	0.307	0.307
2012	0.307	0.307
2013	0.308	0.308
2014	0.310	0.310
2015	0.314	0.314
2016	0.324	0.329
2017	0.341	0.351
2018	0.365	0.383
2019	0.396	0.425
2020	0.432	0.477
2021	0.472	0.536
2022	0.514	0.601
2023	0.557	0.673
2024	0.602	0.751
2025	0.648	0.836
2026	0.695	0.929
2027	0.742	1.028
2028	0.790	1.138
2029	0.839	1.216
2030	0.910	1.327
2031	0.984	1.442
2032	1.062	1.564
2033	1.141	1.686
2034	1.224	1.814
2035	1.305	1.939
2036	1.384	2.060
2037	1.460	2.177
2038	1.534	2.291
2039	1.607	2.404
2040	1.681	2.519
2041	1.755	2.634
2042	1.830	2.748
2043	1.903	2.862
2044	1.977	2.976
2045	2.049	3.088
2046	2.120	3.198
2047	2.191	3.307
2048	2.260	3.414
2049	2.329	3.522
2050	2.398	3.627
2051	2.466	3.733

Table 7B.2 (Continued)

Year	Ratio of benefits to gross costs (no special education cost savings)	Ratio of benefits to net costs (special education cost savings included)
2052	2.533	3.837
2053	2.599	3.939
2054	2.663	4.039
2055	2.725	4.135
2056	2.785	4.227
2057	2.843	4.316
2058	2.897	4.400
2059	2.949	4.481
2060	2.999	4.558
2061	3.047	4.632
2062	3.090	4.700
2063	3.132	4.764
2064	3.170	4.823
2065	3.205	4.877
2066	3.236	4.925
2067	3.263	4.968
2068	3.288	5.006
2069	3.311	5.042
2070	3.331	5.072
2071	3.347	5.098
2072	3.361	5.120
2073	3.374	5.140
2074	3.385	5.156
2075	3.394	5.170
2076	3.401	5.181
2077	3.406	5.190
2078	3.411	5.197
2079	3.414	5.201
2080	3.416	5.204
2081	3.416	5.205
2082	3.416	5.205
2083	3.415	5.204
2084	3.414	5.202
2085	3.412	5.199
2086	3.409	5.195
2087	3.406	5.190
2088	3.403	5.185
2089	3.399	5.180
2090	3.395	5.174

APPENDIX 7C

FURTHER RESULTS OF SIMULATIONS OF FINANCING UNIVERSAL PRESCHOOL BY REALLOCATING FUNDS FROM K-12 EDUCATION

This appendix provides some additional numbers for the effects of financing universal preschool by reducing K–12 spending.

I consider three simulations. Simulation 1, described in the chapter text and the endnotes to the chapter, assumes that the effects on student achievement and subsequent earnings of reduced K–12 spending are the same per dollar as those estimated by Krueger (2003).

The other two simulations arbitrarily assume other scenarios. I assume that the productivity effects of lowering K–12 spending are one-half of those estimated by Krueger, and one-quarter.

Table 7C.1 shows the results of these simulations. The universal preschool program and K–12 spending reduction are enacted in 2011 and continue indefinitely. Effects are shown on state residents' earnings as a percentage of total state earnings.

Figure 7C.1 compares the three simulations. The comparison only shows the net benefits. As one would expect, this hypothetical budget reallocation has greater effects as K–12 spending reductions are assumed to be less consequential for student learning and subsequent earnings.

Table 7C.1 Effects on State Economic Development of Financing Universal Preschool Through Reducing K–12 Spending, Various Scenarios

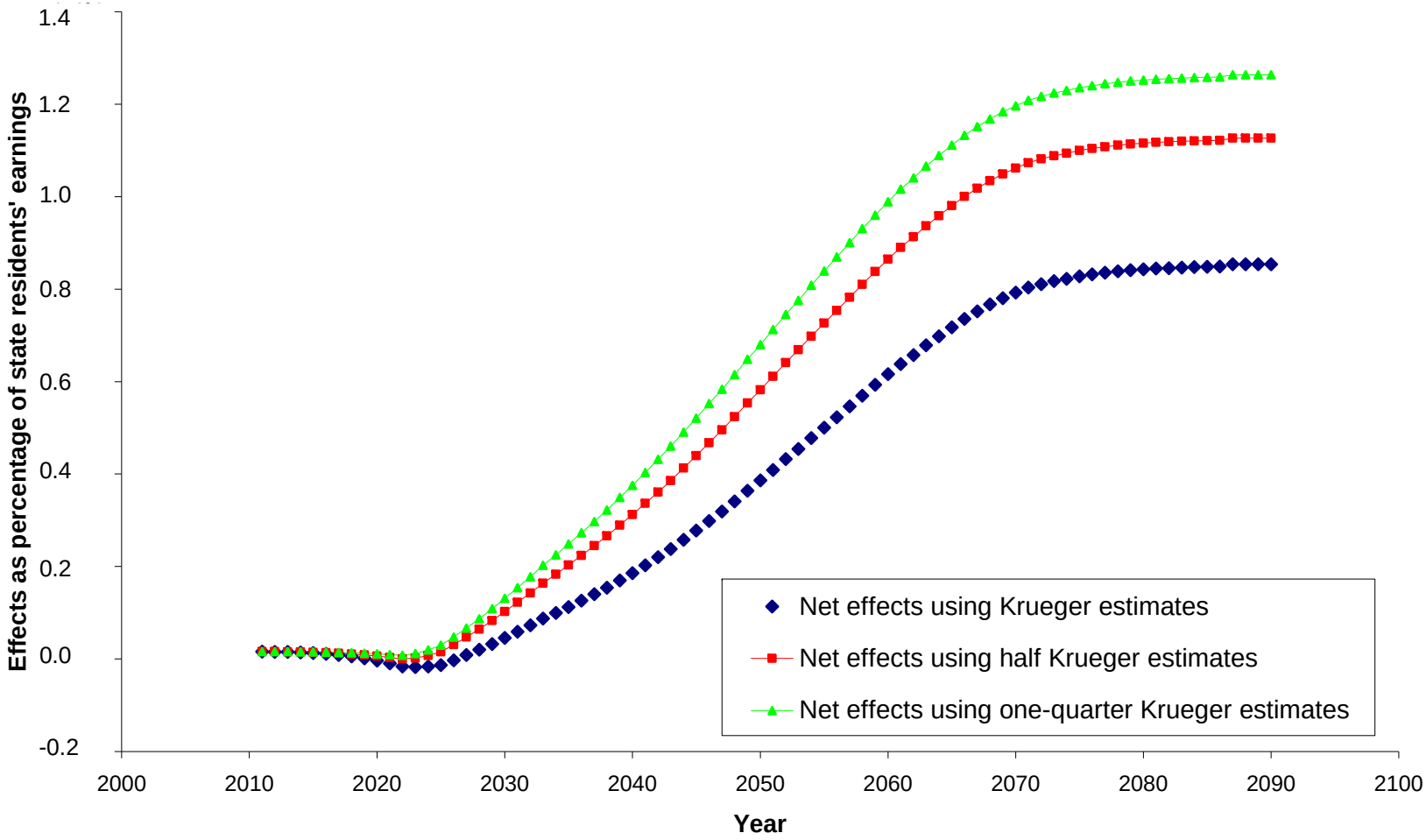
Year	Universal preschool effects	Full Krueger effects		Half Krueger effects		One-quarter Krueger effects	
		Reduced K–12 $ effects	Net effects	Reduced K–12 $ effects	Net effects	Reduced K–12 $ effects	Net effects
2011	0.067	-0.052	0.016	-0.052	0.016	-0.052	0.016
2012	0.064	-0.048	0.016	-0.048	0.016	-0.048	0.016
2013	0.060	-0.045	0.015	-0.045	0.015	-0.045	0.016
2014	0.056	-0.042	0.014	-0.041	0.015	-0.041	0.015
2015	0.053	-0.040	0.013	-0.038	0.014	-0.038	0.015
2016	0.049	-0.038	0.011	-0.035	0.013	-0.034	0.015
2017	0.048	-0.040	0.009	-0.036	0.012	-0.034	0.014
2018	0.048	-0.043	0.005	-0.037	0.011	-0.035	0.013
2019	0.047	-0.046	0.001	-0.039	0.008	-0.035	0.012
2020	0.047	-0.050	-0.004	-0.041	0.006	-0.036	0.011
2021	0.046	-0.056	-0.009	-0.043	0.003	-0.037	0.009
2022	0.046	-0.062	-0.016	-0.046	0.000	-0.038	0.008
2023	0.051	-0.068	-0.018	-0.049	0.002	-0.039	0.012
2024	0.060	-0.076	-0.017	-0.052	0.007	-0.040	0.019
2025	0.072	-0.085	-0.013	-0.056	0.015	-0.042	0.030
2026	0.091	-0.094	-0.003	-0.060	0.031	-0.044	0.048
2027	0.112	-0.104	0.008	-0.065	0.047	-0.046	0.067
2028	0.135	-0.115	0.020	-0.070	0.065	-0.048	0.087
2029	0.158	-0.126	0.032	-0.075	0.083	-0.050	0.108
2030	0.183	-0.137	0.045	-0.081	0.102	-0.052	0.131
2031	0.208	-0.150	0.059	-0.086	0.122	-0.054	0.154
2032	0.235	-0.162	0.073	-0.092	0.143	-0.057	0.178
2033	0.262	-0.175	0.087	-0.098	0.164	-0.059	0.202
2034	0.287	-0.188	0.099	-0.104	0.183	-0.062	0.225
2035	0.313	-0.201	0.113	-0.110	0.203	-0.065	0.249
2036	0.340	-0.214	0.126	-0.116	0.224	-0.067	0.273
2037	0.367	-0.227	0.140	-0.122	0.245	-0.070	0.297
2038	0.395	-0.241	0.154	-0.129	0.266	-0.073	0.322
2039	0.425	-0.255	0.170	-0.135	0.289	-0.076	0.349
2040	0.454	-0.268	0.186	-0.142	0.312	-0.078	0.375
2041	0.484	-0.282	0.203	-0.148	0.336	-0.081	0.403
2042	0.515	-0.295	0.220	-0.154	0.361	-0.084	0.431
2043	0.547	-0.309	0.238	-0.161	0.386	-0.087	0.460
2044	0.580	-0.322	0.258	-0.167	0.413	-0.090	0.490
2045	0.613	-0.336	0.278	-0.173	0.440	-0.092	0.521
2046	0.647	-0.349	0.299	-0.180	0.468	-0.095	0.552
2047	0.681	-0.362	0.319	-0.186	0.495	-0.098	0.583
2048	0.716	-0.375	0.341	-0.192	0.524	-0.101	0.615
2049	0.751	-0.387	0.364	-0.198	0.553	-0.103	0.648
2050	0.786	-0.400	0.386	-0.204	0.582	-0.106	0.680
2051	0.821	-0.412	0.409	-0.210	0.611	-0.109	0.712
2052	0.856	-0.424	0.432	-0.215	0.641	-0.111	0.745
2053	0.889	-0.435	0.454	-0.221	0.669	-0.114	0.776
2054	0.924	-0.446	0.478	-0.226	0.698	-0.116	0.808
2055	0.957	-0.457	0.500	-0.231	0.726	-0.118	0.839
2056	0.990	-0.467	0.523	-0.236	0.754	-0.120	0.869

Table 7C.1 (Continued)

Year	Universal preschool effects	Full Krueger effects		Half Krueger effects		One-quarter Krueger effects	
		Reduced K–12 $ effects	Net effects	Reduced K–12 $ effects	Net effects	Reduced K–12 $ effects	Net effects
2057	1.023	-0.477	0.546	-0.241	0.782	-0.123	0.900
2058	1.055	-0.485	0.570	-0.245	0.810	-0.125	0.931
2059	1.087	-0.494	0.593	-0.249	0.838	-0.126	0.960
2060	1.117	-0.501	0.616	-0.253	0.865	-0.128	0.989
2061	1.146	-0.508	0.638	-0.256	0.890	-0.130	1.016
2062	1.172	-0.514	0.658	-0.259	0.913	-0.131	1.041
2063	1.198	-0.520	0.678	-0.262	0.937	-0.132	1.066
2064	1.223	-0.525	0.698	-0.264	0.959	-0.134	1.089
2065	1.246	-0.529	0.717	-0.266	0.980	-0.135	1.112
2066	1.268	-0.532	0.736	-0.268	1.000	-0.135	1.133
2067	1.287	-0.535	0.752	-0.269	1.018	-0.136	1.151
2068	1.305	-0.538	0.767	-0.270	1.034	-0.137	1.168
2069	1.320	-0.540	0.781	-0.271	1.049	-0.137	1.183
2070	1.334	-0.542	0.792	-0.272	1.062	-0.138	1.196
2071	1.346	-0.543	0.803	-0.273	1.073	-0.138	1.209
2072	1.355	-0.544	0.811	-0.274	1.081	-0.138	1.217
2073	1.362	-0.545	0.817	-0.274	1.088	-0.138	1.224
2074	1.368	-0.546	0.822	-0.274	1.094	-0.139	1.230
2075	1.374	-0.547	0.828	-0.275	1.100	-0.139	1.236
2076	1.379	-0.547	0.832	-0.275	1.104	-0.139	1.240
2077	1.383	-0.548	0.836	-0.275	1.108	-0.139	1.244
2078	1.387	-0.548	0.838	-0.275	1.111	-0.139	1.247
2079	1.389	-0.548	0.841	-0.276	1.114	-0.139	1.250
2080	1.391	-0.549	0.843	-0.276	1.116	-0.139	1.252
2081	1.393	-0.549	0.844	-0.276	1.117	-0.139	1.254
2082	1.394	-0.549	0.845	-0.276	1.118	-0.139	1.255
2083	1.395	-0.549	0.846	-0.276	1.120	-0.139	1.256
2084	1.397	-0.549	0.847	-0.276	1.121	-0.139	1.257
2085	1.397	-0.549	0.848	-0.276	1.121	-0.139	1.258
2086	1.398	-0.549	0.849	-0.276	1.122	-0.139	1.259
2087	1.400	-0.546	0.854	-0.273	1.127	-0.137	1.263
2088	1.400	-0.546	0.854	-0.273	1.127	-0.137	1.263
2089	1.400	-0.546	0.854	-0.273	1.127	-0.137	1.263
2090	1.400	-0.546	0.854	-0.273	1.127	-0.137	1.263

NOTE: Estimated universal preschool effects are as described in Chapter 4 and Bartik (2006). The "full Krueger effects" are as described in Chapter 7. Net effects simply sum the preschool plus reduced K–12 spending effects. These three columns are the basis for Figure 7.4. The remaining two scenarios scale the Krueger estimates back. The net effects under these three scenarios are used to generate Figure 7C.1.

Figure 7C.1 Effects on State Economic Development of Financing Universal Preschool through Reducing K–12 Spending, Three Scenarios for Effects of K–12 Spending



NOTE: Effects of cutting K–12 spending are modeled as described in chapter text, and follow estimates of Krueger (2003). The only difference in the simulations is whether to use full Krueger effects, or to scale those effects back by one-half or three-quarters.

APPENDIX 7D

This appendix presents some of the numbers behind Figures 7.5 and 7.6. The calculation of these numbers is explained in the text.

Adding in a job training component affects these calculations of economic development benefits and costs in three ways. First, it adds in earnings effects on parents. Second, it adds in some extra budgetary costs of the programs. Third, that extra spending adds in some balanced budget multiplier effects.

As explained in the text, the earnings effects on parents are assumed to be the same for parents as was achieved for adult women in the JTPA experiment. Costs per trainee are also assumed to be the same as for adult women in the JTPA experiment. I had to make some assumptions about how persistent these earnings effects would be. I also had to assume when these earnings effects would begin. I assumed that earnings effects begin at age 20, and persist the same in real terms until age 50. It should be noted that keeping earnings effects the same in real terms implies a smaller percentage effect as earnings grow over the early part of the life cycle. Persistent earnings effects are consistent with postprogram evidence from the GAO (1996). After age 50, I assumed earnings effects declined similar to what was assumed in the Abecedarian program's baseline calculations for the effects of the original program on adult women. These declining earnings effects reflected the decline in control group earnings as individuals age, which is accompanied by lower employment rates and lower real wage rates.

As with the original calculations, all estimates adjust for death rates at different ages and for the proportion of the adults likely to stay in the same state. Estimates also assume that one-third of this supply shock results in displacement, so estimated effects are scaled back by one-third.

Finally, estimates had to assume something about how many adults will participate in this program. As the Abecedarian program targets a disadvantaged group, I assumed that 75 percent of Abecedarian families would have adults participating in job training. But universal preschool includes many middle- and upper-class families that are less likely to participate in these training efforts, at least

training efforts similar to JTPA. I assumed 75 percent participation in training of the high-risk group of families, 25 percent participation of the medium-risk group of families, and zero participation of the low risk group of families. The proportions for the different risk groups are derived from Karoly et al., and are reproduced and discussed in Bartik (2006).

Table 7D.1 shows the estimated effects for universal preschool with an add-on training program. Table 7D.2 show similar estimates for the Abecedarian program. These tables are the numbers behind Figures 7.5 and 7.6.

Table 7D.1 Ratio of Annual Economic Development Benefits to Costs, Universal Preschool Program, with and without Adult Training Component

Year	Ratio of benefits to costs with adult training	Ratio of benefits to costs without adult training
2011	0.221	0.225
2012	0.242	0.213
2013	0.262	0.201
2014	0.281	0.189
2015	0.299	0.176
2016	0.316	0.163
2017	0.344	0.161
2018	0.371	0.160
2019	0.397	0.159
2020	0.422	0.157
2021	0.445	0.154
2022	0.468	0.152
2023	0.509	0.170
2024	0.560	0.199
2025	0.621	0.240
2026	0.704	0.305
2027	0.791	0.376
2028	0.881	0.450
2029	0.976	0.529
2030	1.073	0.612
2031	1.172	0.697
2032	1.273	0.785
2033	1.377	0.876
2034	1.473	0.959
2035	1.573	1.048
2036	1.673	1.137
2037	1.774	1.229
2038	1.876	1.321
2039	1.983	1.420
2040	2.088	1.518
2041	2.197	1.620
2042	2.307	1.724
2043	2.418	1.829
2044	2.533	1.940
2045	2.648	2.051
2046	2.765	2.165
2047	2.879	2.278
2048	2.996	2.393
2049	3.115	2.513
2050	3.230	2.628
2051	3.346	2.746
2052	3.462	2.863
2053	3.572	2.974
2054	3.685	3.090

Table 7D.1 (Continued)

Year	Ratio of benefits to costs with adult training	Ratio of benefits to costs without adult training
2055	3.794	3.202
2056	3.899	3.311
2057	4.006	3.421
2058	4.109	3.529
2059	4.210	3.634
2060	4.308	3.736
2061	4.399	3.832
2062	4.481	3.919
2063	4.565	4.008
2064	4.642	4.089
2065	4.716	4.168
2066	4.784	4.241
2067	4.845	4.306
2068	4.899	4.363
2069	4.949	4.416
2070	4.990	4.461
2071	5.029	4.503
2072	5.056	4.532
2073	5.078	4.556
2074	5.097	4.576
2075	5.116	4.597
2076	5.130	4.612
2077	5.143	4.626
2078	5.153	4.637
2079	5.161	4.646
2080	5.168	4.654
2081	5.173	4.659
2082	5.177	4.663
2083	5.180	4.667
2084	5.184	4.671
2085	5.186	4.673
2086	5.188	4.675
2087	5.189	4.677
2088	5.191	4.679
2089	5.193	4.681
2090	5.195	4.682

NOTE: Methodology behind these numbers is explained in text. The program is assumed to start in 2011 and be ongoing. These numbers are used to generate Figure 7.5.

Table 7D.2 Ratio of Annual Economic Development Benefits to Costs, Abecedarian Program, with and without Adult Training Component

Year	Ratio of benefits to costs with adult training	Ratio of benefits to costs without adult training
2011	0.296	0.307
2012	0.318	0.307
2013	0.327	0.308
2014	0.333	0.310
2015	0.340	0.314
2016	0.356	0.324
2017	0.379	0.341
2018	0.409	0.365
2019	0.446	0.396
2020	0.487	0.432
2021	0.532	0.472
2022	0.578	0.514
2023	0.627	0.557
2024	0.676	0.602
2025	0.726	0.648
2026	0.777	0.695
2027	0.828	0.742
2028	0.881	0.790
2029	0.934	0.839
2030	1.008	0.910
2031	1.086	0.984
2032	1.167	1.062
2033	1.249	1.141
2034	1.335	1.224
2035	1.419	1.305
2036	1.500	1.384
2037	1.578	1.460
2038	1.655	1.534
2039	1.730	1.607
2040	1.806	1.681
2041	1.883	1.755
2042	1.959	1.830
2043	2.034	1.903
2044	2.110	1.977
2045	2.183	2.049
2046	2.256	2.120
2047	2.327	2.191
2048	2.398	2.260
2049	2.468	2.329
2050	2.537	2.398
2051	2.605	2.466
2052	2.673	2.533

Table 7D.2 (Continued)

Year	Ratio of benefits to costs with adult training	Ratio of benefits to costs without adult training
2053	2.740	2.599
2054	2.805	2.663
2055	2.867	2.725
2056	2.926	2.785
2057	2.984	2.843
2058	3.039	2.897
2059	3.091	2.949
2060	3.140	2.999
2061	3.188	3.047
2062	3.231	3.090
2063	3.272	3.132
2064	3.310	3.170
2065	3.345	3.205
2066	3.375	3.236
2067	3.403	3.263
2068	3.427	3.288
2069	3.450	3.311
2070	3.469	3.331
2071	3.485	3.347
2072	3.500	3.361
2073	3.512	3.374
2074	3.522	3.385
2075	3.531	3.394
2076	3.538	3.401
2077	3.544	3.406
2078	3.548	3.411
2079	3.551	3.414
2080	3.553	3.416
2081	3.554	3.416
2082	3.553	3.416
2083	3.553	3.415
2084	3.551	3.414
2085	3.549	3.412
2086	3.547	3.409
2087	3.544	3.406
2088	3.540	3.403
2089	3.537	3.399
2090	3.533	3.395

NOTE: Methodology behind these numbers is explained in text. The program is assumed to start in 2011 and be ongoing. These numbers are used to generate Figure 7.6.

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