Investing in Early Childhood Education in Ohio: An Economic Appraisal

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**Investing in Early Childhood Education in Ohio:
An Economic Appraisal**

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Executive Summary

Early childhood education enhances children's prospects. It also has an economic pay-off to society. Using economic analysis and new empirical evidence, this paper describes and calculates this pay-off for the state of Ohio.

Currently, only 28% of three-year olds in Ohio participate in publicly-supported educational programs before kindergarten (through state/federal Head Start, Special Education, or pre-K providers). The proposal here is to raise that proportion to 57% and to offer education for two years before kindergarten. This proposed policy would require 42,874 new pre-K places. It would require a total investment of between $285 million and $482 million.

This investment is likely to yield a strong pay-off for the state government. Economic analysis is used to estimate this pay-off, using existing research evidence, new findings from national datasets, and state-specific data for Ohio. The analysis indicates that an expanded pre-K program would yield cost-savings across several domains:

- The school system would save $242 million. These savings would arise from lower costs of special education, less grade retention, improved working conditions for teachers, lower teacher turnover/absenteeism, and improved school safety.
- Tax revenues would be higher by $140 million. Parents and guardians would be free to enter the labor market and the pre-K children would have higher earning capacity in the future.
- Health and welfare systems would reap savings of $25 million in resource redistribution from existing programs.
- Criminal justice system savings would be $375 million. Pre-K programs have a powerful impact in reducing both juvenile and adult criminal activity.

The net present value to the state of Ohio from expanding pre-K provision in Ohio is therefore estimated at $372 million. This estimate is based on a 5% discount rate and with conservative assumptions about impacts. Sensitivity analysis indicates that the net present value is unlikely to fall below $108 million.

This economic analysis establishes that strongly positive returns are expected from investment in pre-K provision in Ohio.

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Section 1

Introduction

Early childhood education enhances children's prospects. It also has an economic pay-off to society. Using economic analysis and new empirical evidence, this paper describes this pay-off and calculates its importance for Ohio.

These investments in early childhood education (ECE) can be set with a balance sheet framework, which relates the program costs to anticipated future benefits. As set out in Section 2, this balance sheet allows for a full consideration of each potential benefit. Published economic evaluations are briefly reviewed.

In Section 3 the policy scenario is set out. The proposed policy is to expand ECE programs in Ohio so that they are available for children for two years prior to kindergarten enrollment. The impact on ECE enrollments is described. Also, the investment cost for such a policy is calculated, based on current evidence about unit costs of provision.

Section 4 describes in detail the full fiscal benefits for the state of Ohio which may be anticipated from this proposed policy change. This is the most substantial section of the paper. Both prior evidence and new empirical research results are used to estimate the economic benefits. This investigation advances beyond previous research in identifying and estimating the benefits of early childhood education across many domains. State-level information is used where available.

Section 5 combines the analysis of costs and benefits to calculate the economic returns to expanded pre-K provision. Sensitivity analysis is used to see how the amount of cost-savings vary, depending on what assumptions are used.

Finally, Section 6 gives a concluding summary.

Section 2

Investments in Early Childhood Education

A full economic appraisal of investments in Early Childhood Education must begin with a framework for examining both the costs and the anticipated benefits. Empirical evidence can then be used to identify the significance of each of these benefits.

2.1 Template Balance Sheet

To compare costs and benefits of any investment, a balance sheet should be constructed.

On one side of the balance sheet is the cost of providing ECE programs. The cost ingredients include: salaries for administrative directors, teachers, and assistants; facilities; and materials (for Ohio, see Reschke and Hermsdorfer, 2003). Costs of programs are determined by: standards, such as class size and staff–child ratio; by service requirements (e.g. for meals, screenings/referrals); and teaching regulations (e.g. minimum education/certification).

Across the US, the amounts spent on ECE programs range up to $9,700 (NIEER, 2003). However, these amounts are expressed per enrollee. In most states only a minority of children are served by publicly funded pre-K. (Only in Georgia and Oklahoma is pre-K universal). Therefore, the amount spent per three-year old child is considerably lower.

Nationally, programs vary in pedagogy and resource usage; they may be full-day or half-day, delivered through licensed or accredited centers, short-term or sustained. This analysis assumes that investments in ECE programs are in well-resourced, good quality provision for a reasonable period of time for children below the age of entry into kindergarten. Programs which are high quality include the High/Scope Perry Pre-School Program, the Abecedarian Early Childhood Intervention, and Chicago Child-Parent Center and Expansion Program. These are the programs which the research evidence has established most clearly improve outcomes in early childhood and have long-lasting impacts.

The benefits of ECE programs are set out in Box 2.1. Conventionally, three agents – the child, the child's family, and the society/economy – are identified as recipients of an array of benefits. (For exposition, family benefits are subsumed into child benefits). These benefits accrue in the short term, i.e. at the time of and immediately after ECE. They accrue in the medium term, i.e. as the child progresses through school. And, they accrue over the longer term and through adulthood, with entry into the labor force. Each of these benefits has been established in a number of high-quality, peer-reviewed research studies. Not every benefit was obtained in each study, however; details for individual ECE programs are given in program-specific citations and reviews (see sources in Box 2.1; Gilliam and Zigler, 2000). Importantly, in this investment appraisal the focus is on the economic impacts for society.

The short-term benefits are obtained primarily by the child participant, mainly in terms of improved academic achievement, but also in terms of higher quality health (e.g., greater likelihood of being

immunized) and better nutrition, as well as lower probabilities of being neglected or abused. The long-term benefits in adulthood are enhanced economic well-being. These items are listed in the top panel of Box 2.1.

Critically, it is important to establish the mediating links between the individual outcomes and the consequences for society. Two strong mediating links have been proposed. The first is that the educational benefits to participants are the foundation for the economic and societal benefits. Both educational attainment and achievement raise economic well-being; this may predispose children against crime/delinquency and toward participation in the labor market. The second mediating link encompasses more general behavioral and non-cognitive outcomes from ECE programs. Although there is less research on these behavioral consequences, they may explain the more wide-ranging differences in life circumstances that are associated with participation in ECE programs.

The bottom panel of Box 2.1 itemizes the economic benefits to society. These are grouped into short-term, medium-term, and long-term benefits in relation to the benefits that accrue to participants. Most of these benefits are obtained only after the children mature, and so these future gains must be discounted (i.e., given a lower weight).

Box 2.1
Benefits/Cost-Savings from Early Childhood Education Programs

Benefits/Cost-savings

For child:

Short-term:
- Enhanced academic achievement
- Improved health and nutrition
- Increased well-being and less abuse

Long-term:
- Higher likelihood of graduation and college enrollment
- Higher wages/employment probability
- Lower teen-pregnancy/delinquency

For society/economy:

Short-term:
- Income tax revenues from parents' additional time

Medium-term:
- Greater school system efficiency
  [via reduction in special education and grade repetition; higher learning productivity and reduced pressure on school resources]
- Reduction in abuse/neglect
- Lower reliance on public healthcare

Long-term:
- Increased income tax revenues
- Lower welfare dependence
- Reductions in delinquency and crime
- (Educational subsidies for college)

Sources: Currie (2001) ; Masse and Barnett (2002); Reynolds et al. (2001); Campbell and Ramey (1994); McCarton et al. (1997); Benasich et al. (1992); Johnson and Walker (1991); Henry et al. (2003); Loeb et al. (2004); Montes et al. (2003); Schweinhart et al. (1993); Reynolds et al. (2002).

For this fiscal impact analysis it is appropriate to divide the gains according to which government agencies are affected. For Departments of Revenue, there are two sources of additional tax gain. There is an immediate benefit from enhanced tax revenues, as the children's families enter the labor force. Over the long-term, there are gains as the children enter the labor force themselves and with higher earnings contribute larger tax payments. For Departments of Health and Welfare, there are gains in terms of lower reliance on these services by children who participate in ECE programs. For Departments of Criminal Justice, there are cost-savings from reductions in crime rates. These cost-savings may be significant, given the high expense incurred for each crime and the strong impact on criminal activity found for ECE programs.

Finally, Departments of Education should reap efficiency gains from expanded ECE programs. There are two direct effects in that ECE programs reduce special education and grade repetition. In

addition, expanded programs will generate gains in terms of higher learning productivity. These may be important for the school system. Annually, total education spending on K–12 schooling in Ohio is over $12 billion (ODE, 2004a), and any improvement in the proficiency of a cohort of children entering school may yield cost-savings. Academic advantages for participants of ECE programs are well-established, but in a generalized program there will be spill-over impacts for other students. These spill-overs come through 'peer effects': more able students enhance the learning of their classmates, e.g., by not disrupting class discussions, and by influencing their aspirations and values. These effects are also well-established in the research literature. A second source of learning productivity gains relates to the more general behavioral advantages that arise when students are better prepared for school. Good student behavior relieves pressure on school resources both for teaching and for non-instructional aspects of education (such as policing, custodial, disciplinary and security services). These cost items will all be affected where participation in ECE programs is more widespread.

2.2 Economic Evaluations of ECE

This balance sheet framework can be used to account for all the benefits from investment in ECE. For each agent, all benefits can be investigated, while maintaining an overall perspective of its importance in comparison to other benefits and in justifying the costs of investment. Several high-quality studies have been undertaken which utilize this balance sheet approach to assessing the economic importance of ECE. Each study shows the total economic benefits which outweigh – by a considerable margin – the costs of the program. These studies are reviewed in Box 2.2 below.

Box 2.2
Economic Evaluations of Early Childhood Education

Program	Outcomes for Society
High/Scope Perry Pre-School Program [a]	For every $1 investment, $2.54–$8.74 was recouped in terms of benefits over the entire time-frame.
Chicago Child-Parent Pre-School Center & Expansion Program [b]	For every $1 investment, $7.14 was recouped in benefits.
Abecedarian Early Childhood Intervention [c]	For every $1 investment, between $2–$3.66 was recouped in terms of benefits over the entire period. The internal rate of return ≈ 7%.
Head Start [d]	Costing exercises for a large-scale version of this program have focused on the short-term and medium-term benefits. These benefits alone offset 40-60% of the total costs.

Sources: [a] Schweinhart et al. (1993). [b] Reynolds et al. (2001, 2002). [c] Masse and Barnett (2002). [d] Currie (2001).

In each study, the child and family were net beneficiaries from participation in ECE programs. This provides a motivation for individuals to enroll, should programs be made available to them. Critically, the strongest gains were for society across the domains listed above. Moreover, in three of the studies these societal gains far outweighed the initial program investment. These results provide a strong evidence base for calculating the economic pay-off to society from investing in early childhood education.

Each study takes account of discounting. Because the benefits of ECE programs occur much later than the costs are incurred, these benefits should be valued at a lower rate, i.e. discounted. Discounting is necessary because $100 received immediately is worth more than $100 received a decade later. For example, the immediate $100 could be invested in an interest-yielding account, and after ten years it would be worth more. (Discounting also reflects the certainty of money now versus the uncertainty of money later). Thus, a discount rate must be applied to all money streams received in the medium term and long term. The further away from the initial investment time, the greater the discount (Levin and McEwan, 2002). Typically, a discount rate of 3%-7% p.a. is used. When a future benefit has been discounted, it is referred to as a present value. So, assuming a discount rate of 3%, a benefit recouped one year after the investment and worth $103 would only be worth $100 in present value terms.

2.3 From Targetted to Universal Programs

Some of the above evidence comes from targetted ECE programs for at-risk students, i.e. those who expected to be most likely to benefit. This raises the question as to whether the impacts identified above would occur in a system of expanded provision.

However, studies of state-wide programs have found generalized benefits, at least in terms of academic achievement. Participants in Oklahoma's universal program report strong academic gains (of 16%) in overall language and cognitive skills tests; there are especially strong impacts for African American and Hispanic students (Gormley and Phillips, 2003). Similarly positive – but not as powerful – academic effects are found in evaluations of the universal pre-K provision in Georgia (Henry et al., 2003).

Moreover, even where the ECE programs were targetted, the target populations represent a non-trivial proportion of all children. For example, given the characteristics of the sample, the High/Scope Perry Pre-School Program target group might be regarded as those children who are likely to drop out of high school. Presently, 10.7% of all persons aged 16-24 are high school dropouts (for African Americans, the rate is 10.9%; for Hispanics, it is 27.0%). Moreover, the rate of on-time graduation is significantly below 10%; using the federal Cumulative Promotion Index, only 70.3% of Ohio public school students graduate on-time (Swanson, 2004). These individuals (drop-outs and behind-time graduates) would likely benefit from ECE programs.

Furthermore, some of the benefits itemized above are only likely to arise from large-scale programs. It seems unlikely that one student's higher academic achievement after pre-schooling will make a difference to the school budget. Instead, a critical mass of more able or better-prepared students is needed to produce the full set of benefits from ECE. Impacts will also be stronger if the program quality is high.

Another concern is fade-out from ECE programs, such that achievement gains are only evident in the early years. Some studies have found academic fade-out (see Currie and Thomas, 1995; Lee and Loeb, 1995). Others argue that early gains set children on a different trajectory, such that 'skills beget skills', eventually leading to labor market success (Carneiro and Heckman, 2003). Equally importantly, studies have not found behavioral fade-out; if anything, behavioral differences are accentuated over time. As well, educational impacts have been found to be long-lasting in relation to grade repetition and special educational placement.[1] The most plausible explanation for this discrepancy is that early childhood programs generate strong gains in ways not restricted to test scores.

In conclusion, any generalization of the benefits to broader populations must be cautiously performed.[2] This caution is manifest here in a number of ways. First, as many assumptions as possible are drawn from published research or direct empirical evidence. Second, whenever alternative assumptions are plausible, the more conservative one is applied. Third, where benefits from ECE are anticipated, but there is inadequate data to enumerate them, they are omitted from the analysis. (One important omission refers to the costs of crime to victims). Fourth, economic impacts on earnings and crime are assumed to apply only to the proportion of all students for whom the impacts of ECE programs are found to be strongest, i.e. the group on the margin of dropping out of high school. Finally, a relatively high discount rate of 5% is chosen to weight all future money benefits. These assumptions produce an estimate of the economic impact of ECE which is very conservative.

Section 3

Early Childhood Education in Ohio

This Section sets out a scenario for changes to ECE provision in Ohio. The assumed change is the implementation of a comprehensive ECE program which would offer pre-K to all children for the two years prior to their entry into kindergarten.

Four steps are necessary for a full economic evaluation. First, the consequences for enrollments in ECE in Ohio 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.

The next step is to estimate the economic benefits of ECE. This estimation is performed in Section 4. The final step is to link these benefits to the costs. This is performed in Section 5.

3.1 ECE Enrollments and Funding

In Ohio, there are approximately 296,000 children aged between 3 and 5 (Census, 2000). Currently, very few of them are covered by publicly-supported pre-K programs (NIEER, 2003, 110): 10,643 children are served through special education services (ODE, 2001); and provision is offered through either the state public school initiative or Head Start. The Public School Preschool Program serves 5,599 children with state funds of $19.3 million (2002). Federal funds for Head Start provide pre-schooling for 34,307 children; in addition, the state spends $98.8 million to supplement Head Start for an additional 18,000 children. Thus, there is considerable scope for expansion of pre-K programs.

To simplify the analysis, a one-time investment for the cohort of 148,000 three-year olds in 2004 is assumed. **The proposed policy change is to expand public pre-K provision to those who receive no provision presently: coverage would be expanded to 40% of these children**.[3]

It is assumed that this provision would be of quality sufficient to generate the outcomes identified in prior research. Specifically, such provision would need to achieve a rating of at least 5 on the Early Childhood Environment Rating Scale – Revised, (ECERS–R , see Harms et al., 1998). This threshold rating corresponds to a program such as the High/Scope Perry Pre-School program, for example. 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. With sufficient resources, a state-wide program should score well for each category.

The proposed policy is significant and ambitious, but not infeasible. An expansion of 40% would raise the proportions of students served to levels in states where pre-K is universal. Even where publicly-provided pre-K programs are described as universal, as in Georgia and Oklahoma, the take-up rates are below 75%. The proposed policy would raise the take-up rate in Ohio to a level which may be regarded as ‘universal’ or ‘comprehensive’.

Table 3.1 sets out the demographics of provision under current circumstances and under the proposed policy scenario of expanded provision for children aged 3. The differences are reflected in the increased enrollment in publicly-provided pre-K and the reductions in the numbers who receive no state provision. Those in special education and Head Start and Even Start would remain the same. Thus, the proposal would require 42,874 new places; current public provision would therefore need to be expanded by a factor of approximately 10. Nevertheless, these changes would still leave 43% of children without any state-subsidized pre-K.

For this proposed policy change it is necessary to determine the children eligible for the newly state-subsidized provision. Current programs in Ohio are targetted at families with income levels below 185% of the poverty line. These are families where the impact of ECE programs is anticipated to be the strongest. Expansion of the program may therefore have weaker influences on children from families with greater incomes. However, the program envisaged here is for two years, and most research has been conducted on programs that are less than two years in duration. Moreover, existing programs do not cover all families below these poverty-line thresholds; an expanded program could still be directed toward low-income families.

Table 3.1
Provision of Early Childhood Education for Children Aged 3 in Ohio

ECE Provision Types in Ohio	Current ECE Provision	Proposed Policy: Comprehensive Pre-K (40% Expansion)
Publicly provided pre-K	4,015	46,889
No public provision	107,185	64,311
Public pre-K special education	9,400	9,400
Head Start (state)	9,350	9,350
Head Start (federal)	17,150	17,150
Even Start	900	900
Children aged 3	*148,000*	*148,000*

Sources: ODE (2001); NIEER (2003); Census (2000).

The proposed policy change leaves open whether publicly funded provision should be publicly or privately provided. Currently, provision in Ohio is publicly-provided (but in some states private providers are encouraged and subsidized). However, this analysis assumes that all providers will meet ECERS–R ratings, regardless of their ownership status or organizational form. Fundamentally, such high quality provision would be established through the allocation of sufficient resources for any types of provider.

3.2 ECE Unit Costs

Expenditures and unit costs data are needed to calculate the financing necessary for 42,874 new ECE places of high quality. These data are available from the Ohio Department of Education.

Table 3.2 shows the unit costs for different provision types. For the fiscal year 2002, average annual state expenditure per enrollee was $5,491, including Head Start provision. Looking only at average expenditures per enrollee in the Public School Pre-K Program the figure is considerably lower, at $3,484. In comparison, annual per student expenditure in Ohio K-12 schools is $8,441.

The final column of Table 3.2 shows the total investment required to implement the new policy for 42,874 children for two years each. Three different costing models are itemized. Assuming new participants received the same resource as currently provided by the Public School Pre-School Program, the total additional investment would total $284.86 million in present value dollars. This approximates to $150 million in additional funds per year (undiscounted); which is less than 1.5% of the total budget of the Ohio Department of Education. Assuming new participants received the same resource as available through state-funded Head Start, the additional investment required would be $410.04 million.

Table 3.2
Proposed Government Spending on Early Childhood Education in Ohio

ECE Programs	Unit Funding Per Child Per Year	Total Investment ($ million)
Public School Pre-School	$ 3,484	$ 284.86
State-funded Head Start	$ 5,491	$ 410.04
Ohio Pre-K Program	$ 5,900	$ 482.40

Sources: For rows 1 and 2, NIEER (2003, p.110-113). For row 3, Ohio Dept of Education.
Notes: Total Investment for 42,874 places for two years, with a discount rate of 5% applied.

Finally, in order to guarantee pre-K provision which is rated at a quality threshold of ECERS–R of 5 or higher, it may be necessary to spend even more per child. The last row of Table 3.2 assumes funding of $5,900 per child. This amount is 70% of the funding per student in the public schools. Offering provision to an additional 42,874 children would require an investment of $482.4 million for the two years. Provision at this level would ensure that the advantages of ECE programs are obtained for all new participants.

The next Section calculates the gains to society from this investment.

Section 4

Economic Benefits for Ohio

This Section investigates the evidence on each of the economic benefits of early childhood programs. To model the consequences of a comprehensive ECE program it is necessary to enumerate these impacts in full.

As set out in Box 2.1, these benefits include cost-savings which arise from increased efficiency in the school system; such cost-savings are important to Departments of Education. In addition, benefits arise for: Departments of Revenue, with increases in tax revenues; Departments of Criminal Justice, with reductions in criminal activity; and Departments of Social Services and Health, with improvements in general well-being. For Ohio, the Office of Budget and Management has set out a Children's Budget to "provide a comprehensive picture of the state's investments on children" (Ohio OBM, 2004). This Budget presents an excellent summary of the expenditure items which may be influenced by a more comprehensive pre-K program.

Two different models are applied across each domain. The two models are labeled {1} 'representative' and {2} 'conservative'. (Both models are cautious, for reasons given above). The economic impacts are unlikely to be below these amounts, with representative models reporting the best estimate of the economic consequences of ECE. Money values are expressed in present-value 2003 dollars throughout. For benefits that accrue in the future, a 5% discount rate is applied.

4.1 Cost-Savings from Special Education and Grade Retention

The main medium-term impact of ECE is the reduction in the incidence of special education. This effect is well-documented. Review of the literature indicates that reductions in the incidence of special education range from 6% to 48%, with a representative estimate of 12% (CDCP, 2003). Three studies relate impacts to costs (Currie, 2001; Masse and Barnett, 2002; Barnett, 1985). These studies report cost-savings per child at between $2,060–$7,996. This is clearly an important cost-saving from targetted ECE programs, by itself offsetting a large proportion of the initial investment costs.

The second medium-term impact of ECE is the reduction in grade retention. Again, this effect is well-established. Review of this literature indicates reductions in the incidence of grade repetition range between 6% and 23%, with a representative estimate of 21%. For studies with costs data, the cost-savings from reductions in grade repetition amount to between $193-$785 per child. These are small impacts, but when set against an initial investment of $3,484 they should not be regarded as trivial.

The economic impacts for Ohio can be calculated directly, using school financial data from the Ohio Department of Education. In Fiscal Year 2003, average per-pupil spending on each year of regular education is $8,441; and per-pupil spending on each year of special education is proportionately higher, at $16,038. For each three-year old, there is a subsequent commitment to K-12 public schooling, funded by the state. Depending on which track these children follow, they will receive present value expenditures

over the next 12 years of: $69,199 if they do not repeat a grade or receive special educational services; $135,491 if they receive special educational services; or $74,097 if they do repeat a grade but do not receive special educational services.[4]

Table 4.1 traces through the impacts for the 128,760 children in Ohio public schools. The incidence of special education in Ohio is 13.0%, close to the national average of 13.2% (NCES, 2003, Table 55). Initial grade repetition rates are at least 15% of all regular track students.[5] With the current provision of ECE, the remaining students (75.65%) follow the regular educational track. Over their schooling life, this complement of students will require discounted expenditures of $10.1 billion.

The final two columns of Table 4.1 present the new composition of students after ECE programs have been provided. Models {1} and {2} differ in their assumptions about how effective ECE programs will be.

- Model {1} assumes impacts that are described above as representative. So, special education rates are assumed to fall by 12%, to 11.44%. Grade repetition rates are assumed to fall by 21% for the 40% of students who newly participate in ECE; thus the proportion repeating a grade is 10.39%.
- Model {2} assumes impacts only one-quarter as large as the average impacts reported above. Special education rates are assumed to fall by 8.5%, from 13.0% to 11.9%. Grade repetition is assumed to fall by 9.25%, from 11.35% to 10.93%. These are highly conservative impacts, given the published research and state-level data.

The economic impacts are given in the final rows of Table 4.1. Savings are generated by moving students from special education and grade repetition into the lower-cost regular track. Total expenditures will fall, to below $10 billion. Disaggregated, the final rows show that savings in special education amount to between $94.32 and $133.16 million and savings in grade repetition amount to $2.65 to $6.01 million.[6] These are considerable savings from ECE programs.

Table 4.1
Cost-Savings from Reductions in Special Education and Grade Retention

	Current Provision	Cohort Entering Kindergarten in 2006 with Expanded ECE Provision	
		{1} Representative Model	{2} Conservative Model
Students Per Category (%):			
Regular education (non-repeater)	75.65	78.17	77.18
Special education	13.00	11.44	11.90
Repeats 1 grade	11.35	10.39	10.93
Costs Per Category:			
Regular education (non-repeater)	$ 69,199	$ 69,199	$ 69,199
Special education	$ 135,491	$ 135,491	$ 135,491
Repeats 1 grade	$ 74,097	$ 74,097	$ 74,097
PV Total K–12 Expenditures ($ million)	$ 10,091	$ 9,952	$ 9,994
PV School System Cost-Savings ($ million):			
Reduction in special education		$ 133.16	$ 94.32
Reduction in grade repetition		$ 6.01	$ 2.65

Notes: Present Value (PV) figures are discounted over the child's educational span from K–12 at a discount rate of 5%. Economic values are in 2003 dollars.

4.2 Learning Productivity Gains

4.2.1 Learning Productivity Frameworks

An important benefit of ECE programs arises from enhancements in academic achievement and behavior. These enhancements are evident in higher test scores, graduation rates, retention rates, and college progression. Together, they raise learning productivity within the public school system.[7]

The framework for learning productivity effects is set out in Box 4.1. The first panel lists the two immediate effects of expanding pre-K programs. One immediate impact of expansion of pre-K is an improvement in academic achievement in public schools. This improvement will arise both from individual gains (as a result of being more proficient in school) and from peer effects (as other students who are more proficient contribute to a positive learning environment). The second immediate impact of expansion of pre-K is an improvement in student behavior. These improvements may be a consequence of improved achievement, but they may also be directly attributable to the ECE programs.

These two immediate impacts will in turn relieve pressures on school budgets in three domains. These domains are itemized in the bottom panel of Box 4.1. There will be savings on (A) budgets for teachers, (B) expenditures across the school as a whole, and (C) expenditures across the school system.

Budgets for teaching will be influenced in four ways. Teacher salaries are in part a function of the behavior of the students: where student behavior is poor, teachers must be paid more as a compensation for less pleasant working conditions. Therefore, any improvement in working conditions can be thought of as a raise in full earnings (Walden and Sogutlu, 2001). Teacher turnover is also an important concern: many teachers quit within five years of beginning their careers and this raises the costs to a school in hiring new teachers as replacements. One of the factors that has been found to influence teacher quit rates is the quality of the job, which in turn depends on student behavior. (Using national data from the 2000 Schools and Staffing Survey, NCES (2004) documents a strong link between teacher quits, satisfaction and working conditions; see Stinebrickner, 1998). A third cost relates to teacher absenteeism; this too is higher when students are either low-performing or poorly behaved. Finally, some teacher professional development is in response to student behavioral problems (Ohio spends approximately $103 million p.a. on professional development programs). The need for such costs would be lessened as behavior improves.

Box 4.1
Learning Productivity Gains from Expansion of Pre-K Programs

Expansion of Pre-K Programs
(42,874 New Places)

↓

(1) Improvements in academic achievement through individual gains and through peer effects

(2) Improvements in student behavior (e.g. lower rates of absenteeism, fighting, disruption of class)

↓

(A) Teacher-related savings in:

- Pay to compensate for unpleasant working conditions
- Hiring costs associated with increased teacher turnover
- Substitution costs associated with teacher absenteeism
- Professional development related to student behavior

(B) School-wide savings in:

- Security, policing, and custodial services to ensure safety
- Substance abuse, truancy, and absenteeism operations/programs in relation to low achievement
- Expenditures associated with theft and damage to property

(C) System-wide savings in:

- State programs to raise student achievement

Budgets for the whole school will also be affected. Where student behavior is improved, there will be less need for expenditures on: (i) security, policing, and custodial services to ensure safety; (ii) substance abuse, truancy, and absenteeism; and (iii) replacements from theft and damaged property.

Finally, system-wide schooling costs will be affected. Many system-wide programs are directed at improving student achievement. The need for such programs will be lessened where achievement is raised through ECE programs.

This framework sets out the anticipated impact in terms of learning productivity from a comprehensive ECE program. To calculate the cost consequences it is necessary to estimate: the gains in achievement and behavior; and then the economic consequences for budgets for teaching, schools, and systems.

4.2.2 Academic Advantages from Pre-K

The academic gains from ECE programs are clear and direct benefits to participants. These gains are found for targetted programs and in states where ECE coverage is comprehensive (as noted above, in Oklahoma and Georgia). Academic gains are also found using new data from the Early Childhood Longitudinal Study (ECLS).

The ECLS dataset includes information on over 22,000 children across the U.S. who enter kindergarten in 1998. It also has information from their schools and their teachers (West et al., 2000). Test scores, student behaviors, and school climate data are available, and this data can be linked to whether or not the child participated in center-based pre-K prior to entering kindergarten. On initial reading and math tests in kindergarten, children in center-based care report the highest scores in comparisons with pre-schooling care either by parents, by relatives, by non-relatives, or in mixed settings. (Children in Head Start do less well, but this is attributable to these children being from more disadvantaged environments). Three separate studies show very similar conclusions. In their very broad specification, Fryer and Levitt (2004, Table A2) find extremely strong effects from center-based pre-schooling, even exceeding the effect of a one-standard deviation increase in socio-economic status. Using a stepwise model, Portas (2004) reports similar results. Lastly, Magnuson et al. (2004) find that pre-K attendance raises math/reading scores by 0.1 standard deviations in the first school year, with persistent academic gains for children from low-income families.

Table 4.2 gives summary information directly from the ECLS dataset with the sample restricted to the 11,739 public school students in their kindergarten year. Those children who attend center-based pre-K report test scores that are 0.3 standard deviations higher than other children. Controlling for child characteristics and school effects, the estimated effect size of center-based pre-K relative to parental care on reading and math is approximately 0.15. This is about 43% of the raw difference between children who attend center-based pre-K and other children. (Other evidence lends support to the argument that pre-K attendance improves academic achievement. Of the sample of 2,850 public school teachers in the ECLS dataset, 62% strongly agree or agree that “attending pre-school is very important for success in Kindergarten”. Similar results are found in a 2004 national survey of kindergarten teachers, see Fight Crime: Invest in Kids, 2004a).

Table 4.2
Academic Gains from Pre-K for Public School Students

	Effect Size Academic Gains from Attending Center-based Pre-K	
	Raw Mean Difference	**Predicted Gains** [a]
Standardized Test Scores:		
Reading	0.3573	0.1536
Math	0.3270	0.1578
Students (Schools)	*11,739 (711)*	

Notes: [a] Based on Random effects Maximum Likelihood weighted Estimation. Model includes controls for gender, English not first language, socio-economic status, socio-economic status squared, disability, other care provision (by relatives, by non-relatives, Head Start, other provision), number of siblings, age, and age squared. Model also includes variable for % of class attending center-based pre-K.
Source: ECLS, school-level data from child-level questionnaire (base year, 1998).

In addition to this individual effect, there should be peer effects on academic achievement. These widespread peer effects are probable only with ECE programs that enroll high proportions of children. Empirical evidence shows peer effects are strong (Hanushek et al., 2003; Hoxby, 1998).[8]

A positive and statistically significant peer effect is found using the ECLS dataset. This effect is identified by including a variable for 'percentage of children in the class who attended pre-K' into the equation determining individual achievement (as per the specification in Table 4.2). For children in schools where greater numbers of their peers have participated in center-based care, own individual academic scores are higher. This impact is strongly positive and is independent of own pre-schooling. To identify the magnitude of the peer effect, an increase of 40% in the proportions of students having attended pre-K is assumed. If a pre-K program expanded in this way, the gain in academic achievement would be approximately 0.15 standard deviations. This peer effect is comparable to magnitudes found in other studies.

In total, the first immediate impact of widely available pre-K provision would be to raise academic achievement of each participating child by approximately 0.30 standard deviations.

4.2.3 Behavioral Advantages from Pre-K

There are also strong impacts on student behavior from higher academic ability and from center-based pre-K (for behavioral peer effects, see WKC, 2000). These too can be substantiated with the ECLS dataset, based on information from responses by the teachers and school administrators.

The results from a series of regression equations are summarized in Table 4.3. The column headings show the impacts according to the proportions of the class or school performing at grade level or

having attended center-based pre-K. (Details on the equations are given in the notes to the Table). The impacts refer to reports of student behavior and, at the school-level, school climate.

Responses of the 2,079 public school kindergarten teachers show they are less likely to say that "student behavior interferes with their teaching" either: (i) when their class is reading at or above grade level in Math; or (ii) when more of the class had attended center-based pre-K. Substantively, when 40% more students have attended pre-K, student behavior improves by approximately 32 points.

In turn, this improvement in student behavior strongly raises the probability that the teacher "really enjoys current job" or "would choose teaching again". The ECLS dataset also shows a link between student behavior and teacher absenteeism/turnover. Plausibly, absenteeism and turnover are lower when students are better behaved.

Similar conclusions can be drawn from empirical analysis at the school-level. In the ECLS dataset, school administrators are asked what problems there are at the school. Data is available for over 400 public schools with kindergarten cohorts. As shown in Table 4.3, schools with higher academic scores or higher proportions of pre-K enrollees report: fewer problems in maintaining order and discipline and in student absenteeism. These schools also report less fighting, fewer weapons brought into school, fewer thefts, and fewer physical attacks in schools. Such schools are also more likely to be described as safe or very safe. Again, these effects are substantively strong.

Table 4.3
Impacts from Higher Achievement and Pre-K Enrollments

	Impact of:	
	Reading/Math at grade level: % in class/school	**Center-based pre-K: % in class/school**
Teacher-level:		
Student behavior interferes with teaching	-ve*	-ve**
Number of teachers	*2,079*	
School-level:		
Problem maintaining order/discipline	-ve**	-ve*
Problem with student absenteeism	-ve**	-ve**
Fighting observed	ns	-ve**
School not judged very safe	ns	-ve**
Weapons brought into school	-ve*	ns
Thefts reported in school	-ve*	-ve*
Physical attacks in school	-ve**	ns
Number of schools	*410*	*536*

Notes: Correlations are denoted by: ns, not significant; -ve, negative. ***, **, * denotes a statistically significance at 1%, 5%, or 10% level. Student behavior equation includes variables for region (3), urban/rural, teacher has doctorate, gender, and tenure. Population-Averaged Probit Estimation; group variable is school (n=637) with teacher weights applied. School-level equations include variables for region (3), urban/rural, % free-lunch students, Hispanic enrollment, African American enrollment, school size (4). Probit estimations with school weights. Full details from author.
Source: ECLS, from teacher and school administrator questionnaires (base year, 1998).

Given the consistency in the results (and the absence of any counter-evidence), a strong link between pre-K and achievement with student behavior, school climate, and teacher working conditions is established. These impacts are now costed out.

4.2.4 Cost-Savings from Academic and Behavioral Impacts

Based on the above evidence and set within the framework in Box 4.1, there are three ways to calculate the fiscal implications of higher learning productivity. These approaches are based on: improving student achievement by 0.30 standard deviations; raising student behavior levels by 32 points; or – the most direct approach – expanding pre-K programs to cover only an additional 40% of children. Using these approaches, five cost items from Box 4.1 are investigated. (For the remaining items in Box 4.1 insufficient data was available). The cost consequences are summarized in Table 4.4 below. In each case, the cost figures are discounted and calculated for the entire K-12 span for the affected children.

The first cost item relates to the effect on teacher pay according to working conditions. When student behavior rises by 32 points, this has a very strong impact on teacher job satisfaction (of the order

of 10 percentage points). Conservatively, this improvement in working conditions is assumed to be equivalent to a 3% increase in pay for all teachers. In Ohio, there are 119,954 teachers with average pay of $45,414 p.a. (AFT, 2004). Across the 40% of affected teachers, this compensating wage differential of 3% would be worth $46.41 million.

The second cost item is teacher turnover as a consequence of poor student behavior. When pre-K enrollment increases by 40%, teacher turnover falls by approximately 24%. This has a considerable impact on educational budgets for teaching. Around 9% of the teaching staff changes annually (NCES, 2003). The conventional costing assumption is that the cost of turnover is equivalent to 33% of the salary of the new hire (SBEC, 2000). Therefore, in Ohio 10,796 teachers will need to be replaced each year, and the annual cost is $161.79 million. Reducing this by 24% would therefore generate a total saving of $27.57 million.

The third cost item is teacher absenteeism. Teacher absenteeism is a greater problem in schools where student achievement is relatively low or where pre-K enrollments are low. Higher rates of teacher absenteeism increase the need to hire substitute teachers as cover. Across the teaching profession, approximately 1 in 15 teachers is a substitute teacher. Reducing teacher absenteeism by 5% would reduce teaching budgets by $6.55 million (based on salaries of $45,414 and indirect costs of 27.3%, see OCWC, 2002).

The fourth cost is school safety, which refers to the many manifestations of danger listed in Table 4.3 (e.g. threats, thefts, weapons possession). Empirically, the effect on school safety can be estimated in three ways. One approach assumes that student achievement is higher by 0.30 standard deviations. In that case, physical attacks on teachers fall by 10 percentage points, i.e. by 19%. The other two approaches assume that pre-K enrollment is 40% higher. The safety of the school (proxied by fighting, observer evaluations of safety, or rates of theft) would be enhanced by 42-63 percentage points. A conservative estimate is therefore that school safety rises by 19%. Ohio schools spend over $83 million annually on school safety (ODE, 2004a). (This is the dedicated funding for school safety and does not include other school safety costs, e.g. when teachers monitor student behavior or principals spend time on school safety issues). Assuming that this budget could be reduced by 19% would yield discounted savings of $11.2 million.

Finally, there are specific state programs which are directed at improving achievement. Using the Children's Budget generated by the Ohio OBM (2004), there are proposed investments of: $50.9 million for Reading and Writing Improvement; $54.9 million for Extended Learning Opportunities; $32.4 million for Ohio Reads; and $16.5 million for Alternative Education Initiatives. These are necessary investments that are specifically directed at improving achievement (mainly for at-risk children), apart from the general instruction provided in schools. If an achievement gain of 0.30 standard deviations were obtained by new ECE participants, a significant proportion of the resources for these programs could be redistributed or applied more effectively. Conservatively, the cost-saving is estimated at $10.99 million or $5.55 million (assuming a 10% or 5% redistribution).

These cost-savings to the school system are summarized in column 1 of Table 4.4. They are the representative estimates of the consequences for the Department of Education from investments in ECE programs. Applying a more conservative model, it is assumed that each of the learning productivity gains lasts only for six years and not for the full K-12 education period. This generates lower estimates of the gains from learning productivity, but they are still substantively significant.

Table 4.4
Cost-Savings for Educational Budgets

Cost Savings	Cohort Entering Kindergarten in 2006 with Universal ECE Provision from 2004-2006	
	{1} Representative Model	{2} Conservative Model
Teacher-related:		
[1] 32-point improvement in student behavior raises teacher job satisfaction	$ 46.41	$ 25.08
[2] 40% rise in pre-K in class reduces teacher turnover	$ 27.57	$ 9.67
[3] 40% rise in % pre-K in class reduces need for substitute teachers	$ 6.55	$ 3.54
School-related:		
[4] 40% rise in % pre-K in class raises school safety	$ 11.20	$ 6.05
System-related:		
[5] 0.30 sd rise in student achievement reduces pressure for support programs	$ 10.99	$ 5.55

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 2003 dollars.

Overall, there are likely to be substantial savings to a school system with higher achievement and increased enrollments of children who have progressed through pre-K.[9] It is therefore important for Departments of Education to fully trace through the implications of investments made in early childhood programs.

4.3 Fiscal Benefits: Tax Revenues

Tax revenues will be affected in two ways from expanded participation in ECE programs. First, ECE participation by children will free up their parents to enter the labor market. Second, ECE participation has been found to increase earnings and labor market activity in adulthood (see Box 2.1). For this cost-benefit analysis, only the tax revenues are counted and not the individual gains in earnings. In addition, revenue impacts from other tax streams (e.g. sales taxes) are not counted.

The earnings gains for parents can be calculated based on estimates from prior studies. In the High/Scope Perry Pre-School program, the present value gains from parental participation in the labor

market yielded incomes of $963 (Barnett et al., 2004). This impact is the average of all parents, not only those parents who newly entered the labor market (and accounts for parents of multiple children). It is the total additional income expected per parent, as a result of the extra time to work arising from more comprehensive child care opportunities. The equivalent impact for the proposed policy in Ohio would be greater, because it is fully two years in duration (longer than the High/Scope program). Therefore, the impact on parental incomes is estimated to amount to $1,445 per parent. It is legitimate to generalize this impact directly to all 42,874 new ECE participants (it is simply a function of the free time, not the quality of the program). Applying the average tax rate of 31%, the present value benefit is worth $19.21 million. Applying a marginal tax rate of 15%, the benefit is $9.29 million.

The fiscal impact of ECE programs in terms of future earnings of participants is also well-established. To calculate the economic impact for this expanded program, the link between education and earnings is used. For the Chicago Child–Parent Centers Study, Temple et al. (2000) report that the program reduces the high school drop-out rate 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 Intervention, the reduction is even larger, at 32%. It is therefore appropriate to trace the fiscal impact in terms of wage gains when the number of high school drop-outs is reduced by 24%. This is a conservative assumption, in that it assumes no earnings advantages for the majority of pre-schoolers who accumulate more months of education (regardless of their graduation status).

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 this cohort of 42,874 children, 10.7% will drop-out of high school but 29.7% will not complete on time (NCES, 2003; Swanson, 2004). A fall of 24% in the number of high school drop-outs will therefore result in 1,060 or 2,984 extra high school completers. These are extra graduates, over and above those who would graduate 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.[10] For society, the gain is only the tax revenue from this income. The average tax rate assumed here is 31% (www.irs.gov). In total, there will be a total additional tax revenue of between $15.19 million (0.31×$92,000×1,060) and $120.32 million (0.31×$127,000×2,984).

4.4 Fiscal Benefits: Expenditures by the Criminal Justice System

Each economic evaluation of pre-K programs has found that the largest returns to society are a result of reduced criminal activity (see Reynolds et al., 2001; Barnett et al., 2004). Participants in ECE programs report lower rates of juvenile crime, adult crime, and less time spent on probation or in prison. Increasingly, attention is being paid to the powerful role of education in preventing crime (for Ohio, see the recent report endorsed by police officials, Fight Crime: Invest in Kids, 2004b).

Because these impacts of crime are relatively important in terms of the magnitude of the cost-savings from ECE programs, three alternative costing approaches are considered. The average of these three approaches is then used for the savings to the criminal justice system. Again, the estimation procedure is conservative because it does not count the costs of crime to victims, e.g. in terms of lost posessions, physical injury, or distress (for a full estimate of the burden of crime, see Anderson, 1999).

Barnett (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 (discounted at 7%). However, for the many reasons noted above, these effects are unlikely to generalize to children from more advantaged backgrounds. (The High/Scope Perry Pre-School program shows high rates of criminal activity both in the treatment and control groups). The assumption here is that such benefits will only apply to the students who are most at-risk. As noted in Section 2, at-risk students can be defined as those who are likely to drop-out or not graduate on time. Respectively, 10.7% or 29.7% of students fall into these categories. With 42,874 newly enrolled children, there are 4,588 or 12,734 children who may be defined as at-risk; these are the children for whom criminal activity will be reduced. The total present-value savings from reductions in crime are therefore between $215.61 million and $590.42 million. Using these cost estimates, the returns from reduced criminal activity could pay for the investment in ECE outright.

The second estimation procedure uses the results produced by Lochner and Moretti (2004). Using Census and NLSY data, Lochner and Moretti (2004) calculate the effects of education on crime and estimate the economic returns. They find very strong impacts: each additional male graduate yields annual social benefits of between $1,170 and $2,100 (including victim costs). Assuming an educational impact for females proportional to the male/female arrest rate, the cost-savings from reductions in crime across the 1,060 or 2,984 high school graduates would be between $155.21 and $278.58 million. These estimates are relatively low in that they are only calibrated for those graduating from high school (assuming no effects of education on crime for those who accumulate more education via alternative routes).

The final approach uses data from the Chicago Child–Parent Center program. In that study of over 1,000 youths in Chicago, Reynolds et al. (2002) report the average present value gains to the criminal justice system from reductions in juvenile and adult crime of $6,000 per participant. Across the 42,874 new participants in ECE in Ohio, this amounts to $257.24 million in savings to the criminal justice system.

Given the similar results of these studies despite very different methodologies, the predicted consequences of ECE programs can be bounded with reasonable confidence. Using the average of the lower boundaries, the estimated cost-savings to the criminal justice system from ECE participation would be $209.35 million. Using the upper boundary evidence, it would be $375.41 million. (Even these estimates are conservative, given the incidence of juvenile crime. In Ohio, for example, 19% of all arrests are juveniles, FBI, 2002).

4.5 Fiscal Benefits: Health and Welfare Expenditures

The final cost items are related to expenditures on child welfare and health. The advantages conveyed by pre-schooling affect 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 (these may be delivered directly through the program or as a result of higher family incomes). In a review by the Center for Disease Control and Prevention (CDCP, 2002), the effect size impact for social risks after pre-schooling was -0.41; the gain in health screening rates was 44% (see Smokowski et al., 2004). Reynolds et al. (2003, 643) find very

strong impacts on child welfare: court petitions of child maltreatment by age 17 were reduced by 52% (from 10.5% to 5%) as a result of pre-K participation.[11]

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. Nevertheless, these impacts will influence the child's reliance on welfare programs and health support services.

For Ohio, there are a number of health and welfare-related investments that would be influenced by comprehensive pre-K. 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.[12] To avoid double-counting and maintain a conservative approach, only the most pertinent expenditure items are considered.

Using the Children's Budget for Ohio (Ohio OBM, 2004), it is possible to identify a number of investments in child welfare that would be influenced by pre-K program impacts. In ensuring children are ready for school, Ohio invests $2.48 million; for at-risk children to succeed in school, the state invests $3.2 million and $48.1 million.[13] More important are the commitments of: $154.7 million for Services for Severely Emotionally Disturbed and At-Risk Children and Youth; $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 ECE participants would yield a present value gain of $23.58 million for this cohort (or $11.79 million).

A similar approach for child health can be applied. In its 'Youth Choose Healthy Behaviors' budget, the state invests $41.7 million. (In addition, the state investment in school breakfasts and lunch are $263 million annually). Reducing this commitment by 5% (or 2.5%) for the new ECE participants would save $1.18 million (or $0.59 million).

Section 5

Cost–Benefit Analysis of ECE

This Section combines the analyses on the investment costs of universal pre-K and its anticipated economic benefits for government agencies. This calculus is necessary to identify the amount of public support for Early Childhood Education. However, it does not count the private benefits to the individual children from participation, nor does it fully assess public willingness to pay for ECE programs (because it does not account for the victim costs of crime).

Table 5.1 reports the full economic impact analyses. It incorporates the range of assumptions and models. With three costing assumptions and two benefit models, there are six potential configurations. For exposition, three configurations are presented. The first column {1} of Table 5.1 assumes the middle range of costs and the representative benefits. This reflects the 'best estimate' of the economic impact of the program. The second column {1B} assumes that the costs are high, at $5,900 per participant (i.e., 70% of the resource expected at school). The third column {2} applies the average cost assumptions and the conservative impacts; these are the fiscal benefits that are contrived to produce very low boundaries for the returns to ECE.

Model {1} shows a clear economic pay-off to investing in an expanded ECE program. The program has a present value investment of $420.04 million (spread over two years). The present value economic gains come across four domains. First, there are cost-savings to the school system of $241.89 million. Second, tax revenues of $139.52 million are expected. Third, cost-savings to the criminal justice system of $375.41 million would result. Finally, there will be a saving of $24.76 million in health and welfare expenditures. The total fiscal benefits in present value terms would amount to $781.58 million.

The net fiscal cost-saving to the investment, using a 5% discount rate, would be $371.55 million.

This yields a benefit–cost ratio of 1.91. The benefits are 1.91 times greater than the costs of the investment.

Table 5.1
Economic Impact Analysis from Expanded ECE Programs in Ohio

Present Value Figures ($ million)	Cohort Entering Kindergarten in 2006 with Expanded ECE Provision from 2004-2006		
	{1}	{1B}	{2}
Pre-K ECE Investment Cost	**$ 410.04**	**$ 482.40**	**$ 284.86**
School System Cost-Savings	$ 241.89	$ 241.89	$ 146.80
Tax Revenues from Earnings	$ 139.52	$ 139.52	$ 24.49
Criminal Justice System Cost-savings	$ 375.41	$ 375.41	$ 209.35
Health/Welfare Cost-savings	$ 24.76	$ 24.76	$ 12.38
Total Fiscal Benefits	**$ 781.58**	**$ 781.58**	**$ 393.02**
Net Fiscal Cost-Savings	**$ 371.55**	**$ 299.19**	**$ 108.16**
Benefit–Cost Ratio	1.91	1.62	1.38

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 2003 dollars. For details of cost-savings see Tables in Section 4.

This investment may also be expressed in terms of the ratio of investment to cost-savings either in total or across domains. In total, the returns will be 91% greater than the costs. Across domains, it is possible to calculate the fiscal impact for particular government agencies. For a Department of Education, the ECE investment requires additional funding. However, there would be savings of $141.89 million, which is equivalent to 59% of the initial investment of $410.04 million. The net commitment required by the Department of Education would be considerably below $200 million (less than 1% of the annual budget). For a Department of Revenues, the present value tax revenues of $139.52 million offset 34% of the $410.04 million investment.

Investment in ECE provision also yields strongly positive returns when the anticipated costs of provision are substantially higher. As shown in column {1B}, even with an initial investment of $482.4 million, the investment in ECE more than pays for itself at a 5% discount rate. The net present value of the investment is $299.19 million, i.e. 62% of the initial costs.

Similarly, assuming average costs and conservative impacts as per column {2}, the net present value is clearly positive. Although the total fiscal benefits fall to $393.02 million, these would still offset the costs of investment. The benefit–cost ratio is 1.38.

Section 6

Conclusion

The above analysis applies the fundamental components of an investment appraisal technique to a proposed investment in early childhood education. 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 Ohio. The state does not have expansive coverage of public pre-K, and so there is considerable scope for expansion. Economic modeling indicates that – given current patterns of spending, the educational pathways students follow, and government revenue sources and expenditures – the returns to such an investment should be strongly positive.

With an investment of $410.04 million, there will be strongly positive returns to spending on education, crime, health and welfare, as well as increases in tax revenues. These returns are estimated at $781.58 million. The benefits of the investment are therefore 1.91 times greater than the costs.

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. Most importantly, to insure against inflated assumptions, a highly cautious set of assumptions is applied. Moreover, sensitivity analysis shows that there are no plausible scenarios where the costs exceed the benefits.

At a more fundamental level, this analysis is aimed at answering a simple question, namely whether there is compelling economic evidence in favor of expanding Early Childhood Education programs in Ohio. On this evidence, there is likely to be a very strong economic pay-off.

End Notes

1. This discrepancy could reflect measurement error in achievement tests (or compression in the distribution of test scores). Or, there may be more rapid progression of high-achieving students through the education system.

2. This is particularly important where the aim is to reduce special educational placement: for example, the initial rate of special education in the Abecedarian Early Childhood Intervention was 43%, considerably higher than any state-wide proportion. It is unlikely that the program's reduction in special education rates would be applicable to a state-wide study.

3. No effects are assumed for those infants who become pre-schoolers after 2004 or those who are currently four-year olds. Of course, it is anticipated that the proposed policy would be implemented for each successive cohort of three-year olds.

4. These present value costs assume three-quarters of students attend kindergarten and then onto first grade. Kindergarten transition rates are not very influential for this analysis. Where pre-K boosts enrollment in kindergarten, it should further increase the economic benefits of ECE. And, for the costing exercises it is only the differences in kindergarten enrollment that are material.

5. This figure is the national average, but Hauser et al. (2000, Figure 7b) report Ohio as having 45% of students as predicted below their modal grade level by age 15.

6. Set against these cost-savings are the additional expenditures arising from students staying in school for longer. However, where these expenditures are incurred, they serve to improve outcomes as well; they are not simply additional costs.

7. For learning productivity impacts, the pertinent group is the annual entry cohort into kindergarten in public schools. In Ohio, 4.8% of the kindergarten entry cohort attend private schools, but the proportion rises with entry into school (NCES, 2001, Table 22).

8. Hanushek et al. (2003) find a 0.1 standard deviation increase in peer average achievement leads to an increase in own achievement of 0.02 standard deviations. Hoxby (1998) estimates that a third-grader in a class where the average student scores 1 point higher posts a math/reading score which is 0.6 points higher. These estimates are comparable to the results found using the ECLS dataset.

9. Other behavioral difference may have important economic impacts. For example, substance abuse is strongly positively correlated with low achievement and the quality of the school environment (CASA, 2001). The educational costs that are associated with such abuse are: student-related (programs for at-risk children, for student assistance, and for those with substance-related learning difficulties); staff-related (administrative costs for monitoring and enforcing substance abuse policies, training and staff development); and school-wide (drug-testing programs and special facilities for substance-abusing students, legal expenses, and property damage). CASA (2001) estimates – very approximately – that 10% of all educational expenditures were related to alcohol and substance abuse. However, without direct evidence on the link between ECE participation and substance abuse, this impact cannot be included here.

10. 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.

11. These differences are striking. In the most detailed review of the links between family to child welfare behaviors, Reynolds et al. (2003) find pre-K participation is associated with: higher ratings of parental involvement; lower court petitions; and lower substantiated state reports of maltreatment.

12. 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 (of which 44% is federal).

13. The amounts for children to be ready in school are the sum of: Field Specialty Services Program; Early Childhood Mental Health Initiative; and Foster Grandparent Program. The amounts for children to succeed in school are the sum of: Intersystem Collaborative for Children; and Community Alternative Funding System.

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