The Fiscal Impacts of Universal Pre-K: Case Study Analysis for Three States

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Abstract
Economic evaluations find small-scale pre-K programs generate high economic returns to the state, and most states offer pre-K provision targeted to low-income families. This paper investigates the economic consequences of expanding pre-K provision so that it is universally accessible to all children. First, the model assumptions and framework are set out. Second, case studies for three states – Massachusetts, Wisconsin, and Ohio – are presented. For each state, the existing provision of pre-K is described, along with a policy scenario to ensure universally accessible pre-K. The costs of expanding provision are reported. Using national and state-specific data, the fiscal benefits to the state – from higher tax revenues, lower crime expenditures, more efficient school systems, and lower health/welfare burdens – are calculated. The costs and benefits are then compared. For each state, the fiscal benefits of making pre-K provision universally accessible outweigh the costs of program.

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1. Introduction

Pre-schooling programs are an investment in the future, creating opportunities for the children involved and generating economic and social benefits to society at large. For public policy, the question is which families should receive public support to make this investment. Here, I directly examine the fiscal impact of expanding pre-K provision to make it universally accessible to all children.

The framework for analysis of the costs and benefits of expanding pre-K is a balance sheet. Set against the costs of providing the program are the benefits reaped from participating in pre-K. Studies of small-scale, high-quality programs have identified a considerable array of benefits for the individual child (e.g., enhanced academic attainment and college progression, improved health, higher wages, and reduced rates of criminal activity, for a review, see Gilliam and Zigler, 2000; Loeb et al., 2004).[1] Consequently, strong benefits from pre-K programs are generated for society, including higher tax payments by participants and their families; more efficient use of school resources; lower reliance on welfare; and lower rates of criminal activity. Prior evaluations show these societal benefits to be more than sufficient to pay for the costs of providing early education, and this provides motivation for public support for pre-K.[2] However, almost all extant research has focused on the economic consequences of single, small-scale, and high-quality pre-K programs. Caution is necessary to infer from this research that a universally accessible program would be a good public investment. It is necessary to establish whether: these societal benefits would be obtained by all children; general equilibrium effects would impact; program costs would rise; and whether all states – conditional on their existing pre-K programs and K-12 school systems – would reap similar returns.

Using the balance sheet framework, I provide empirical estimates of the costs and benefits of expanding pre-K across three states: Massachusetts, Wisconsin, and Ohio. The perspective adopted is that of the state legislature – primarily, it is state politicians who must decide whether to commit resources to expand pre-K, and they need to identify whether this

[1] Some evidence shows fade-out, with achievement gains only for the years immediately after participation (Currie and Thomas, 1995; Lee and Loeb, 1995). In rebuttal, pre-K may set children on a different trajectory as 'skills beget skills' (Carneiro and Heckman, 2003). More emphatically, research does not show behavioral fade-out, particularly for attainment, earnings, and crime. This discrepancy could reflect measurement error in tests or more rapid progression of high-achieving students. The most plausible resolution is that pre-K benefits are not restricted to test scores gains.

[2] Each balance sheet study finds the total economic benefits easily outweigh program costs. For the High/Scope Perry Pre-School Program, every $1 investment returns as much as $17 is recouped in benefits (Barnett et al., 2004). For Abecedarian Early Childhood Intervention, every $1 investment returns $2–$3.66, yielding an internal rate of return of 7% (Masse and Barnett, 2002). For the Chicago Child-Parent Pre-School Center and Expansion Program, for every $1 investment, $7.14 was recouped (Reynolds et al., 2001). For Head Start, the short- and medium-term benefits offset 40-60% of the total costs (Currie, 2001).

investment is worth making from their own perspective. For each state, the expanded program would build on existing provision; state-specific data is used to estimate the fiscal benefits.

The outline is as follows. Section 2 sets out the modeling assumptions necessary for an economic evaluation of expanded pre-K. Section 3 describes the state-specific policy reform, the numbers of affected children and the funding requirement. Section 4 describes in detail the full economic benefits anticipated for each state. Both prior evidence and new empirical research results are used to estimate these economic benefits. Section 5 sets the resultant cost-savings against the costs of the investment, allowing for adjudication as to whether a comprehensive program does merit public support. Section 6 concludes.

2. Modeling Pre-K Programs

Four steps are necessary for a full fiscal impact analysis from expanding pre-K provision. First, the consequences for pre-K enrollments in each state need to be considered, in light of the existing patterns of options. Second, the unit and total costs of new provision to accommodate changes in enrollment patterns must be calculated. Third, the economic benefits of pre-K must be calculated. Finally, the costs and benefits must be compared. Before performing these steps, the model framework requires further explanation.

To simplify the analysis, only one cohort (age group) of children is considered, with impacts counted across the life-time. Investments are made over multiple years (if the program duration exceeds one year) and fiscal benefits are accrued both immediately and as the pre-K participants enter adulthood. All figures are in present value 2004 dollars with a discount rate of 5% applied.

2.1 Targeted Versus Universal Programs

The economic models applied here builds on evidence from extant high quality studies, recognizing that this evidence is from targeted programs for at-risk students. In addition, existing pre-K programs in most states are provided mainly for low-income families. As these are the children who are most likely to benefit, it is legitimate to ask whether all children would benefit to the same extent under an expanded program.[3]

In analysis across targeted and universal programs, four points are pertinent. First, achievement gains are evident for universal programs in Oklahoma and Georgia, suggesting that

[3] Also, many children receive private pre-K or childhood care which has educational content. However, the impact sizes of pre-K programs are based on comparisons between those who received a particular program and a control group, some of which may have received private provision.

the benefits from pre-K may be widespread.[4] Second, even as studies focus on targeted populations, these are not a small percentage of the population. For example, the High/Scope Perry Pre-School Program target group was children at risk of dropping out of high school; and at least 10% of all 16-24 year-olds are dropouts. Third, some of the benefits from pre-K may be magnified as increasing numbers of children participate: only with a critical mass of more able or better-prepared students will schools be able to reap savings, for example. Finally, targeted programs may not adequately reach the intended children. (They also raise the costs of screening children, of determining who is eligible, and of monitoring eligibility). If targeting is inaccurate, then there may be both efficiency and equity reasons for offering expanded provision to ensure all children are offered pre-K programs.

More generally, the quality and duration of the pre-K program is important. The policy scenarios below are for time-intensive investments in pre-K of reasonable duration. They also assume high-quality provision, such as a rating of 5 or above on the Early Childhood Environment Rating Scale – Revised (ECERS-R).[5] Each state may organize pre-K differently, e.g. in assessing and ensuring quality and in the mix of public and private providers.[6] Fundamentally, any high quality provision is established through the allocation of sufficient resources.

Nevertheless, the impacts from expanded pre-K need to be calibrated carefully as the program reaches more advantaged children. Two approaches are possible. One is to assume that the benefits obtained by at-risk children will be attenuated for more advantaged children; however, there is no reliable information on the extent of attenuation. The other approach, which is the one adopted here, is to restrict the impacts only to at-risk children, relying on the published evidence on marginal impacts from pre-K.

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[4] Participants in Oklahoma's universal program – especially African Americans and Hispanics – report strong academic gains (of 16%) in overall language and cognitive skills tests (Gormley and Phillips, 2003). In a subsequent investigation, Gormley et al. (2004) find positive academic effects for all income groups and ethnic groups on the Woodcock-Johnson achievement test. Similarly positive – but not as powerful – academic effects are found for Georgia's universal pre-K program (Henry et al., 2003).

[5] See Harms et al. (1998). The scale assesses the quality of the early childhood environment in terms of space, materials, and experiences. The scale covers categories relating to: personal care routines; space/furnishings; language-reasoning; activities; interactions; program structure; parents and staff. The costs of such programs include staff salaries, classroom space, and curriculum materials. For high-quality programs, investments must be made in: curriculum plans; teachers with certification and in-service training; meals; and screening and referral services (see NIEER, 2003). As an example, the High/Scope Perry Pre-School program is rated 5.

[6] Providers will vary in costs and effectiveness, and a more detailed model would calibrate which providers children choose, the unit costs, and the costs of ensuring quality provision. Only for one state is there information on costs and (separately) on quality across different types of provider (Marshall et al., 2002), there is no definitive evidence on which providers parents would choose. Moreover, each provider would require sufficient resources to ensure high-quality provision.

2.2 Conservative Assumptions

To ensure that gains are not overstated, a conservative approach is adopted in creating the model. If there are strong economic returns from pre-K when cautiously estimated, then there should be reasonable confidence that these gains do exist.

This conservative approach has four components. First, all assumptions are drawn from published studies where possible. Second, whenever alternative assumptions or parameter values are plausible, the more conservative one is applied. (Identification of multiple values of parameters also helps in triangulating the results). Third, where benefits from pre-K are anticipated, but there is inadequate data to enumerate them, they are omitted from the analysis (such as multiplier effects from investing in jobs for workers in the pre-K sector). Fourth, a 5% discount rate is applied (above the 3.5% rate advocated by Moore et al., 2004).

Finally, the economic model also includes a sensitivity analysis to ascertain whether the results are robust to the assumptions of the model. For exposition, two different models are applied: Model [1] is the best estimate, using representative impacts of pre-K and sufficient resources; Model [2] is very conservative, using lower bound impacts conditional on generous funding. The economic impacts are unlikely to be below these amounts.

3. Expanding Pre-K Programs across Three States

Regardless of state context, the proposed policy would expand pre-K provision by augmenting the current baseline of provision. Children may fall into five categories. One group already receives pre-K through federal programs or through special education; their provision is unchanged. A second group will not take up programs, even if high-quality and offered at no cost. A third group currently receives programs of sufficient quality; it too has no impact on the analysis. A fourth group currently receives provision, but of low-quality (i.e., ECERS–R<5). Under an expanded program, children in this group would be offered provision of adequate quality. Finally, there are children who presently obtain no pre-K provision, or who receive no public funding for pre-K provision**,** but who would take up provision were it high-quality, accessible, and available at no cost. This group would now participate in pre-K. The distribution of children in each category varies from state to state.

For each state, Table 1 compares the demography of pre-K provision under current circumstances with newly expanded provision. The proposed expansion is significant; however, in each case it would raise enrollments only to levels in the two states where universal access is already obtained (and the funding commitment is less than 5% of the total budgets of state Departments of Education). Table 2 reports the additional investments required to effect

expansion. In each case, a generous allocation is assumed (both to ensure high-quality provision and to allow for increasing marginal costs).

3.1 Massachusetts

For Massachusetts, the assumed policy change is the implementation of a comprehensive program offering pre-K to all pre-schoolers for the two years prior to their entry into kindergarten, i.e. those children aged 3 would receive pre-K prior to their entry into kindergarten.

The first panel of Table 1 shows the distribution of the cohort, both for current provision and after the policy change. In 2003-04, pre-K was supported by income-eligible vouchers through the Office of Child Care Services and direct funding through the Community Partnerships for Children program (19%); but two-thirds of children receive no public funding (children in federal programs and special education (14%) are unaffected by this policy). Under the new policy, all children who presently receive funding would now have access to high-quality programs:13,246 places would need to be upgraded; and 42,671 extra children (47%) who previously received no state-sponsored pre-K would now receive high-quality provision.[7] The policy would impact on 54% of the age cohort, leaving 20% of children without any state-subsidized pre-K.

The additional investment required for this policy is set out in the first panel of Table 2. Using a Costs of Care formula derived by the Massachusetts Department of Education, pre-K provision would cost approximately $6,500 per child (Model [1]); this is above the current funding commitment of $5,118 (Model [2]). For a two-year investment in new and upgraded provision, the total additional present value expenditure would be $578 million.

3.2 Wisconsin

For Wisconsin, the proposed change is the implementation of a state-wide pre-K program offering one year of provision to all children aged 4 in the year prior to their entry into kindergarten.

This policy would build on the existing state 4K program, which is 'universal' in that all 4-year-olds are eligible if a district offers the program. Based on enrollment, the 4K program is financed by the state (two-thirds) and the district (one-third), but for only 2.5 hours per day; districts wishing to provide a more intensive program must finance it directly. In turn, provision is locally controlled: school boards dictate class sizes, admissions policies, and other program details; a community-based approach is favored, including a significant commitment to parental outreach.

[7] Marshall et al. (2002) found that 39% of early childhood programs for center-based 3 and 4 year olds were high quality; the remaining 61% were not. Therefore, some of the existing provision will need to be upgraded in the new program.

The second panel of Table 1 shows the distribution of the 89,170 four-year-olds in Wisconsin. As of 2003, high-quality 4K was available for 18% of children, leaving 64% without public provision (with 18% of children receiving public support from other sources). Under an expanded program, 32,102 extra children would enroll in 4K, raising the take-up rate of 53% of the cohort. The additional investment required is given in the second panel of Table 2, per child and in total. Assuming 4K is (generously) funded at a level equivalent to Head Start ($6,445 per child), the extra investment would be $207 million.

3.3 Ohio

For Ohio, the proposed policy change is to expand public pre-K provision to an additional 40% of three-year olds for the two years prior to kindergarten.

As of 2002-03, only a small proportion of children in Ohio access publicly funded pre-K via the Public School Preschool Program. With state funds of $19.3 million to cover children aged 3 and 4, only 3% of three-year-olds are covered and eligibility is targeted to those with incomes 185% below the poverty line. However, there is a substantial commitment of federal and state funds for Head Start, such that 25% of children receive pre-K. Notwithstanding, 72% of children are not enrolled, leaving substantial scope for expansion.

The final panel of Table 1 shows the distribution of children: a 40% expansion would require 42,874 new high-quality places. As shown in Table 2, each place would cost $5,900 – the amount currently provided via the Public School Preschool Program; in total, an additional $482 million funding per cohort would be needed.

4. The Fiscal Impacts of Expanding Pre-K Programs

These pre-K programs are anticipated to generate economic benefits to the state. Cost-savings should arise from increased school system efficiency and from increases in tax revenues, arising from parental work and from greater labor market effort by pre-K children in adulthood. In addition, there are likely to be very significant consequences for expenditures by the criminal justice system, both as the children are juveniles and adults, and by government agencies for health and welfare. (Here no distinction is made between federal, state, and local financing jurisdictions).

4.1 School System Cost-Savings

4.1.1 Special Education and Grade Retention

The main medium-term impact of pre-K is in raising the efficiency of the school system, via reductions in special education placement and grade retention, as well as improvements in

learning productivity.[8] This last impact is traced through student achievement and behavior; put simply, more proficient students reduce the unit costs of education.

Special education and grade retention savings are estimated as follows. Using state-level data on K-12 costs, the present value amount of public expenditures across student types is calculable. In Massachusetts, for example, a new kindergarten entrant is anticipated to receive $55,281 of public funds for their entire K-12 schooling; if that child repeats a grade, expenditure is $59,076; and if he or she is placed in special education, the expenditure rises to $113,260. Thus, if pre-K programs reduce grade repetition and special education, they will lower public expenditures.

Review of the literature indicates that special education placement is reduced by between 6%-48% after pre-K, with a representative estimate of 12% (Reynolds et al., 2000). Similarly, grade retention is reduced by between 6%-23% after pre-K, with a representative estimate of 21%. Two models are presented, differing in their assumptions about how effective pre-K programs will be. Model [1] assumes impacts that – as reported in the published literature – are representative. So, special education in Massachusetts is assumed to fall by 12%, from 16.6% to 15.52%; grade repetition is assumed to fall by 21%, from 2.03% to 1.8%. Model [2] is very conservative: it assumes impacts of only one-quarter as large as the average of the published impacts. Again using Massachusetts as an example, special education is assumed to fall by 8.5%, to 15.84%, and grade repetition is assumed to fall by 9.25%, to 1.93%. These effects are linked with the per student expenditures.

The economic consequences of shifting placement of students are reported in the first two rows of Table 3. State-specific costs, rates of special education, and grade retention incidences are applied across the two models. The cost-savings in terms of special education expenditures are significant; for grade retention the economic consequences are in some cases trivial (<$1m).

4.1.2 Learning Productivity Gains

In addition, pre-K programs generate savings from their association with gains in academic achievement and improved student behavior. This direct benefit to students will also have widespread effects on other students and the school, raising overall learning productivity. For the cost-benefit analysis, I estimate the academic and behavioral impacts from expanded pre-K and then estimate the budgetary consequences for the school system. Two assumptions are applied:

[8] There may be additional costs to the state as students stay in school for longer. However, where these expenditures are incurred, they serve to improve outcomes as well; neither costs nor benefits of college progression are included here.

in Model [1] the impact is assumed to exist for all K-12 schooling; in Model [2] the impact is assumed to fade-out after the first six years (to 5th grade).

Using Early Childhood Longitudinal Study (ECLS) data, regression analysis shows that pre-K programs raise individual achievement by 0.14 standard deviations (see Appendix Table 1A; see also Fryer and Levitt, 2004). There is also a peer effect, as other students benefit from their classmates' participation in pre-K (see Hanushek et al., 2003). In addition, separate analyses show the correlation between school-level rates of participation in pre-K and school safety: where pre-K enrollments are higher or academic achievement is enhanced, principals are less likely to report: fighting; the school is unsafe; weapons are brought into school; thefts; and physical attacks (see Appendix Table A2). In turn, there are consequences for teachers: as the percentage of pre-K enrollees in a school rises, teachers report higher job satisfaction, lower turnover and absenteeism, and they are less likely to report "student behavior interferes with my teaching" (see Appendix Table A3). The effect is to improve student behavior by 16 percentage points.

Assuming that pre-K enrollment rates in each state are expanded as outlined in Section 3, the consequences for the education budgets of public schools are estimated across five domains. There are cost-savings because improved student behavior is equivalent to (i) a compensating wage differential for teachers; it also reduces spending on (ii) substitute teachers and lowers the costs of (iii) teacher turnover. Directly, pre-K programs will reduce the need for spending on (iv) school safety and reduce the pressure on (v) programs which are intended to address low academic achievement.[9] Table 3 reports the present value cost-savings in terms of educational expenditures for the three states. Here, exposition is based on the Massachusetts context, but the same method is applied for each state using teacher salaries and numbers.

For teacher job satisfaction, empirical analysis of the ECLS shows that when student behavior rises by 16 points, teacher job satisfaction rises by as much as 10 percentage points. This effect is substantial, particularly as teachers place considerable weight on job conditions relative to salaries (Lankford et al., 2002). A very low estimate of raising job satisfaction by 10 percentage points would be a 3% increase in salary (Heywood et al., 2002). Using Massachusetts teacher salary levels and teacher numbers (AFT, 2004), an improvement in job satisfaction equivalent to a 3% raise would generate a present value cost-saving of over $75 million.

[9] Teacher professional development (PD) requirements are influenced by student behavior. Specifically, courses and syllabi must be provided on responding to student actions such as threatening behavior or truancy. Given the average PD requirement of 4-5 days per year, there is a potential impact on 2% of the overall instructional budget. However, in the absence of data on the link between student behavior and PD needs or on the costs of such programs, this impact is not included in the analysis.

For teacher turnover, an expanded pre-K program will reduce turnover rates by 12%. Given the costs per exiting teacher (equivalent to 33% of the salary of the new hire, SBEC, 2000) and the quit rate of 9% per year (NCES, 2003), the annual cost of teacher turnover is over $100 million. Reducing this by 12% would therefore generate a total saving of $9 million.

Teacher absenteeism is also lower when learning productivity is higher, and again the relationship is substantively very strong. On average, school systems employ 1 substitute teacher for every 15 regular teachers: total expenditures on substitute teaching in Massachusetts are therefore $222 million over the entire age cohort. Even a 5% or 10% reduction in substitute teaching would therefore generate considerable savings.

For school safety, a conservative estimate is that school safety rises by 10% as a result of universal pre-K. On average, schools spend 6% of their budgets – either directly or indirectly – on safety. An improvement in school safety would therefore save 0.6% of the total budget, worth approximately $36 million.

Finally, there are specific state programs which are directed at improving achievement. Of course many educational programs are aimed at improved achievement generally, but examination of state budgets reveals two that are explicitly and solely intended to do so. In 2002, annual budgetary appropriations in Massachusetts included $13 million for education improvement and $46 million for MCAS Low-Scoring Student Support. The pressure on these appropriations would be lessened if achievement gains could be generated through pre-K investments. If an achievement gain of 0.14 standard deviations were obtained, a significant proportion of the resources for these programs could be redistributed. With a 30% redistribution from these programs into pre-K, the present value savings would be $13 million.

4.2 Tax Revenues

Tax revenues to the state will be affected in two ways from expanded participation in pre-K programs: it will free up parents to enter the labor market; and it will increase earnings and labor market activity in adulthood. Both effects should raise tax revenues.

Earnings gains for parents are derived from prior studies. Barnett et al. (2004) calculate the present value gains from parental participation in the labor market at $963 for the average parent/child (accounting for multiple children and parents whose labor market participation is unchanged). The equivalent impact for the proposed policies in Massachusetts and Ohio would be even greater, because these programs would extend for a full two years. For Massachusetts, the impact on parental incomes is estimated at $1,445 per child, and this amount should be applied across all 42,874 participants. Applying the average tax rate of 27% (not including sales

taxes), the present value gain is $17 million for Massachusetts; applying a marginal tax rate of 15%, the gain falls to $9 million.

The gains to participants in terms of earnings are well-established: pre-K enrollment is positively associated with years of schooling attainment, which are strongly associated with earnings. To be conservative, however, only the effect of pre-K on raising high school graduation rates is considered, i.e. a college-bound student is assumed to experience zero wage gain from pre-K participation. Review of the literature indicates that pre-K participation will reduce the rate of high school drop-out by at least 24%; wage gains can be calculated accordingly.[10]

National datasets can be used to calibrate the gains in tax revenues, as well as calculating the cost offset in terms of additional college enrollment by new high school graduates. For the cohort of 55,917 Massachusetts pre-K enrollees, 10.7% will drop-out of high school but 29% will not complete on time (NCES, 2003; Swanson, 2004). A fall of 24% in the number of high school drop-outs will mean between 1,462 and 3,961 more high school completers. These are additional high school graduates, over and above those who would have graduated anyway. Using Census (2000, PINC-04) data on lifetime earnings, each of these high school completers will earn approximately $92,000–$127,000 more in present value dollars over the lifetime compared to a high school drop-out.[11] With an average tax rate of 27% applied across this earnings range, that will generate a total additional tax revenue of between $98 million ($92,000×3,961×0.27) and $50 million ($127,000×1,462×0.27). Exactly analogous approaches are used for Wisconsin and Ohio.

4.3 Criminal Justice System Cost-Savings

The largest returns from investments in pre-K programs may arise from reductions in criminal activity (see Reynolds et al., 2001); in part this is because crime imposes a significant fiscal burden (it also imposes a sizeable social burden to the victims, but these are not included here). To validate the estimates of the savings to the criminal justice system, three alternative approaches are applied and the mean saving is calculated.

Barnett et al. (2004) find that the lifetime cost-savings to the criminal justice system per participant in the High/Scope Perry Pre-School program are $47,000. However, for the many

[10] This rate too is conservative, in applying the lower bound of estimates. Temple et al. (2000) report that the Chicago Child–Parent Centers program reduces high school drop-out by 24%. For the High/Scope Perry Pre-School program, the reduction is almost exactly the same, at 25% (Barnett et al., 2004). For the Abecedarian EC Intervention, the reduction is even larger, at 32% (Masse and Barnett, 2002).

[11] This average wage premium is discounted at 5%, with zero earnings growth, including an offset for college costs; it varies according to the numbers of high school graduates who then progress to college. General equilibrium effects are assumed to be small, with falling premia to graduation being offset by rising premia to drop-outs.

reasons noted above, these effects are unlikely to generalize to children from more advantaged backgrounds. By assumption, the effects are only applied to those at risk of high school drop-out, i.e. to 10.7% of the newly enrolled children. Across the 42,671 newly enrolled children, the total present-value savings from reductions in crime are therefore $215 million. Including the 13,246 children who receive upgraded pre-schooling, the crime savings rise to $286 million. Next, Lochner and Moretti's (2004) analysis using the Census and NLSY is adopted. In calculating the effects of education on crime, they find very strong impacts: each additional male graduate yields annual social benefits of $1,170-$2,100. Assuming an educational impact for females proportional to the male/female arrest rate, the cost-savings from reductions in crime across the 3,961 additional high school graduates would be $132-$238 million. Finally, using data from the Chicago Child–Parent Center program, Reynolds et al. (2002) report average present value criminal justice system savings of $6,000 per participant. Across the 42,671 or 56,917 new participants in pre-K in Massachusetts, this amounts to $256-$342 million.

Reassuringly, despite very different methods, these three derivations generate reasonably consistent estimates of the savings to the criminal justice system, with a mean saving of $201-$288 million for Massachusetts. Again, an equivalent approach is applied using data for Wisconsin and Ohio.

4.4 Health and Welfare Cost-Savings

The final cost items are related to expenditures on child health and welfare. Pre-K affects general behavior and the prevalence of risk factors associated with problem conditions (McCarton et al., 1997; Johnson and Walker, 1991); there are also health gains associated with screening, immunization, and nutrition. A review by the Center for Disease Control and Prevention (CDCP, 2002) reported effect size impacts for social risks after pre-schooling was -0.41; the gain in health screening rates was 44% (see Smokowski et al., 2004). These impacts in turn influence the child's reliance on health support services and welfare programs.[12]

Across the states, welfare programs are extensive, including services in relation to: prevention, for children at risk of abuse and neglect; family preservation and reunification; child protection; in-home and out-of-home support; out-of-home placements; and adoption. From a national survey, Geen et al. (1999) report that spending on these child welfare programs at federal, state, and local levels is $17.4 billion per year. The potential for savings is therefore substantial.

[12] Review yields one estimate of the cost-savings from reduced abuse/neglect of children; per child, the cost-savings in this domain have been estimated at $338 (Reynolds et al., 2000). No economic evidence on health support services is available.

However, states vary in how they report health and welfare programs. Across the three states, Ohio reports the most complete information in its Children's Budget (OBM, 2004).[13] In ensuring children are ready for school, Ohio invests $2.48 million; for at-risk children to succeed in school, it invests $51.3 million (on, e.g., mental health programs). More important are the commitments of: $154.7 million for Services for Severely Emotionally Disturbed and At-Risk Children; $33.5 million for Child Protection Services; and the $640 million for Child Foster Care and Adoptions. Assuming only a 5% (or 2.5%) saving in these commitments for the new pre-K children would yield a present value gain of $24 million ($12 million) in terms of welfare. Similarly, for its 'Youth Choose Healthy Behaviors' program, the state invests $41.7 million. A reduction in this commitment by 5% (or 2.5%) would save $1.18 million ($0.59 million). Again, savings of similar proportions are anticipated for Massachusetts and Wisconsin.

5. Cost-Benefit Analysis of Expanding Pre-K Programs

Table 4 itemizes the costs and fiscal impacts of expanding pre-K provision for a single age cohort across the three states (reported in present values with a 5% discount rate). For each case, a representative model [1] is reported, along with a very conservative model [2]. For the representative model, the benefits to the state easily outweigh the costs; of particular interest are the relative magnitudes of the individual benefits and the payback period for the investment.

For Massachusetts, the fiscal benefits are $683 million; set against the costs of $578 million, the net benefit is $105 million. The benefit/cost ratio is therefore 1.18: each dollar invested yields $1.18 in returns to the state. Of the benefits, 42% arise from savings across the criminal justice system and 30% through the school system; 14% of the benefits come from higher earnings in adulthood. For payback, by the time the child has completed schooling at least 50% of the investment has been recouped. For every $1 invested by a state Department of Education in pre-K, there are anticipated to be savings of 35 cents from other programs within the school system.

For Wisconsin, the benefits of investment significantly outweigh the costs. The policy scenario here is for only one year, which means that the costs of the program are relatively low, at $207 million. Correspondingly, the benefits are lower also (but not proportionately). With a net benefit of $339 million, the program yields a net present value of $132 million (Model [1]). For

[13] For Massachusetts, the Department of Social Services in the Office of Children, Youth, and Family Services projects spending of $702 million (FY, 2004). Assuming these expenditures could be reduced by 40% for the relevant pre-K cohort there would be savings of $20-$26 million. Spending on health per year is $4.95 billion ($780 per person); reducing these expenditures by 41% for the relevant pre-K cohort would save $34-$48 million. For Wisconsin, data sources are presented at an aggregated form (WI AFR, 2004; WI DFHS, 2004). For Ohio, additional data is derived from ODE (2001a, 2001b).

every $1 invested, the pre-K program should return $1.64. (Under more conservative assumptions, the benefit/cost ratio is 1.43). For the education system, every $1 invested returns 68 cents in cost-savings from other expenditure items, reducing the risk of the investment for the state Department of Public Instruction.

For Ohio, the fiscal benefits are $782 million, against an investment of $482. The net present value of the investment is $299 million with a benefit/cost ratio of 1.62. Of the three states, Ohio appears to have the clearest opportunity for further investment in pre-K, largely because it is starting for a much lower initial enrollment. The burden of savings for Ohio is also notable: 53% are from reductions in crime and 37% for greater efficiency in the school system. Using Model [2] the benefits from investment fall sharply, but even here the program almost pays for itself at a 5% discount rate.

6. Conclusion

This analysis applies an investment appraisal technique to pre-K provision. This technique allows for a full consideration of where additional funds should be invested, and what the fiscal consequences are. Using national and state-specific data, these impacts are calculated for Massachusetts, Wisconsin, and Ohio. Each state already has some pre-K provision, and the proposal is to extend that opportunity to all children. Although a large financial commitment is necessary, economic modeling indicates that – given current patterns of spending, the educational pathways students follow, and government revenue sources and expenditures – the net present value should be strongly positive.

Inevitably, such economic modeling requires many assumptions about impacts and costs. Questions therefore arise as to the accuracy of these assumptions. Given the high quality of the research evidence, and the availability of new data, it is possible to substantiate many of the assumptions about impacts. For costs data, state-specific information is applied, although budgetary information is far from perfect. To insure against inflated assumptions, a highly cautious set of assumptions are applied. Therefore, the conclusion that universal pre-K will generate net benefits for the state appears to be robust.

Of course, the debate over targeted versus universal programs has many other dimensions. Whereas targeted programs require a smaller investment and may be able to ensure high quality in delivery, there are important benefits from expanded programs (see NIEER, 2004). First, the benefits from pre-K are not limited to at-risk populations, but can influence a broad cross-section – perhaps the majority – of children. Second, imperfectly targeted programs may not deliver pre-K to those most at-risk, as families select into provision (rather than select

out). Third, universal programs may be regarded as more fair, allowing all children an opportunity to progress at an early age; it may be easier to obtain public support as a consequence. Finally, it is possible that universal programs may be more efficient and better quality, as standards and accountability regulations can be established. These are important policy concerns that require further investigation.

It is also important to note two other policy issues. First, where many agencies may obtain cost-savings from pre-K investments, they should contribute funds to the investment; this may mean a federal, state, and district contribution, as well as a contribution from crime and welfare budgets within jurisdictions. Second, cost-savings will only be obtained if resources are actually redistributed from one expenditure item to another. If government agencies do not impose redistribution, then pre-K programs represent a direct additional cost.

But, at a fundamental level, this analysis provides an answer to the simple question as to whether there is compelling economic evidence in favor of a state-sponsored expansion of pre-K programs. On balance, positive economic returns should be expected.

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Table 1 Number of Children in Pre-K: Current and Expanded

	Massachusetts		Wisconsin		Ohio	
Pre-K Provision Type	**Current Provision**	**Expanded Pre-K Provision**	**Current Provision**	**Expanded Pre-K Provision**	**Current Provision**	**Expanded Pre-K Provision**
Current provision [1]	17,466 (19%)	--	16,051 (18%)	--	4,015 (3%)	--
New provision:						
Stay high quality [2]	--	4,220 (5%)	--	16,051 (18%)	--	4,015 (3%)
Upgraded provision	--	13,246 (15%)	--	--	--	--
New funding	--	42,671 (46%)	--	32,102 (35%)	--	42,874 (30%)
Receives no public funding	60,871 (67%)	18,200 (20%)	57,693 (64%)	25,861 (29%)	107,185 (72%)	64,311 (42%)
Special Education, Head Start, Title 1 Pre-K, Even Start	12,663 (14%)	12,663 (14%)	15,156 (18%)	15,156 (18%)	36,800 (25%)	36,800 (25%)
Cohort Size	*91,000*		*89,170*		*148,000*	

Notes: [1] For MA, Office of Child Care Services; Community Partnerships for Children proportions in each category of ECERS-R are based on percentage of children whose primary ECE teacher has a BA or MA degree in education (39%). [2] Low quality is denoted by ECERS-R<5; high quality is denoted by ECERS-R>5. *Sources:* Mass. Dept. of Ed. ECE Indicators [www.doe.mass.edu/els]; Marshall et al. (2002); Census (2000); NIEER (2003); OH Dept. of Ed. (ODE, 2001); WI Dept. of Public Instruction.

Table 2 Proposed Additional Expenditures on Pre-K

	Massachusetts		Wisconsin		Ohio	
	Model [1]	**Model [2]**	**Model [1]**	**Model [2]**	**Model [1]**	**Model [2]**
Annual cost per child	$ 6,500	$ 5,118	$ 6,445	$ 4,468	$5,900	$ 5,491
Total additional amount of pre-K funding ($ millions)	$ 577.94	$ 433.90	$ 206.90	$ 143.43	$ 482.40	$ 410.04
Cohort Size	*91,000*		*89,170*		*148,000*	

Notes: 2003 dollars, with a 5% discount rate for two-year programs. For MA, Model [1] follows the Costs of Care formula (average reported cost of full-time care, incl. parental contributions); Model [2] applies the current cost structure for high-quality provision. For WI, Model [1] assumes funding that is comparable to Head Start funding; Model [2] requires 27% more resources than are needed for current 2003 expenditures on 4K. For OH, Model [1] assumes funding equivalent to the existing Ohio Pre-K program; Model [2] assumes funding that is comparable to Head Start funding. *Sources:* Mass. Dept. of Ed. ECE Indicators [www.doe.mass.edu/els]. NIEER Yearbook (2003); Marshall et al. (2004); Head Start data.

Table 3 School System Cost-Savings from Expanded Pre-K Provision

School system cost-savings	Massachusetts		Wisconsin		Ohio	
	Model [1]	Model [2]	Model [1]	Model [2]	Model [1]	Model [2]
Special education placement	$ 49.11	$ 34.79	$ 42.41	$ 30.04	$ 133.16	$ 94.32
Grade retention	$ 0.68	$ 0.30	$ 0.95	$ 0.42	$ 6.01	$ 2.65
Job satisfaction for teachers	$ 75.32	$ 40.70	$ 51.33	$ 26.55	$ 46.41	$ 25.08
Retention of teachers	$ 8.95	$ 4.83	$ 18.48	$ 9.56	$ 27.57	$ 9.67
Use of substitute teachers	$ 22.18	$ 16.68	$5.48	$ 2.83	$ 6.55	$ 3.54
Spending on school safety	$ 36.29	$ 19.97	$ 14.87	$ 6.31	$ 11.20	$ 6.05
Pressure on school support	$ 12.57	$ 6.28	$ 7.44	$ 3.15	$ 10.99	$ 5.55
Total Cost-Savings	**$ 205.10**	**$ 123.55**	**$ 140.96**	**$ 78.86**	**$ 241.89**	**$ 146.86**

Notes: Present Value figures are discounted over the child's educational span from K–12 at a discount rate of 5%. Economic values are in 2004 dollars.

Table 4 Fiscal Impact Analysis of Expanded Pre-K Provision ($ million, 2004 dollars)

	Massachusetts		Wisconsin		Ohio	
Costs and Benefits	**[1]**	**[2]**	**[1]**	**[2]**	**[1]**	**[2]**
Investment cost (C)	**$ 577.94**	**$ 433.90**	**$ 206.90**	**$ 143.43**	**$ 482.40**	**$ 410.04**
School system cost-savings	$ 205.10	$ 123.55	$ 140.96	$ 78.86	$ 241.89	$ 146.86
Tax revenue gains: family	$ 16.65	$ 9.25	$ 6.76	$ 3.76	$19.21	$ 9.29
Tax revenue gains: participant	$ 98.40	$ 50.13	$ 41.68	$ 28.25	$ 120.32	$ 15.19
Criminal justice system savings	$ 288.47	$ 201.01	$ 142.18	$ 91.25	$ 375.41	$ 209.35
Health expenditure savings	$ 48.27	$ 33.72	$ 7.00	$ 3.34	$ 1.18	$ 0.59
Welfare expenditure savings	$ 26.33	$ 19.74	n.a.	n.a.	$ 23.58	$ 11.79
Total benefits (B)	**$ 683.22**	**$ 437.40**	**$ 338.58**	**$ 205.46**	**$ 781.59**	**$ 393.07**
Benefits – Costs (B-C)	**$105.28**	**$3.50**	**$ 131.68**	**$ 62.03**	**$ 299.19**	**- $ 16.97**
Benefits/Costs (B/C)	**1.18**	**1.01**	**1.64**	**1.43**	**1.62**	**0.96**

Notes: n.a. denotes information not available from WI AFR (2004) or WI DHFS.

Appendix Tables

Appendix Table A1
Academic Gains from Pre-school for Public School Students

Standardized Test Scores	Effect Size Academic Gains from Center-based Pre-school		
	Raw Mean Difference	**Predicted Gains** [a]	**Peer Effect** [b]
Reading	0.3573	0.1555	0.0567
Math	0.3270	0.1614	0.0632
Students (Schools)		*11,739 (711)*	

Notes: [a] Based on Random Effects Maximum Likelihood Estimation. Estimation includes: constant term; region (4); city/urban (2); child ethnicity (4); father/mother works (2); welfare receipt (3); mother's age; mother's education (4); age (and squared); disability; number of siblings; English not first language; male; socio-economic status (and squared). [b] Peer effects are measured as the percentage of the school that has attended center-based pre-school. All impacts are statistically significant at $p<0.01$. *Source:* ECLS-K, school-level data from child-level questionnaire (base year, 1998). Details are available from the author.

Table A2
Academic Achievement and Pre-school Enrollment Effects on School Safety

	Impact of:	
School Safety Measure	**Reading at grade level**	**Center-based pre-school: % in school**
Fighting observed	Ns	↓ ***
School not judged very safe	Ns	↓ ***
Weapons brought into school	↓ **	Ns
Thefts reported in school	↓ **	↓ **
Physical attacks in school	↓ ***	Ns

Notes: Correlations are denoted by: Ns, not significant; ↓, negative/fall. ***, ** denotes a statistically significance at 1% or 5% level. Details are available from the author.

Table A3
Impact of Center-based Pre-K Provision on Student Behavior

Behavioral Measure	Impact of: Center-based pre-school: % in school	
	Coeff.	**(SE)**
(1) Teacher Responds "Student Behavior Does Not Interfere With My Teaching" (*N=2,079)*	0.8650	(0.2408)**
(2) School Problem: Teacher Absenteeism (*N=536)*	-1.6621	(0.4294)**
(3) School Problem: Teacher Turnover *N=536)*	-0.6369	(0.5269)
(4) School Problem: Student Absenteeism (*N=536)*	-1.1853	(0.4296)**
(5) School Problem: Maintenance of Order and Discipline (*N=536)*	-1.0096	(0.4106)*

Notes: Equation (1): Population-Averaged Probit Estimation; group variable is school (*n*=637). Robust standard errors in parentheses. Equation (1) also includes: region (3); site (urban/town); teacher has doctorate; male teacher; teacher tenure. Teacher-level weights. Public school teachers only. Constant term included. **, * significant at 1%, 5%. *Source:* ECLS-K, data from teacher questionnaire (base year, 1998).
Equations (2)-(4): Probit Estimation. Robust standard errors in parentheses. Equations (2)-(4) also include: region (3); site (urban/town); % free lunch; enrollment Hispanic >5%; enrollment Black >5%; school size (4). School-level weights. Public schools only. Constant term included. **, * significant at 1%, 5%. *Source:* ECLS-K, school-level data from school administrator questionnaire (base year, 1998).