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The economic payoff to educational justice[1]

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The economic payoff to educational justice[1]

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The quest for educational equity is a moral imperative for a society in which education is a crucial determinant of life chances. Yet whether there is an economic return to the taxpayer for investing in educational justice is often not considered. It is possible that the economic benefits of reducing inadequate education exceed the costs, returning a healthy dividend to the taxpayer. This article addresses a four-decade quest to ascertain the fiscal consequences of investing in effective approaches to reduce inadequate education in the United States. It uses economic analysis to calculate both the costs of effective strategies to raise high school graduation rates and their benefits to the taxpayer in higher tax revenues and reduced costs of criminal justice, public health, and public assistance. The results suggest that improving educational justice provides substantial returns to taxpayers that exceed the costs.

Keywords: benefits; costs; economics of education; educational equity; educational finance; educational investments; return on investment.

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1 Introduction

The issue of educational equity is a moral imperative for a society in which education is a crucial determinant of life chances. Yet, there is reluctance by some authorities to invest in our most needy populations and even a skepticism on whether money makes a difference in educational results for such students (e.g. Hanushek 1989). Fairness in access to good education is a matter of justice rather than simple economic rationality as measured by investment returns. Yet, one can also ask whether there is an economic return on this investment, even beyond the issue of educational fairness. We know that inadequate education affects not only the poorly educated

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individual, but also the society because of lost productivity, lower tax revenues, and higher costs of public services. Therefore, it is useful to consider not only the important issue of educational justice, but the question of whether seeking such fairness through greater educational investment in at-risk populations provides an overall economic payoff to the public that exceeds the costs. This issue has been a preoccupation of mine from my early career to the present where I am for their now of a certain age.

My attempt to address this question began almost 40 years ago in the early Autumn of 1970 when I received a call from a staff member of U.S. Senator Walter Mondale's Select Senate Committee on Equal Educational Opportunity asking me to testify on how the federal government might improve equality of educational finance. The Committee was established to buttress the momentum of the major Civil Rights victories and the War on Poverty Reforms of the sixties. It was also charged with addressing the surprising finding asserted by the Coleman Report (Coleman et al. 1966) that improved educational finance could not benefit poor and minority students who remained in schools with high concentrations of similar classmates. Only since 1968 had serious desegregation gotten underway, and the Select Senate Committee sought to set out an agenda of what ought to follow.

I trekked to Washington from San Francisco and delivered my prepared testimony before the Committee on October 1, 1970, responding to questions from Senator Mondale and his colleagues and staff members of the Committee on ways to improve equity in educational finance (U.S. Senate 1970: 3503-3538). Upon completion of my testimony, the head of the staff approached and asked if I would have dinner with Senator Mondale. I was taken aback by the suddenness of the invitation, but, of course, I accepted. The dinner was palatable, but I knew that this was not a culinary event. At dessert and coffee, the Senator turned to me with a formal challenge: "Our committee has entertained considerable testimony, all telling us that if we do not improve the education of the poor and minorities now, it will cost us far more later in terms of public assistance, crime, and lost productivity and taxes. But, when I ask these witnesses how much it will cost us, they all tell me they don't know. I want you to do a study that tells us just what educational neglect will cost us, and how much we need to spend to prevent it."

I uttered a polite protest telling him that such a study was too ambitious in scope and too ambiguous in precision to be done and that data did not exist linking educational attainment to the sources of these costs, and what did exist could not establish a causal connection. He smiled and asked me to have a scotch for contemplation, to consider the urgency of greater equity, and added that they had budgeted $10,000 for the study, an amount equal to about $50,000 at today's prices. As the scotch went down and my bravado went up, I agreed. In the Fall of 1971 I delivered the study to the Committee: "The Cost to the Nation of Inadequate Education", and the Report was published in May 1972 (Levin 1972).

Figure 1—Henry Levin and Senator Walter Mondale, c. 1972

The bulk of the study considered the effects of failure to attain a minimum of high school completion among males 25-34 years of age in 1970. Using lifetime income patterns by race and education level and adjusting for the presumed lower ability of the high school dropouts, simulations were made to estimate the additional earnings associated with an increase in the number of high school completers including the value of additional post-secondary education for the small number expected to continue at that level. On the basis of this analysis it was concluded that about $ 237 billion in lifetime income in 1970 dollars (about $1.2 trillion in 2004 dollars) was lost by failing to ensure that all persons in this cohort attained a minimum of high school completion. And, there was a loss of about $71 billion ($350 billion in 2004 dollars) in government tax revenues. The effects of inadequate education on the costs of public assistance and crime were also reviewed, as well as evidence of the effects of poor education on reduced political participation, intergenerational mobility, and health costs.

Cost estimates for how to reach universal high school graduation were unavailable, so we proceeded on the assumption that schools would have to increase spending on compensatory resources by 50 percent for each at-risk student over all the years of schooling, a very large increase. The overall cost of this investment for the 25-34 year old males in 1970 would have been about $40 billion in 1970 dollars ($200 billion in 2004 dollars). When this figure was compared with just the higher tax revenues that were expected to be generated, the public benefits were estimated to be about twice the costs. Under a wide range of assumptions, it was found that

reducing the number of poorly educational persons in the population would yield benefits well in excess of the costs, a worthy public investment.

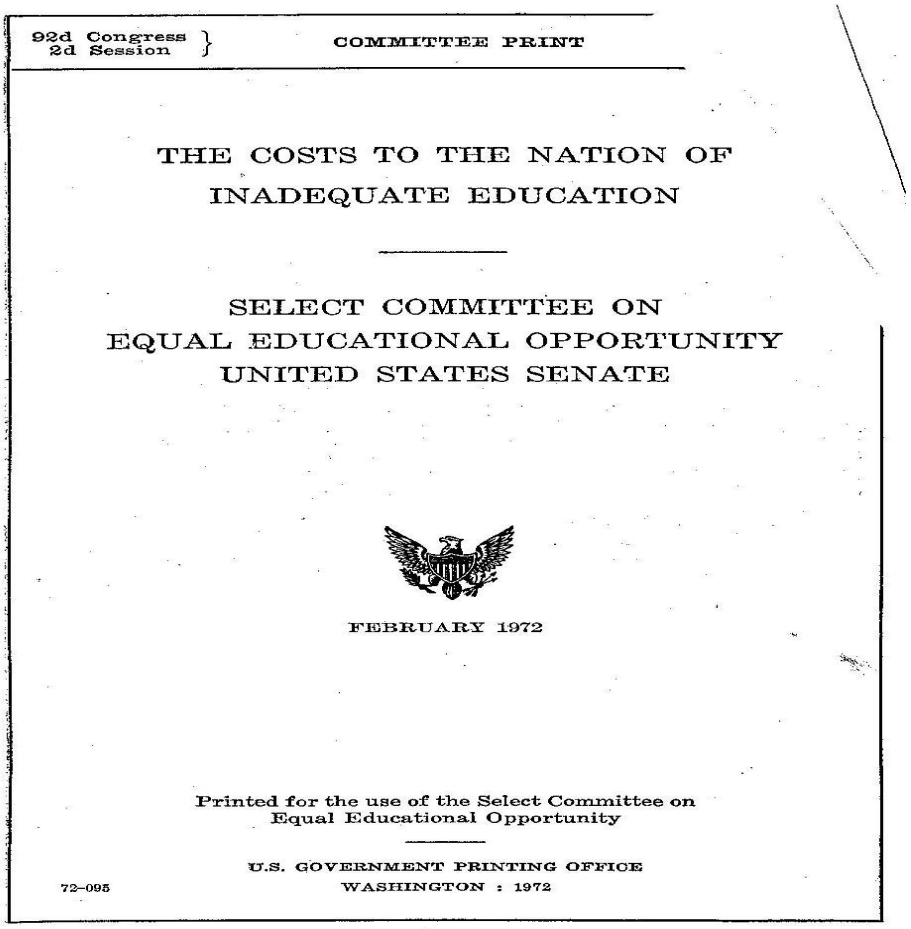

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Figure 2- Report of 1972 Version of The Costs to the Nation of Inadequate Education

The Senate Committee published its report and recommendations in 1972, and the report featured my economic analysis prominently (U.S. Senate, 1972: Chap. 13). But, the report received little attention in the political arena or the from the public, lost in the public outrage overf the Vietnamese War and a polity exhausted by the struggle for civil rights and the War on Poverty of the sixties. So the fact that we had found that the moral argument for educational equity was strengthened politically by the economic evidence did not attract much attention.

2 Research Limitations in 1970

As a scholar I was both excited by our empirical findings, but also disappointed by the gaps in both the data and our knowledge base that might be used to challenge the findings. What were some of the gaps?

- Other than the income data from the Census that might be used to estimate tax losses from those with inadequate education, we had little information on the links between education and participation in public services. Even the sparse data that were available could not reveal the causal relationship between poor education and the costs of criminal justice, public assistance, and health care. At best we had access to statistical associations without adjustment for a third set of factors associated with education such as socioeconomic status that might also account for the use of these social services independently of education. Thus, there was a need for better data and social science models that would connect low levels of education with these outcomes.
- Although many interventions were promoted to reduce school dropouts, none had been subject to rigorous evaluations through experimental, quasi-experimental, or high quality econometric studies. Thus, we lacked specific interventions with reasonably predictable consequences for increasing high school completion, our criterion for a minimally adequate education.
- The lack of evaluation results also meant that we could not estimate costs directly, and what accounting data did exist on school interventions was not appropriate to estimation of the actual costs of interventions. Financial accounting practices for education had been developed primarily for public accountability on spending, not for determining the costs of specific programs or interventions. Indeed, school accounting procedures were antithetical to accurate cost accounting with many conventions that violated the acceptable estimation of costs (Levin & McEwan 2001).
- More specifically the knowledge base on the consequences of education on life outcomes, evaluations of school interventions, and an understanding of school costs were woefully thin and, in some cases, nonexistent. This meant that much of the work that I had prepared for the Select Senate Committee was based upon making calculations based upon the "best" assumptions at the time such as the cost of gaining high school completions. The result was that I and others began to focus on improvement and refinement of the different components of evaluating educational investments for those at-risk of failure.

Of these three major limitations, the lack of data linking public services to the education of clientele would depend upon government and other agencies having the motivation and resources to collect the necessary information for further analysis. However, the question of which interventions "worked" and their costs were areas of inquiry that could be addressed by researchers. Those were the choices that I decided to pursue.

3 Improved knowledge of costs and effects

My earlier work had focused on cost-effectiveness selection of teachers. I compared the effectiveness of different teacher characteristics on student achievement by combining coefficients from educational production functions with costs obtained by estimating earnings functions for those characteristics in teacher labor markets (Levin 1970). This early work found that selecting teachers who were more intellectually able, as measured by a vocabulary test, was five to ten times as effective per unit of cost in raising student achievement as selecting more experienced teachers. Interestingly, this finding is reinforced by more recent findings on teacher test scores and recruitment of teachers from more academically selective undergraduate institutions (Wayne & Youngs 2003). Although this type of analysis could point to general guidelines for selecting better teachers, it was not appropriate for ascertaining the effectiveness of specific instructional approaches and the costs of replicating them.

As information was sought from early evaluations on the effectiveness of instructional strategies such as computer-assisted instruction and class size reduction by other researchers, I began to devote myself to developing methods of estimating the costs of educational interventions. Using the most direct approach, I set out four stages of analysis: (1) accounting for the specific resources that needed to be used to obtain the effectiveness results such as personnel, facilities, materials, and other requirements; (2) using market and quasi-market or shadow prices to place costs on these resources; (3) obtaining total costs for the intervention as well as average costs and marginal costs per student; and (4) analyzing the distribution of cost burdens among governmental and non-governmental entities and clients to find out who was paying for the intervention (Levin 1975).

There were two benefits to this approach for evaluators. First, most of the basic construction of the cost modeling for an intervention could be carried out by the developers or implementers of the intervention rather than requiring a cost accountant or economist to do it. Data could be gathered through reports, observations, and interviews. Second, the data collection could be assembled on a spread-sheet, even prior to the availability of computerized financial spreadsheets as EXCEL, which would enable an overall picture of costs and their determinants as well as easy modification for hypothetical changes in assumptions. Of course, later development of computer spreadsheets not only facilitated the data assembly, but also expanded the possibilities for its analysis.

I was fortunate in being asked to develop methodologically the chapter on cost-effectiveness for the first Handbook of Evaluation Research (Guttentag & Struening 1975), a publication of the fledgling Evaluation Research Society. My chapter on "Cost-Effectiveness in Evaluation Research" presented the initial framework in the literature for implementing cost-analysis and combining it with effectiveness and benefit results to choose among alternatives. We applied these procedures to

a study of the costs of emerging computer-assisted instruction (Levin & Woo 1981) which showed cost-components and their consequences for this new instructional strategy. The experience from these and other empirical studies using the cost model were incorporated into a book-length treatment of cost-effectiveness analysis for evaluators (Levin 1983) a volume that went through 13 printings before being replaced by a second edition (Levin & McEwan 2001)..

At this point the famous Nation at Risk report (National Commission on Excellence in Education 1983) was released proposing a wide range of educational reforms. We decided to investigate which of these reforms had credible evaluations that we might use for a study. The search yielded only four reforms of the twenty or so that had been proposed that also had useful evidence on educational effectiveness, specifically of mathematics and reading gains in the elementary grades. With Gene Glass focusing on the effectiveness side of interventions, we compared the cost-effectiveness for increasing reading and mathematics achievement of peer and adult tutoring, computer-assisted instruction, class size reduction, and longer school days (Levin, Glass & Meister 1987). In general, we found that peer tutoring had one of the highest costs because of the need for adult supervision, but it also had such large effects that it showed the highest cost-effectiveness followed at a distance by computer-assisted instruction (standard application of drill and practice), reduced class size, and a longer school day. The cost model was also adopted for other cost-analytic evaluations such as Barnett's (1985) benefit-cost study of the Perry Preschool project. The model was also applied to other topics such as a World Bank study to ascertain the economic returns to investing in strategies to reduce iron deficiency anemia, a serious, but preventable, scourge in industrializing societies (Levin 1986).

4 Calculating the returns to educational equity

While developing the cost-analysis in the eighties, I developed a strong interest in educational reform for students who were at risk of educational failure. Based upon research in the early eighties on the growing student demography of immigrants, minorities, and the poor, I became convinced that the solution to improving the education of such students was acceleration, not remediation. Educational remediation was based upon repetition through reducing the pace and challenge of instruction, a strategy that had the predictable consequences of increasing the achievement gap as other students followed a more challenging instructional experience. The Accelerated Schools Project adopted the opposite strategy of enriched instruction for all students with the goal of bringing all students into the mainstream of learning. Although running counter to the dominant philosophy at that time, this approach was attractive to many teachers and schools and showed results in pilot schools.

For the next decade the cost-effectiveness and cost-benefit analysis was put on the back burner as the Accelerated Schools project became one of the largest national educational reforms

with more than 1,000 schools in 41 states, Hong Kong, Australia, and Brazil. To the degree that I was able to undertake research, much of it was evaluation research on Accelerated Schools as well as continuing work on issues of school choice and educational vouchers. My leadership of the Accelerated Schools Project came to an abrupt end when I encountered a life-threatening health situation in the late nineties which resulted in a plea by my physician to return to a normal academic life instead of one that combines teaching and other academic activities with a frenzy of travel and managerial responsibilities. After 31 years at Stanford, I took early retirement from Stanford and moved to Teachers College, Columbia University with the intention of returning to my previous field of research on the economics of education.

My first priority was the revision of the earlier book on cost-effectiveness and cost-benefit analysis and an edited collection of applications of the tools to education (Levin & McEwan 2001). But, I also began to revisit the possibility of redoing the Mondale study. In the intervening three decades, many improvements had taken place in data availability, statistical models and computation, and understanding of the underlying relations between educational attainment and life chances. I kept wondering whether the earlier study from 1970 might be replicated at a more refined level some three and one half decades later such that it could be used to guide public educational investment. More specifically, what was the economic payoff to the public for investing in an adequate education for all children? Did the costs exceed the fiscal gains to the taxpayer? And, what proportion of the investment would be repaid through higher tax revenues and reduced demands for public services?

Fortunately, funding for the study was generously provided by two champions of greater educational equity, Lilo and Gerry Leeds. Because of the highly specialized knowledge required for different aspects of the study, a team of highly regarded colleagues was assembled. These colleagues included Clive Belfield, an economist at the City University of New York; Cecilia Rouse, a Princeton University labor economist, and Peter Muennig a faculty member and health economics specialist at Columbia University's Mailman School of Public Health. Together, this team planned and undertook the research.[2]

5 High School Completion as a Minimum

We began by setting the goal for adequate education as high school graduation as a minimum. High school graduation captures both the cognitive and non-cognitive attributes that are important for success in adulthood (Heckman et al., 2006) and it is usually a minimum requirement for engaging in further training and higher education. Most importantly, we focus on high school graduation because for the population as a whole we are far from fulfilling even this goal.

[2] Although the main findings of the research will be reported here, more detail will be found in Levin, et al. 2007.

Moreover, international comparisons show the U.S. lagging behind a substantial number of industrialized countries in the rate of high school completion (OECD, 2006).

Much attention has recently been devoted to determining rates of high school graduation but with no agreement on the exact numbers[3]. Some students may complete 4 years of high school but not graduate. Others graduate late. A non-trivial proportion obtains a General Educational Development (GED) diploma which has been found to be inferior to graduation in terms of earnings and human capital (Cameron and Heckman, 1993). Nevertheless, there is general agreement on two facts. First, graduation rates are low in absolute terms. On-time public high school graduation rates are approximately 66%-70%, meaning that at least three out of ten students do not graduate through the regular school system within the conventional time allotted. Second, graduation rates vary by sex and race/ethnicity. On-time public high school graduation rates for black males are as low as 43%. This compares to 48% for Hispanic males and 71% for white males. Female rates vary similarly across race and ethnicity, but with higher graduation rates overall. Thus, although a large proportion of each cohort meets conventional educational expectations, a significant number have not received an adequate education.

Table 1 shows the distribution of educational attainment for those aged 20 in 2005. These figures are based on the Current Population Survey (CPS) but adjusted to include those who are institutionalized (which the CPS does not count) and treats GED-holders as dropouts. The first two columns show that, from a cohort of 4.2 million persons, almost 100,000 have less than 9th grade education and 709,000 are educated up to a 9th-11th grade standard. Almost one-in-four males and one-in-six females is not a high school graduate; and the proportions are significantly higher for Hispanics and African Americans.[4] We focus on the 709,000 persons with at least some high school education. With enhanced educational investments, these persons might graduate from high school.

Increasing the numbers of high school graduates will also enable and motivate more individuals to attend college. We model progression to college – conditional on high school graduation – in terms of attendance and completion at two-year and four-year colleges. We calculated rates separately by sex and race/ethnicity assuming that new graduates are from relatively disadvantaged backgrounds, reflecting the fact that only education and not family

[3] See, among many, Swanson (2004), Greene (2002), Warren (2005), Kaufman (2004), and Mishel and Roy (2006). Studies typically use the same method: the number of completers divided by the student population for a given age or grade cohort. With the exception of Mishel and Roy (2006), calculations are based on the Current Population Survey or the Common Core of Data, both of which have shortcomings in terms of misreporting, incomplete coverage, and classifications. Studies also vary in their use of contemporaneous over lagged figures and in how they account for private school enrollments, special education students, and migration.

[4] Many Hispanic and other-race persons are immigrants, some of whom did not attend U.S. schools. Although a large fraction of the immigrant population has less than 9th grade education or did not complete high school, this cannot be fully addressed by educational reforms within the U.S. However, the benefits and costs are not affected by whether the dropout was an immigrant or not.

resources is being changed. Using conservative progression rates we construct an 'expected high school graduate', i.e. a person who probabilistically either terminates education after high school or attends college or completes a degree. Approximately, each new high school graduate has a probability of 0.8 of terminating their education after high school, a probability of 0.14 of attending but not completing college, and a probability of 0.06 of attending and completing a four-year college degree.[5] Thus, the 'expected high school graduate' is the appropriate metric; by inducing dropouts to graduate will automatically result in a modest increase of enrollment into postsecondary education, resulting in an extra set of economic benefits and costs.

Table 1 Educational attainment of the population aged 20 (thousands)

	<9th grade	**9-11th grade (GED)**	**High school**	**College level**	**Total**	**High school dropouts (%)**
Male	**63**	**450**	**638**	**1,101**	**2,252**	**23%**
White	18	194	402	749	1,362	16%
Black	6	69	99	127	301	25%
Hispanic	38	168	104	48	358	58%
Other	1	19	33	177	230	9%
Female	**33**	**259**	**508**	**1,183**	**1,983**	**15%**
White	6	100	297	822	1,225	9%
Black	0	71	96	129	296	24%
Hispanic	25	63	81	114	283	31%
Other	2	26	33	118	179	16%

Sources: Current Population Survey (March 2005).
Notes: 9th-11th grade includes those persons with a GED. College level includes those persons with some college and those with at least a BA degree. Dropout percentages include all persons with less than high school education. Race-specific adjustments for rates of institutionalization are from Raphael (2004): the average rate for blacks and other [whites] is 9% [2%]; for those with less than high school education it is 23% [4%]. Race-specific adjustments for GED receipt are from Rumberger's (2004) analysis of NELS (2000): of all graduates, 15% [8%] of blacks and other [whites] are GED-holders.

6 Educational Interventions

In order to carry out the benefit-cost analysis for increasing high school graduation, we undertook a survey of more than 200 articles and unpublished papers to seek interventions that

[5] These rates of continuation and college completion are based upon a relatively disadvantaged population in which continuation rates are for the bottom quartile in reading on NELS 88 and the completion rates are based upon the bottom third in socioeconomic status. See Levin et al. (2007:7).

showed evidence of success. From this data base we found only five that we believed met reasonable evaluation standards using experimental, quasi-experimental, or rigorous econometric designs and showing convincing results on increasing high school graduation. The first column of Table 2 describes the five interventions. Two of the interventions take place in pre-school, one is implemented in elementary school, one in high school, and one through the K-12 years.

The pre-school programs involved intensive educational programs with small group sizes and parental involvement. The Perry Preschool program (PPP) is a high quality pre-school program for 3 and 4-year olds that was the focus of an experimental study using random assignment (Belfield et al., 2006). The program was center-based for 2.5 hours each weekday morning with a child to teacher ratio of from 5:1 to 6.25:1 with teachers trained in special education and early childhood development; home visits by teachers for 1.5 hours a week to work with parents; and parent group meetings. The Chicago child-parent centers (CPC) provide early childhood education and family-support services emphasizing mathematics and reading skills, using high staff-student ratios. (The CPC pre-school program includes both a pre-school and a school-age program, but we focus on the preschool because of its higher effectiveness.)

The class size reduction intervention is based on Project STAR, a four-year randomized field trial in Tennessee. Students were randomly assigned to larger classes of 22-26 students or smaller ones with 13-17 students for up to four years duration, from kindergarten to third grade (Finn et al., 2005).

The high school intervention is known as First Things First (FTF), a comprehensive school reform (Quint et al., 2005). FTF is an example of the current wave of urban high school reform, with an emphasis on small learning communities, instructional improvement, and teacher advocacy for each student. Small learning communities require that schools or sub-units of schools are limited in size to no more than 350 students. Additionally, key teachers work together for several years. Each student is matched with a staff member who meets with the student regularly, monitors student progress, and works with parents to support student success. Instructional improvement focuses on high expectations and rigor in the curriculum as well as engaging approaches that focus on state standards.

Finally, the teacher salary increase proposal evaluates the impact on graduation rates of a 10% increase in wages across all K-12 years. Increasing pay would motivate existing teachers and attract higher quality workers into the teaching labor force. The teacher salary increase (TSI) study by Loeb and Page (2000) estimated the effects of raising teacher salaries on graduation rates using state data with a ten-year time lag.

Table 2 Education Interventions and Costs in Present Values at Age 20

Intervention	Extra graduates if intervention is given to 100 students	Present value cost per student[a]	Present value cost per expected high school graduate[b]
Perry pre-school program (PPP) 1.8 years of a center-based program for 2.5 hours per weekday, child:teacher ratio of 5:1; home visits; and group meetings of parents.	19	$12,500	$90,700
First Things First (FTF) Comprehensive school reform of: small learning communities with dedicated teachers; family advocates; and instructional improvement efforts.	16	$5,500	$59,100
Class size reduction (CSR) 4 years of schooling (grades K-3) with class size reduced from 25 to 15.	11	$13,100	$143,600
Chicago child-parent center program (CPC) Center-based pre-school program: parental involvement, outreach and health/nutrition services. Based in public schools.	11	$4,700	$67,700
Teacher salary increase (TSI) 10% increase in teacher salaries for all years K-12.	5	$2,900	$82,000

Sources: Belfield et al. (2006); Quint et al. (2005); Finn et al. (2005); Reynolds et al. (2001); Loeb and Page (2000). Costs calculations are either from sources or authors' calculations (details in Technical Appendix).
Notes: a The unit cost of delivering the intervention. b The cost of delivering the intervention to 100 students and the induced extra attainment in high school and college for the new high school graduates. Discount rate is 3.5%.

Table 2 shows the impacts of these interventions on increasing the number of high school graduates per 100 students. Since most students would graduate anyway, the effectiveness of each intervention is measured by the additional number of graduates it yields out of 100 students receiving the intervention. The Perry pre-school program is the most effective with 19 new high school graduates; at the opposite end of the spectrum, increasing teacher salaries by 10% would be expected to yield 5 new graduates.

7 Public Costs of the Interventions[6]

Each of the interventions requires an investment of resources as well as the costs of additional years of schooling for the successful graduates. The third column of Table 2 reports the costs per participant receiving the intervention, based on the inputs or ingredients needed in each case, using economic cost accounting (Levin & McEwan 2001) rather than school accounting procedures which do not provide accurate cost estimates. When converted to present value at age 20 using a 3.5 percent interest rate, the cost per student ranges from $5,500 to $13,100.[7]

However, the total public cost must include two additional components. First, increasing the number of high school graduates will mean extra costs from extended attendance in secondary school as well as in college for those who are newly motivated to continue their educational career. We include extra high school costs assuming (conservatively) two extra years are needed to graduate and costs for two-year and four-year colleges based on NCES (2003) data and our expected progression rates. Second, although the investment is spread over a larger pool of potential non-completers, we divide them only by the much smaller number of additional or 'new' graduates. Most recipients would have graduated anyway (we do not know *a priori* who in the susceptible populations would graduate) and it is not possible to perfectly target the interventions to those on the margin of graduation.[8]

The total present value public cost per new expected graduate is given in the final column of Table 2. This cost includes several components. The first is delivery of the intervention to all students in the vulnerable group, which of necessity includes some who would graduate regardless. The second is extra years of high school provision for each new graduate. And the third comprises extra college provision for those who go on to further study. The cost total is divided by the expected increase in high school graduates. In total, these costs are considerably higher than the unit cost of delivering the intervention. They range from $59,100 for First Things First to $143,600 for an intervention to reduce class size. Expressed in this way, it is clear that a significant

[6] More detail on costing procedures is found in Levin et al. (2006), 14-20.

[7] Present value refers to a single number that summarizes the value of a stream of costs disbursed over time where an annual rate of interest (3.5 percent) is applied to take account of the time pattern of spending (Moore et al. 2004). In this case the present value of the costs and benefits of the investment will be summarized at age 20 (Levin & McEwan 2001: 90-94) . The Chicago child-parent center program (CPC) we use the cost estimates reported in Temple and Reynolds (2006). For the High/Scope Perry Pre-School Program (PPP) we use cost estimates reported in Belfield et al. (2006). For both of these programs we deduct the cost-savings from special education and grade retention. For the intervention to increase teacher salaries (TSI) we base our calculations on the average teacher salary in 2004 ($46,597, BLS, 2006) and class sizes of 25. Also, there are no reported costs of the ingredients used in Project STAR so we estimate the costs in terms of extra teachers and classrooms per 100 students expected from reducing the median class size from 24 pupils to 15. Finally, First Things First is a bit more complex since it requires a range of additional resources. These included: reducing class size from 26 to 20 students and adding a counselor, a technical assistant, and a special education teacher per 350 students. These are estimated using the ingredients approach in Levin and McEwan (2001).

[8] For example, to effectively target the intervention teacher pay would have to be raised only for classes with high numbers of dropouts.

investment is required to generate and support each new high school graduate. At issue is whether this investment is worth making.

8 Public Benefits of the Interventions

We have divided the fiscal benefits to the taxpayer into four categories: additional tax revenues and reductions in the public costs of criminal justice, public assistance, and public health. With additional education, the levels of employment, productivity, and earnings of recipients increase, generating additional tax revenues. More education is also associated with declines in crime, public assistance, and dependence on the system of public health. In each case we have tried to approximate the net effect of education on these outcomes rather than relying on the simple statistical association by following the evidence from the best causal estimates of others or from out own statistical estimations.

8.1 Education and Increased Tax Revenues[9]

As reviewed by Rouse (2007), empirical research establishes that the earnings benefits from education are genuinely causal rather than just correlational. That is, they are not attributable to unmeasured characteristics such as ability or aptitude. Nor are they attributable to sheepskin effects. The earnings premium for each additional year of education is substantively important, perhaps as high as 17-20% (Carneiro and Heckman, 2003, 148-149). Consequently, when individuals are not adequately educated the state is losing potential income tax revenues.

We calculate earnings by education level from the March Current Population Surveys (CPS) for 2003 and 2004 of the U.S. Census which covers households across the United States.[10] The CPS has many advantages. It has individual reports of many kinds of income (such as that derived from wages and interest), in addition to social insurance (such as unemployment insurance) and transfer payments. Also, it has a measure of annual earnings comprised of an individual's hourly wage, the number of hours worked per week, and the number of weeks worked per year.

There are significant cross-sectional differences in employment, unemployment, and earnings by education level. These translate into large differences in lifetime earnings which are reported in present value terms at age 20 in the top panel of Table 3. These figures include all persons, not just those earning an income, so they account for the effect of education on labor force

[9] The analysis on additional education and tax revenues was carried out by Cecilia Rouse (2007). Also, see Levin et al. (2007) and the technical detail in Levin et al. (2006), 24-30.

[10] The CPS provides information on income and wages for a national sample of households and individuals over the previous year. Data from 2003 and 2004 are combined to ensure a sufficient sample size and are weighted using BLS weights. The sample only includes those who completed at least 9th grade. Also, we start calculating earnings as of age 20; earnings at younger ages are typically low and sporadic (with very high proportions of dropouts not in the labor force). The March CPS does not distinguish high school graduates from GED-holders and it only includes the civilian non-institutionalized population (not persons in the military or in jail). Below we adjust for differences in incarceration rates by race, ethnicity, and sex, although this affects the final figures only slightly.

participation rates and job stability. Over the lifetime each white male high school dropout earns a present value of total income of $627,000; this rises to $949,000 for those who are high school graduates (with no further schooling) and $2,014,000 for college graduates. Black male dropouts earn $339,000, which is only one-fifth of the earnings of a black male college graduate. Hispanic and other-race male dropouts do relatively well, earning over $600,000. But they too earn considerably more if they graduate from high school or progress on to college. For females, the absolute differences in lifetime earnings are lower, but the disparities across education levels are equally strong. High school dropouts earn $235,000-$300,000 over the lifetime compared to approximately $1,000,000 for college graduates.

Tax revenue gains associated with higher earnings from high school graduation are estimated using the TAXSIM computer program administered by the National Bureau of Economic Research (version 6). TAXSIM is a set of programs and datasets that allow for simulation of an individual's U.S. federal and state income taxes. We used the tax calculator, a program that recreates each year's federal and state tax law, and the March CPS to obtain a sample of individuals and their income sources. Finally, we include property and sales tax differences by education, although these contribute only slightly to our overall estimates.[11]

The bottom panel of Table 3 reports the differences in total income tax payments calculated in present values at age 20. These mirror the differences in earnings. Over a lifetime a male dropout will pay $130,000-$212,000 in income taxes. A male high school graduate pays $232,000-$358,000; and a male college graduate pays $610,000-$854,000. For females, the effect of education is equally strong, but the absolute values are lower. High school dropouts contribute $74,000-$82,000 in income taxes. High school graduates contribute $190,000-$234,000 and college graduates $409,000-$470,000. In our overall calculations we add sales and property tax payments, such that the disparities widen.[12]

[11] We assume sales tax at 5% of income. To calculate the effect on property taxes we used the 5% sample of the 2000 Census. We estimate that households headed by a dropout contributed about $150 less in property taxes in 1999 (in 2004 dollars) than households headed by high school graduates and about $570 less than those with at least a high school degree. That said, these estimates for property taxes must be interpreted cautiously. First, the causality between education and property tax payments is unknown. Second, property taxes are based on housing values and we can only determine payments made jointly by the household. Third, renters pay property taxes indirectly. Fourth, many states offer property tax relief for low-income home owners which may not be included in the Census figures.

[12] We also calculate lifetime earnings with different assumptions about productivity growth and the discount rate. We assume a productivity growth rate of 1.5%, which follows convention; of course the rate may be higher or lower over the following decades. These calculations are available from the authors.

Table 3 Total Lifetime Earnings and Tax Revenues (Present Value at Age 20)

	High school dropout	High school graduate	Some college	BA degree or above
Earnings:				
Male:				
White	$627,000	$949,000	$1,164,000	$2,014,000
Black	$339,000	$637,000	$896,000	$1,485,000
Hispanic	$602,000	$719,000	$826,000	$1,552,000
Other	$618,000	$862,000	$1,036,000	$1,839,000
Female:				
White	$235,000	$479,000	$604,000	$986,000
Black	$300,000	$420,000	$576,000	$1,150,000
Hispanic	$272,000	$416,000	$558,000	$1,088,000
Other	$249,000	$455,000	$587,000	$1,025,000
Income tax payments:				
Male:				
White	$212,000	$358,000	$462,000	$854,000
Black	$130,000	$232,000	$338,000	$610,000
Hispanic	$184,000	$256,000	$346,000	$751,000
Other	$201,000	$319,000	$418,000	$815,000
Female:				
White	$77,000	$156,000	$234,000	$425,000
Black	$82,000	$145,000	$217,000	$470,000
Hispanic	$73,000	$139,000	$176,000	$405,000
Other	$75,000	$150,000	$212,000	$417,000

Source: March Supplement of the Current Population Survey, 2003 and 2004.
Notes: 2004 dollars. Figures corrected for incarceration probabilities. Assumes 1.5% productivity growth in earnings and a discount rate of 3.5%. Tax payments are averaged from two estimates: one where taxes are filed by households and one where taxes are filed by single persons. Education levels are by highest education level completed.

8.2 Health Benefits[13]

Increased educational attainment reduces mortality, changes health behaviors, and improves health outcomes (Cutler and Lleras-Muney, 2006). The cumulative effects on health may be substantial: for example, Wong et al. (2002) find that high school graduates live about 6 to 9 years

[13] The value of health benefits from additional education was carried out by Peter Muennig (2007) with details of the calculations in the technical report, Levin et al. (2006), 31-39.

longer than dropouts, and Muennig (2005) finds that the average 45-year-old college graduate is in better health than the average 25-year-old high school dropout. We therefore anticipate significant savings to government-based insurance systems as education levels increase.

Medicaid eligibility is based on income rather than health status (Iglehart, 1999), so those with more education are less likely to qualify. They are also more likely to have higher quality jobs that provide health insurance. All citizens are eligible for Medicare at age 65. But, persons under 65 who are on social security disability income also qualify for Medicare, and their per enrollee costs are three times those of non-disabled enrollees (Keehan et al., 2004). So, to the extent that education reduces the probability of disability, it should also proportionately reduce Medicare enrollment, and therefore reduce public costs.

We use data from the Medical Expenditure Panel Survey or MEPS (2004), a nationally representative sample of over 40,000 non-institutionalized civilian subjects. Information is available on health-related quality of life scores and public insurance enrollments as well as personal characteristics and medical expenses.[14] All analyses control for the highest educational level completed, sex, ethnicity, and age. Public sector costs data are from the National Health Accounts which is generally thought to be more comprehensive than MEPS (Selden et al., 2001).[15]

Logistic analysis of the MEPS data shows significant lifetime differences in Medicaid and Medicare coverage across education levels. Across ethnic groups, dropouts enroll in Medicaid at rates of 15-32% for males and 28-51% for females. Graduates enroll at rates that are half this size and those with college degrees enroll at rates of 1-3%. A similarly strong relationship is found for Medicare coverage, although enrollment rates are lower (at 8-13% for male dropouts and 6-10% for female dropouts). Moreover, these enrollment differences reflect genuine differences in health status rather than being due to the hypothesis of reverse causation (Cutler and Lleras-Muney, 2006).

These differences in coverage rates translate into differences in annual per capita costs and so into lifetime costs. Table 4 shows the predicted total present value lifetime costs per member of each education category (not per enrollee). High school dropouts use government health insurance programs at much greater rates than graduates, such that costs are much higher. The costs vary by sex, race and ethnicity, but the educational impacts are significant. For white females, for example, a dropout will receive $60,800 in Medicaid and Medicare payments or services over the lifetime up to 65. A high school graduate will receive $23,200 and a college graduate $3,600. The result is a

[14] After eliminating non-US-born subjects who are typically ineligible for Medicaid and Medicare, those aged under 25 and over 65, and subjects with missing values, the sample is 12,299.
[15] On average, MEPS figures are about 7% lower than similar costs from the National Health Accounts. Also, the MEPS excludes Medicaid payments to hospitals that disproportionately serve Medicaid patients..

significant lifetime public saving per expected graduate. The savings are greater for females but they are also substantial for males.[16]

Table 4 Total Lifetime Public Health Costs per Capita (Present Value at Age 20)

	High school dropout	High school graduate	Some college	BA degree or above
Male:				
White	$43,500	$17,000	$12,900	$3,100
Black	$82,400	$34,200	$25,100	$6,000
Hispanic	$59,000	$23,300	$16,700	$4,000
Other	$61,600	$24,800	$18,200	$4,400
Female:				
White	$60,800	$23,200	$15,900	$3,600
Black	$107,200	$48,500	$33,500	$7,800
Hispanic	$73,700	$29,200	$19,600	$4,400
Other	$80,500	$33,600	$23,000	$5,300

Notes: Costs include Medicaid and Medicare. Discount rate is 3.5%. Education levels are by highest education level completed.

8.3 Crime Benefits[17]

Greater educational attainment is associated with lower criminal activity (Farrington, 2003; Lochner and Moretti, 2004; but see Bernburg and Krohn, 2003; Grogger, 1998). The effect may be attributed to the rise in legitimate earnings associated with greater education as well as a lower tendency to engage in crime. Empirically the association between education and crime is clearest when examining rates of incarceration (Arum and Beattie, 1999). Although dropouts comprise less than 20% of the overall population, they represent 37% of federal prison inmates, 54% of state prison inmates, 38% of local jail inmates, and 33% of probationers (Wolf Harlow, 2003). The educational patterns are stronger for males than females, and they vary by race and ethnicity, but the correlation holds for each subgroup of the population. Importantly, crime imposes a significant and lasting public economic burden (Anderson, 1999). This burden includes costs: for the criminal

[16] We test for sensitivity. If the discount rate is raised to 5%, savings will be somewhat lower. If there is no survival advantage to extra education, the incremental returns increase very slightly. The savings also increase if all subjects survived until age 65, a scenario compatible with no account for premature mortality. The tests provide a boundary of +/-20%.

[17] The benefits from reduced costs of criminal justice due to increased education was carried out by Clive Belfield.

justice system (policing, trials and sentencing); for incarceration, parole and probation; for public restitution to victims (including medical care); and for government crime prevention agencies.[18]

We examine the relationship between high school graduation and five types of crime: murder, rape/sexual assault, violent crime (robbery and aggravated assault), property crime (burglary, larceny-theft, motor-vehicle theft, and arson), and drug offenses (separate from the violent crimes associated with drug trafficking).[19] These crimes impose high costs and are strongly influenced by education levels. Data on specific crimes is taken from the annual *Uniform Crime Report* (U.S. Department of Justice, 2004); and the *Sourcebook of Criminal Justice Statistics,* U.S. Department of Justice, 2002a).

Table 5 Annual Criminal Activity by Persons Aged 20

	Murder	**Rape**	**Violent crime**	**Property crime**	**Drug offenses**
Total arrests	602	868	17,522	53,686	75,04
Arrests per high school dropout	0.000482	0.000694	0.014018	0.042949	0.060043
Crime - arrest ratio	1.7	3.5	2.3	6.5	10
Crimes per high school dropout	0.000819	0.002430	0.032240	0.279167	0.600432
Average sentence per arrest (months)	233	157	78	52	56
Average months parole per arrest (months)	90	48	35	23	48
Impact per new expected high school graduate	-19.6%	-19.6%	-19.6%	-10.4%	-11.5%

Sources: UCR (2004, Tables 39, 42, 43a), adjusted for undersurvey; National Crime Victimization Survey (2003); Wolf and Harlow (2003); UCR (2003, Table 1); Belfield et al. (2006); Daly and Tonry (1997, Tables 2 and 8); Durose and Duncan (2003, Table 4). Impacts from Lochner and Moretti (2004), adjusting for effects from higher college progression rates (1.27 for some college and 1.64 for degree holders) and assuming rape effects equivalent to violent crime.
Notes: Violent crime includes robbery and aggravated assault. Property crime includes burglary, larceny-theft, arson, and motor vehicle theft. The share of total arrests by high school dropouts is 0.48 (based on incarceration rates).

Table 5 shows the absolute level of annual criminal activity by type of crime for the cohort of 20-year olds. Row 1 shows annual arrests for 602 murders, 868 rapes, 17,522 violent crimes, 53,686 property crimes, and 75,054 drugs-related crimes. Of these arrests, almost half (48%)

[18] The social burden of crime will also be significant including costs directly imposed on victims (such as lower quality of life); transfers of assets from victims to criminals; avoidance costs by potential victims; and productivity losses from participating in criminal activity rather than work.
[19] These five crime types are approximately 30% of all crimes, but most other crimes are misdemeanors. A sixth crime – child abuse – should be considered because of the significant burden it imposes. However, data are inadequate to perform an accurate costing exercise. Data limitations also preclude analysis of white-collar crimes such as fraud.

involve individuals who have less than high school education. Given the population of high school dropouts, it is possible to calculate the number of arrests per dropout each year; these are given in row 3. Crime–arrest ratios are given in row 4, which allows for calculation of crimes per dropout (row 5).[20] The next two rows report the average sentence per arrest and the average months of parole per arrest. Sentences vary from 233 months for murder to 52 months for property crime; parole rates are proportionately lower.

To estimate the impact of high school graduation on rates of arrest (by crime type) and incarceration probabilities, we rely on the empirical modeling of Lochner and Moretti (2004). Using pooled 1960-1980 Census and FBI data, their identification strategy is to relate the change in compulsory schooling laws to educational attainment. Using the National Longitudinal Survey of Youth and Census data, they control for a rich set of background control variables. The relationships appear consistent across the datasets. We note, however, that much of the data is over 20 years old (such that incarceration rates are below current rates), there is no adjustment for under-reporting of crimes by drop-outs, and the results for rape are not consistent with those for other violent crimes (such that we apply estimates from the latter). Also, we could not estimate separate effects by race, ethnicity, and sex. Despite these caveats, Lochner and Moretti's (2004) evidence clearly suggests that increased rates of high school graduation would significantly lower criminal activity. As itemized in the final row of Table 5, we estimate the effect at 10-20% per expected graduate.

The reduction in crime will, in turn, yield fiscal savings to the public.[21] We distinguish costs per arrest from costs per crime, using criminal justice system expenditures adapted from Belfield et al. (2006) and the U.S. Department of Justice, Bureau of Justice Statistics (2002a,b). Costs per arrest are trial/sentencing costs (not all arrests result in convictions, but the costs of a trial are still incurred). Unit costs per arrest range from $ 917 for drug-related crimes to $12,991 for rape. We also include the costs to the government in payments to victims, including medical expenses not covered by the victims' insurance, losses directly arising from the crime, e.g. injury-related absence from work, and losses from time spent engaging with the criminal justice system.[22] These public-

[20] Official crime rates are considerably lower than victim-reported rates because many crimes are not reported. Also, there is no information on whether crime–arrest ratios vary by ethnicity. Finally, the UCR does not report crimes for 100% of the population; coverage is typically 93-96%. Table 5 uses a conservative estimate of the crime rate. Thus, the calculations are likely to be conservative, not least because they also exclude juvenile crime impacts (for our cohort, these are in the past).

[21] Throughout, the model parameters are conservatively derived. Notably, recent cost estimates by Cohen et al. (2004) are considerably above those applied here; and no juvenile crime effects are counted (because for our 20 year old cohort these are in the past).

[22] These losses are calculated directly from the National Crime Victimization Survey (NCVS). The NCVS is the only dataset available, but it too significantly understates victim costs. Only expenses incurred within six months of the crime are reported, hospital bills are sent to insurers, and mental health costs are not included (Cohen, 2005). Therefore, we add two additional costs. Cohen (2005, 63) estimates that the average amount paid to each victim from the Crime Victims Fund is $2,000; we apply this for murder, rape, and violent crimes. MacMillan (2000, Table 1) estimates annual earnings losses for victims at 13%; we apply this to rape

funded victim costs range from $33,415 for murders to $555 for drug-related offences. There are also costs of government programs specifically intended to prevent crimes (particularly for violence against women and drugs).[23] We assume that these expenditures (for rape and drugs-related crimes) will be reduced in proportion to the reduction in the numbers of crimes committed. Finally, incarceration costs must be added. The average monthly cost per inmate for incarceration is $2,500 and for parole is $155 (U.S. Department of Justice, Bureau of Justice Statistics, 2002a). Because there is no empirical evidence on the relationship between education and probation rates and their associated costs, they are excluded from the analysis.

The largest proportion of potential public cost savings from increasing high school graduates derive from reducing crimes of violence and drugs, leading to lower rates of incarceration. There are significant differences by sex, race, and gender of the effects of high school graduation on reducing public costs, with females imposing a considerably smaller cost saving than males. These differences arise because of differences among groups in criminal activity, in arrests, and in the effect of education on crime. The present value of lifetime costs for crime at age 20 associated with a typical dropout averages about $26,600.[24] We believe that this is a very conservative estimate of cost savings because we have not included crimes perpetrated below the age of 20 and incarceration rates by education are limited to data that are two decades old and considerably below the higher incarceration rates for prisoners found today.

8.4 Welfare Benefits[25]

Greater educational attainment is associated with lower receipt of public assistance payments or subsidies. The relationship may be caused directly through lower rates of single motherhood or teenage pregnancy or indirectly through higher incomes which reduce eligibility for means-tested programs. The impact of education on welfare payments may be significant. Annually, the federal government spends $168 billion and state governments spend $25 billion on the following need-tested benefit programs: cash aid, food benefits, housing aid, training, and energy aid (U.S. Congress, Congressional Research Service, 2004). As incomes rise with education, eligibility for these payments will be reduced.[26]

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and violent crimes and for murder victims we assume ten years of lost earnings and tax revenues at a high school graduate level.

[23] Excluding child juvenile services and education costs, the federal government commits almost $8 billion annually in the war on drugs, with 60% being routed through the Departments of Homeland Security and Justice; as well, state governments commit $2.1 billion.

[24] We take account of the decay rate of crime according to age based on the pattern of criminal activity reported by age (FBI UCR, 2004, Table 1): approximately, criminal activity peaks around age 20 and decays by a few percentage points each year.

[25] Caculated by Clive Belfield based on analysis Waldfogel, Garfinkel, & Kelly (2007).

[26] However, more educated persons are better able to navigate the welfare system and claim benefits to which they are entitled (Osborne Daponte et al., 1999). This offsets somewhat the gains from reducing welfare entitlements through increased educational attainment.

To estimate welfare costs we adopt a model derived by Waldfogel et al. (2007) for analysis of single mothers using the Current Population Survey data of the U.S. Census. First, we identify the impact of education in reducing non-elderly welfare receipt from three sources: Temporary Assistance for Needy Families (TANF), food stamps, and housing assistance. We also include state-level payments on a proportionate basis. Second, we calculate the monetary savings from reductions in welfare receipt over the lifetime for those who are new high school graduates.

There are 1.3 million TANF recipients aged 21-64 annually. Caseloads are predominantly female (approximately by a factor of ten), with black and other race and ethnic groups disproportionately represented. Notably, almost half are high school dropouts, with persons with some college representing less than 3% of recipients (U.S. Department of Health and Human Services 2004). A similar pattern is assumed for housing assistance, of which there are 1.6 million recipients annually according to the 2003 Current Population Survey of the U.S. Census. Finally, the most extensive program is food stamps, in which 9.6 million non-elderly adults participated in 2004. Again, education is important, with 30% of recipients being high school dropouts (Waldfogel et al. 2007: Table 8-2). Over a lifetime, these differences add up: Rank and Hirschl (2005, 142) report that 64% of dropouts will use food stamps during adulthood, compared to 38% of high school graduates.

According to Waldfogel et al (2007), high school graduation is associated with a lower probability of TANF receipt by 40%, of housing assistance by 1%, and of food stamps by 19% (controlling for personal characteristics). For those with some college or above, welfare receipt is even more sharply reduced: by 62% for TANF, by 35% for housing assistance, and by 54% for food stamps.[27] We apply these impacts to the unit costs of welfare. The average monthly benefit is approximately $355 for TANF and $85 for food stamps, to which we add administrative costs (U.S. Department of Health and Human Services, 2005; Barrett and Poikolainen, 2006). For housing assistance, annual spending is $3,100 per person (U.S. Congress, Congressional Research Service, 2004). We add in state costs proportionately. Total costs per year are calculated as the impact times the unit cost.[28]

Annual figures are extrapolated to calculate lifetime effects of increasing educational attainment. The average cost-saving per expected new graduate is $3,000 over the lifetime. As with the other costs, the amounts are calculated as an average across the dropout population, most who receive no public assistance. The largest proportion of the savings comes from reductions in TANF payments although there are non-trivial savings in housing assistance and food stamps as well. The

[27] Pre-welfare reform figures reported by Jayakody et al. (2000) are not significantly different. Grogger (2004) finds very strong effects for females across all types of welfare: high school graduates are 68% less likely, and those with some higher education are 91% less likely, to enter welfare rolls than high school dropouts.

[28] Because TANF is time-limited, we assume no receipt after the cohort reaches the age of 40. The method used here is annualized, so durations of welfare receipt are not important.

total figure is relatively low (compared to the other domains) for the following reasons: welfare is time-limited; children and the elderly receive high proportions of welfare funds; and males do not receive much welfare (but they constitute a large proportion of all high school dropouts).[29] Nevertheless, the cost savings are still noteworthy, particularly for female dropouts.

9 The Returns to Investments in Adequate Education

High school graduation is associated with higher incomes, better health, lower criminal activity and lower welfare receipt. This has private benefits to the better-educated individuals, but it also produces significant public benefits. Table 6 shows the value of the lifetime economic benefits to the public per expected high school graduate. Each new graduate will, on average, generate economic benefits to the public sector of $209,100. This benefit is composed of additional tax revenues of $139,100, health savings of $40,500, crime savings of $26,600, and welfare savings of $3,000. These are gross benefits and do not account for what it costs for the necessary educational interventions to raise the graduation rate or fund college progression contingent on graduation. The amounts vary by sex, race, and ethnicity with high school graduation providing a gross public saving of $196,300-$268,500 for males and $143,000-$174,600 for females.

Importantly, we are not proposing that policy should be based crudely on net present values across sex and race or ethnicity (not least because an alternative criterion – the rate of return – yields a different ranking). We present disaggregated figures to show that the conclusions are not in fact driven by one group and that population-wide interventions are easily justified. A broader perspective must be adopted to decide where the most urgent investments should be made. As noted above, both 'levels' and 'differences' are important and it is necessary to understand the causes of any fiscal differences. These causes might include the potency of education's effects based on the quality of available schools, the progression rates to college, the extent of involvement in the labor market (and society's valuation of non-participation), and the receipt of public services, as well as factors such as labor market discrimination. Investigation of all these factors is beyond our scope and so we emphasize that – as shown in bold in Table 6 – the gross public benefits from graduation are very large for all cases.

The net public benefits of high school graduation are also substantial. Table 7 shows that the benefits easily exceed the costs for each intervention. The first row shows the educational cost per new graduate, i.e. the sum of intervention and attainment costs for each of the five interventions which have been shown to increase graduation rates. These costs range between $59,100 and $143,600 (see Table 2). The second row shows the average lifetime economic benefits per expected

[29] The estimates are conservative. Grogger (2004) reports larger effects of education. We do not count any welfare receipt before age 20. We omit welfare benefits from other programs (mostly at the federal level) where we have insufficient evidence as to the influence of education. Finally, we do not count any cross-family effects such as welfare receipt for children of dropouts.

high school graduate (see Table 6). The last two rows show the benefit–cost ratio, i.e. the factor by which the benefits exceed the costs, and the net present value, i.e. the difference between the benefits and the costs. Taking the median intervention – a teacher salary increase – the benefits are 2.55 times greater than the costs and the net present value from this investment is $127,100 per additional high school graduate. For the upper bound intervention – First Things First – the benefits exceed the costs by a factor of 3.54. For the lower bound intervention – class size reduction – the benefits exceed costs by a factor of 1.46.

Table 6 Total Lifetime Public Savings per Expected High School Graduate (Present Value at Age 20)

	Extra tax revenues	Health savings	Crime savings	Welfare savings	Total
Average	**$139,100**	**$40,500**	**$26,600**	**$3,000**	**$209,100**
Male:					
White	$202,700	$27,900	$30,200	$1,200	$262,100
Black	$157,600	$52,100	$55,500	$3,300	$268,500
Hispanic	$119,000	$37,800	$38,300	$1,200	$196,300
Other	$168,600	$39,000	$30,200	$1,200	$239,000
Female:					
White	$109,100	$39,600	$8,300	$5,000	$162,000
Black	$94,300	$62,700	$8,600	$9,000	$174,600
Hispanic	$85,000	$46,500	$8,300	$3,100	$143,000
Other	$96,700	$49,200	$8,300	$3,100	$157,300

Notes: An expected high school graduate is one who probabilistically either: terminates education after graduation; completes some college; or completes a BA degree. Gender and race-specific probabilities are applied. Benefits are gross, i.e. they do not count for additional educational costs. Discount rate is 3.5%. Numbers are rounded to nearest $100.

The aggregate consequences of raising the high school graduation rate for each age cohort are economically large. Each cohort of 20-year olds includes over 700,000 high school dropouts. If this number were reduced by half through successful implementation of the median educational intervention, the net present value economic benefit would be $45 billion. This figure is an annual one because each cohort is assumed to include the same number of dropouts in the absence of powerful interventions. And it does not count the private benefits of improved economic well-being that accrue directly to the new graduates themselves. If we were able to obtain these fiscal benefits over a decade, we would approach fiscal savings of about half a trillion dollars.

Table 7 Net Public Investment Returns per Expected High School Graduate (Present Value at Age 20)

	Interventions to raise high school graduation rates				
Per additional expected high school graduate	**First Things First**	**Chicago Parent-Child Centers**	**Teacher salary increase**	**Perry Pre-school**	**Class size reduction**
Costs (C)	$59,100	$67,700	$82,000	$90,700	$143,600
Benefits (B)	$209,100	$209,100	$209,100	$209,100	$209,100
Benefit/cost ratio (B/C)	3.54	3.09	2.55	2.31	1.46
Net present value (B-C)	$150,100	$141,400	$127,100	$118,400	$65,500

Notes: Numbers are rounded to nearest $100. Costs include delivering the intervention and any subsequent public subsidies for high school and college. Discount rate is 3.5%.

10 Sensitivity Tests

The net economic benefits of investments to raise high school graduation rates appear to be very large. We suspect this conclusion is unlikely to change if alternative assumptions are applied. Our economic analysis, based on the best available evidence, has used conservative assumptions for each domain. Clearly, if we can identify more effective interventions or if these interventions are less effective when brought to scale, net benefits will be affected. But, these influences are not easily measured.

A number of other assumptions may affect the results positively or negatively.[30]

First, by looking at 20-year olds we have excluded any prior benefits such as reductions in juvenile crime or teenage pregnancy, both of which are associated with attainment. We have also not calculated the additional benefits to students who prospered from a more enriched education among those who would have graduated anyway. Second, because of insufficient data, we have not counted any intergenerational, family, or civic benefits from graduation. Third, we have assumed that the collection of taxes imposes no deadweight loss on taxpayers. Fourth, because sample surveys undercount those in poverty, benefits would likely increase if more accurate data were available (Schmitt and Baker, 2006). In contrast, factors which would reduce the return include: a fall – or slowing – in market wages as more graduates enter the labor market; an increase in the average cost of delivering each intervention; no progression on to college by new high school completers; and a higher discount rate. We test the two most conservative assumptions (no college

[30] Details on a sensitivity analysis are found in Levin et al. (2006), 59-63.

progression and a discount rate of 5%) and find that the net economic benefits are still strongly positive. The overall trend for several decades has been for relative demand for skills to be rising faster than the supply, countering a tendency for the relative earnings of high school graduates to fall as their numbers increase (Juhn, Murphy, & Pierce 1993; Autor, Katz, Kearney (2008).

11 Conclusions

In this study we have found that the monetary value of the public benefits of reducing high school dropouts exceeds considerably the required public costs of successfully, validated educational interventions.

Three aspects of this investigation are worth noting. First, a large fraction of the total public benefit is a result of the higher earnings of those with more education. The earnings effect is both direct – in raising tax revenues – and indirect – in reducing reliance on public services. Second, we express our figures as totals across all levels of government. But the benefits from and the costs of high school graduation are not spread evenly across federal and state/local government. The federal government receives most of the income tax benefits and recoups the larger proportion of health and welfare savings (but the lesser proportion of criminal justice system savings). In contrast, state and local governments incur most of the educational costs, including the extra years of high school. Thus, our findings have implications for the just distribution of burden of funding for educational interventions.

Third, we selected only those interventions for which rigorous and credible evaluations were available and which showed positive impacts on reducing the dropout rate. Although this process is supported by mainstream authorities in evaluation (Mervis, 2004), only five interventions met these criteria. Given the clear economic benefit of raising attainment levels, it appears to be imperative to seek more new ways to effect such change. New interventions that appear promising include combinations of features such as small school size, high levels of personalization, high academic expectations, strong counseling, extended-time school sessions, and competent and appropriate personnel (Quint, 2006). But, one effective strategy that could cut the cost considerably would be if an intervention could be targeted to those students most likely to drop out or most likely to benefit from it. When an intervention is targeted to the entire school (including those students who would have graduated anyway), it requires more resources than if it were more finely targeted to a particular group of the most vulnerable students. Thus, targeting the intervention or portions of the intervention, if possible, represents a way of reducing the cost for each additional student that graduates. However, such practices may also have negative consequences through greater segregation and stigmatization (Oakes 2005).

Overall, investment in adequate education for all children is more than just good public investment policy with high monetary returns. A society that provides fairer access to

opportunities, that is more productive and with higher employment, and that has better health, less crime, and lower dependency is a better society in itself. It is simply an added incentive that the attainment of such a society is also profoundly good economics.

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