The Fiscal and Social Burden of Inadequate Education in Colorado *

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Summary

This report calculates the economic consequences of failing to educate adequately students in Colorado's public school system. We also report on the challenges faced by low-income students that adversely impact on their ability to complete high school. Finally, we provide an economic evaluation of educational programs that can raise the high school graduation rate.

Median family income in Colorado is significantly above the national average, but the state ranks in the middle in terms of attainment and spends considerably less per student than neighboring states. Approximately one-in-five public school students do not satisfy the state graduation standards; and many high school graduates are underprepared for college.

We use a range of Colorado data and the best available research evidence to calculate the economic burden arising from inadequate attainment. Our determination of 'inadequate' is that the student fails to complete high school. We report the economic burden for a single cohort of 12th grade students who are currently finishing up in Colorado public schools. We express all money amounts in present values at 18, i.e. all amounts are equivalent to a lump-sum deposit at that age. All figures are in 2011 dollars, weighted for Colorado prices.

The personal gain from accumulating more education is the extra income over the lifetime associated with a higher paying job. We calculate lifetime income streams for four education levels.

- **Lifetime earnings by education level** are: $459,200 per high school dropout; $696,300 per high school graduate; $789,300 per college attendee for some period; and $1,297,700 per college graduate.
  Relative to dropouts, the lifetime earnings gains are $237,100 for each high school graduate and $838,400 for each college graduate.

We calculate the **net fiscal contributions** by education level per individual. These contributions are tax payments net of expenditures on government health, the criminal justice system, welfare programs, and school/college. They are separated into contributions to the state of Colorado and to the federal government.

- **Lifetime state fiscal contributions** are -$57,700 per high school dropout; -$4,300 per high school graduate; +$21,300 per person with some college; and +$44,300 per college graduate.

Relative to dropouts, each high school graduate pays in $53,500 more over their lifetime to the state government; and a college graduate pays in $102,100 more.

- **Lifetime federal tax net contributions** are -$23,500 per dropout; +$61,600 per high school graduate; +$105,700 per person with some college; and +$198,800 per college graduate.
  Relative to dropouts, each high school graduate pays in $85,100 more over their lifetime to the federal government; and a college graduate pays in $222,400 more.

From the perspective of the state of Colorado, each person who fails to graduate from high school imposes a fiscal burden of $140,100. Across each annual cohort of Colorado public school students, this burden is $1.61 billion.

We also calculate the **social burden of low attainment** for Colorado. This social burden includes the fiscal impacts net of transfers but also incorporates losses in workforce productivity, the deleterious effects on economic growth from having an inadequately skilled workforce, and the burden on victims of crime.

- The social burden borne by the overall Colorado population is extremely large: relative to a high school dropout, each high school graduate represents a present value social gain of $434,300; each college enrollee represents a social gain of $640,900; and each college graduate represents a social gain of $1.35 million.

From a social perspective, the full resource burden associated with inadequate education in Colorado is $524,400 per student. Across each annual cohort of Colorado public school students, this burden is $6.03 billion.

Many low-income school children face considerable impediments and barriers to being successful in school and hence are unable to invest sufficiently in their schooling. We draw attention to several ways in which more affluent families help their children's educational advancement: through a more 'school-like' home; by more educative use of out-of-school time; and by more intensive parental involvement. In addition, low-income children live in communities with few supports for education and often in neighborhoods with high levels of crime and violence. Low-income children require considerable educational supports to compensate for these impediments to learning and these supports are typically underprovided within the current system.

It is possible to compare these economic burdens with the costs of education reforms that might be applied within the Colorado public school system. We do not advocate for these particular reforms for Colorado; such policy decisions would need to be guided by the evidence as it applies to local contexts. However, there are a number of education reforms that have been demonstrated to raise the high school graduation rate. These include: expanded pre-

school programs and Head Start; increasing teacher salaries; reducing class size; and some high school reforms. Other targeted reforms – such as ALAS and Career Academies – have shown promise that they can raise attainment. Typical amounts spent on these reforms are far below our estimates of the fiscal and social burden from low attainment in Colorado. The benefits of these investments therefore significantly exceed the costs.

Alternatively, these social burdens can be compared to what spending is needed to ensure that Colorado meets its state standards and requirements. In their recent study, Augenblick et al. (March 2011) estimate that – at maximum – the amount required to satisfy the Colorado state requirement is 51% more than is currently being spent. In present value terms across K-12 schooling, this would amount to additional spending of $74,400. This is approximately half of the fiscal value of each new high school graduate and less than one-seventh of the social value of each new graduate.

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1. Introduction

The research literature on the economic and social benefits of education is vast (Lochner, 2011; Heckman, 2008; Oreopoulos and Salvanes, 2011). These benefits accrue to the students themselves and to taxpayers and society as a whole. Additional schooling is especially beneficial for disadvantaged students who might live in neighborhoods of concentrated poverty or speak a first language other than English. In Colorado, 30% of students are eligible for free-lunch programs and 10% are learning English as a second language; and both groups have grown rapidly over the last decade.

Spending on education – particularly on reforms that raise high school graduation rates – should be viewed as a public investment, yielding a stream of benefits across decades. At issue is the size of these benefits – what is being lost every time a student fails to graduate from high school or does not complete a college program? Once the value of educational attainment is established, then we can see how much might be spent on programs to raise its level.

This paper calculates the value of inadequate K-12 schooling for the state of Colorado. Colorado's education system performs broadly in the middle of the national rankings, but this still means that almost one-in-five of each age cohort fails to complete high school; for Hispanics and blacks, the proportion is closer to one-in-two. Also, many of those who do graduate from high school subsequent fail to complete college: only about half of students in the state's 29 four-year institutions and 39 two-year institutions graduate within six years (IPEDS, 2009). Increasing students' attainment levels is therefore vital for economic growth in Colorado.

Our investigation into the benefits of additional attainment for Colorado is set out in five sections. First, we describe attainment and spending for current cohorts of school children in Colorado. In Sections 2 and 3 we calculate the fiscal and social burdens associated with low educational attainment across the state; we use evidence from the best, most recently available research and apply it using Colorado-specific data. These burdens include earnings, tax payments, as well as government spending on health, crime, education, and welfare. In Section 4, we provide summary figures of the total economic burdens and perform sensitivity testing. In Section 5, we review why children might face significant challenges in succeeding in school and hence why additional public investments might be justified. Finally, we compare the economic burdens against potential interventions that might be successful in raising attainment and against recent estimates of what Colorado should spend on

education to meet its constitutional requirements. We select these interventions in light of our review of reports and testimony by state officials. [1]

Our analysis is for a single age cohort of 12th graders in Colorado public schools who should be graduating in 2011. Each age cohort can be divided into four groups: those who will be high school dropouts, high school graduates, have some college or an Associate's degree, and those who will complete at least a Bachelor's degree. The lifetime economic consequences of being in each group are tracked. We can then predict what would happen if some students moved from being dropouts to being graduates (with the option of attending college). All money amounts are expressed in present values at 12th grade using a 3.5% discount rate.[2] All prices are adjusted to account for cost-of-living in Colorado and all figures are reported in 2011 dollars.[3]

2. The Education System in Colorado

2.1 Educational Attainment

To make the analysis tractable, we categorize educational attainment in Colorado into four pathways: high school dropout; high school graduate; person with some college; and person with a BA degree or above. Of course, at age 18 these pathways are not yet complete, so we model subsequent college enrollment and completion based on rates for prior cohorts. Once individuals are categorized, it is possible to see how attainment levels might be inadequate or sub-optimal.

Fundamentally, we view inadequate education as a failure to graduate from high school. We take this view because there is a very strong link between graduation and future life experiences such that economic independence is very difficult if one is a high school dropout; and higher education and many training opportunities are closed off for high school dropouts. (We prefer this attainment measure to an achievement measure because of the many non-cognitive influences on economic outcomes). However, a sizeable proportion of high school graduates are not college-ready and must take sequences of developmental education prior to taking any college credits. This is equivalent to repeating high school classes, with the additional burden that the student is paying fees and may be de-motivated (Bailey et al., 2010). As noted above, many college enrollees will not complete their studies. Thus, within each cohort of students, many have education levels that are below what might be expected and are almost certainly below what is needed for future economic success.

In our analysis we exclude students who need college remediation (or fail to finish college) from our definition of 'inadequate education' and as such the numbers of persons whom we estimate with

inadequate education is highly conservative.[4] That said, we do not assume that all students will be able to graduate from high school: many face severe personal and economic challenges that will preclude this. Rather, we look at the benefits for incremental proportions of students who should – given a thorough and uniform education – be able to graduate from high school and potentially enroll in college.

The research evidence on dropout rates is very large and growing. Many different metrics can be used and the reported rate (and its trend) does vary somewhat according to the method used.[5] (Strictly, our analysis does not depend on a very precise measure of the dropout rate). Our tabulation of attainment in Colorado is a pooled estimate from the Colorado State Department of Education and from federal statistics for Colorado given in Stillwell (2010) and Swanson (2004).

Table 1
Educational Attainment in Colorado (2010)

	TOTAL		White		Hispanic		Black		Other	
High school dropout	11,497	18%	6,408	17%	7,650	43%	1395	38%	762	25%
High school graduate	13,737	22%	9,345	25%	3,029	17%	680	19%	683	22%
Some college or 2-year degree	24,426	39%	12,189	32%	5,136	29%	1152	31%	1,158	38%
4-year degree	12,542	20%	9,751	26%	1,975	11%	443	12%	445	15%
Cohort size (at 9th grade)	*62,202*		*37,694*		*17,790*		*3,670*		*3,048*	

Sources: Tabulations from the Colorado State Department of Education, www.cde.state.co.us/cdereval/rv2010pmlinks.htm; Swanson (2004); and Stillwell (2010). *Notes:* GED completion assumed equivalent to high school graduate.

Table 1 shows the attainment profiles of a single age cohort in Colorado. At 9th grade, there are 62,200 persons: one-in-five of these persons will be a high school dropout; just over one-fifth will have a high school diploma (including GED); two-fifths will have either an Associate's degree or some college; and one-fifth will obtain a BA degree or above.[6] Each cohort in Colorado includes 11,500 high school dropouts and another 13,740 who have not attempted college.[7] There are significant differences by race, with the Hispanic dropout rate at 43% and the black rate at 35%, as well as differences by sex (with the dropout rate for males far in excess of that for females).

2.2 Education Funding

Annually, the state of Colorado spends $7.04 billion on K-12 education or $9,050 per student.[8] Our analysis cannot determine what the optimal level of spending should be (nor does it preclude the possibility that some expenditures are spent inefficiently). Instead, our analysis is informative in deciding whether inadequate education imposes an economic burden such that it would be more

efficient for the state to offer a high quality education during childhood, rather than pay later for its failure to do so. For illustration, Appendix Table 1 lists the main government departments that are affected by the level of human capital in the economy; total spending across all these departments exceeds $15 billion annually.[9] If there are substantial economic benefits from education, the state should invest more so that it will have to expend less subsequently.

Colorado does allocate more funds to at-risk students, although it is debatable both as to the extent of this allocation and whether it is sufficient. The poverty weight for Colorado has been estimated at 26%, i.e. students in poverty are expected to receive 26% more in funding than the average student. The weight is based primarily on eligibility for free lunch. However, when comparing actual aid to districts, the per-pupil state aid for high poverty districts is only 2% more than amount for the average district. This is the fifth lowest ratio across the country. Even with a poverty weight, Duncombe and Yinger (2005a, p.515) conclude that "no state has an effective poverty weight as high as the estimated weight in the scholarly literature", i.e. no state invests sufficiently to account for the many educational challenges faced by at-risk students.[10]

2.3 Education and the Economy

Almost all economists believe that a more productivity economy comes from more capital, and that human capital – the knowledge, training, and skills that workers possess – is one of the most valuable forms (Hanushek and Woessmann, 2008; Krueger and Lindahl, 2002). Unlike physical capital, human capital is very flexible, can be applied in many different enterprises, and does not depreciate rapidly. Moreover, changes in the structure of the economy favor human capital. Goldin and Katz (2008) describe this as a 'race between education and technology', where workers accumulate skills so as to catch up with changes in how goods are produced. Autor et al. (2003) categorize jobs by routine/non-routine and cognitive/non-cognitive attributes, arguing that the number of routine non-cognitive jobs – those that require the least education – is falling the fastest. The Colorado Division of Labor reports that the fastest growing occupations in the state are: nursing; retail sales; retail sales managers; computer systems analysts; customer service representatives; computer support specialists; and web developers.[11] Almost without exception, high school dropouts do not have the skills to perform these jobs. Carnevale et al. (2010) estimate that, of the 0.9 million new jobs that will be created in Colorado over the next decade, only 10% will be accessible by high school dropouts and only 25% will be accessible for high school graduates with the remaining two-thirds requiring postsecondary credentials. Moreover, against national norms Colorado is a highly skill-intensive state: the state ranks fifth in terms

of its needs for workers to have postsecondary education; and even 'blue collar' jobs (such as construction and extraction) are likely to be dominated by persons with at least a high school diploma. Finally, as in other states across the country, demographic pressures will exacerbate this skill trend: as baby-boom workers retire, more younger workers with requisite skills will be needed.

Table 2
Labor Market Status: Colorado Adults (18-65)

	High school dropouts		High school graduate (incl. GED)		Associate degree or some college		BA degree or above	
Not in labor force	35%		22%		22%		14%	
Unemployed	9%		6%		4%		3%	
In school	11%		3%		10%		1%	
Annual earnings	$14,599	(25,037)	$27179	(32,729)	$32,026	(35,666)	$62,370	(74,206)
State tax (net cr.)	$337	(1,480)	$805	(1,818)	$1,154	(2,199)	$2,284	(4,239)
Federal tax (net cr.)	$849	(4,479)	$2481	(6,571)	$3,861	(8,964)	$9,053	(16,920)
FICA	$1,083	(1,527)	$1,942	(2,072)	$2,262	(2,254)	$3,814	(3,513)
Pension plan	16%		34%		40%		53%	
Private health ins.	36%		64%		73%		87%	
Food stamps	$378	(1,208)	$137	(701)	$106	(654)	$14	(231)
Supplemental Security Income	$244	(1,385)	$176	(1,310)	$94	(1,056)	$37	(635)
N	*1697*		*3521*		*3918*		*4874*	

Source: Current Population Survey, March Supplements 2006-2010 pooled. *Notes:* All adults (male and female). Sample includes persons with zero earnings, tax payments, and welfare receipt. Standard errors in brackets.

Table 2 shows current levels of economic stratification by education level in Colorado. The data are from the Current Population Survey, pooled across 2006 to 2010 to obtain a sufficient sample of Colorado adults. The top panel shows enormous differences in labor market participation: 35% of high school dropouts are not in the labor market, compared to 22% for graduates and persons with some college and 14% for persons with college degrees. In addition, another 9% of dropouts are unemployed; this rate is 50% above the unemployment rate for high school graduates.

Earnings differences by education level are also dramatic. High school dropouts earn approximately $14,600 annually; but high school graduates earn 1.9 times this amount, persons with some college earn 2.2 times more, and college graduates earn 4.3 times as much. Corresponding to these differences in earnings, there are also significant differences in tax payments both at the state and federal levels, as well as FICA contributions. The bottom two panels show two other ways in which

education influences economic status. High school dropouts are much less likely to have work-related benefits: only 16% have a pension plan and 36% have private health insurance; the rates for high school graduates are almost double (34% and 64% respectively). Finally, high school dropouts are much more reliant on public assistance: counting only food stamps and supplemental security income, the average dropout receives contributions of $622 annually; high school graduates receive almost exactly half as much and college graduates less than one-tenth that amount.

2.4 Modeling the Consequences of Inadequate Education

The cross-sectional evidence in Table 2 can be used to model the full economic consequences of inadequate education. To calculate the full consequences of inadequate education we must model the lifetime differences associated with being a high school dropout versus being a high school graduate along with the opportunity that allows for progressing into higher education. We model the differences in earnings, in tax payments, and in government expenditures on health, crime, and welfare. We separate out state and federal tax and expenditure effects. In addition, we model the lifetime social differences for the state of Colorado, which include: general productivity differences associated with changes in the education level of the workforce; variations in the social burden of crime; and variations in the social value of health.[12]

These lifetime values are used to calculate the economic burden – per individual and per cohort – associated with inadequate education. This burden is the amount that the state loses when its citizens are not educated up to a certain level. As defined above, our working assumption is that inadequate education is failure to graduate from high school. So, differences between dropouts and high school graduates provide a lower bound on the burden of inadequate education. A more accurate estimate should include the opportunity to progress on to college and perhaps obtain a four-year degree. Therefore, our estimate of the economic burden of inadequate education accounts for the probability of progression onto college.

3. Economic Benefits Across Education Levels

3.1 Earnings by Education Level

The link between more schooling and higher earnings is strong and robust (Card, 1999). Much of the evidence is from correlation studies (see Belfield and Bailey, 2011). But there has been extensive methodological investigation of whether these correlations are biased and the conclusion is that they are not. The correlations are sufficient approximations to a causal relationship between education and

income (see Rouse, 2007).[13] Thus, it is possible to be confident that earnings advantages from increased levels of education are genuine.

As this is the largest benefit from education, we pool two methods to calculate the lifetime earnings by education level. The first method uses gross earnings data taken directly from the Colorado resident subsample of the Current Population Survey (see Table 2). Gross earnings, i.e. including tax payments and employer contributions, are grouped by education level and age.[14] From these groupings we can derive a lifetime full earnings profile (with assumptions about productivity growth over time) for each education level. This earnings profile is calculated in three different ways, based on changing assumptions about non-wage benefits, productivity growth, and the discount rate. These three estimates of lifetime present value earnings by education level are given in Appendix Table 2 (with full details in the Table Notes).

However, because the Colorado sample in the CPS is not large, this method of calculation does not allow for variations by race and sex. Our second method uses the same protocol as the first method with respect to age bands and the creation of lifetime earnings profiles but uses the entire CPS data from 2006-2010. Given the much larger sample size (over 1 million persons), it is possible to estimate earnings by race and sex separately and we can adjust for work-life expectancies (as reported in Skoog and Ciecka, 2010). Lifetime profiles are calculated for white, black and Hispanic males and separately for males and females. These six profiles are then weighted according to the demographics of educational attainment and wages in Colorado (see Table 1 above).[15] These lifetime present values of earnings are given in Appendix Table 3.

Table 3
Earnings
Lifetime Present Value by Education Level

	High school dropouts	High school graduate (incl. GED)	Associate degree or some college	BA degree or above
Earnings gain (incl. benefits)	$459,249	$696,303	$789,340	$1,297,670
Difference over high school dropout	-	$237,055	$330,091	$838,422
Social gain (incl. productivity spillovers)	$629,171	$953,936	$1,081,396	$1,777,809
Difference over high school dropout	-	$324,765	$452,225	$1,148,638

Notes: See Appendix Tables 2 and 3 for details of two methods used to calculate income differences.

Our best estimate of lifetime labor market productivity by education level is reported in Table 3. This estimate is the average across the three versions of each of the two methods described above.[16] A Colorado public school student who is now 18 years old is predicted to have the following present values of lifetime earnings: $459,200 if a high school dropout; $696,300 if a high school graduate; $789,300 if they attend college for some period; and $1,297,700 if they graduate with a 4-year degree. Relative to dropouts, there are substantial lifetime earnings gains: these amount to almost one quarter of a million dollars for a high school graduate ($237,100) and $838,000 for a college graduate.

These figures only count the private gains in productivity. There is also evidence of economic 'productivity spillovers': as the workforce is more educated, firms are more likely to invest in the locality and workers can learn from each other. Broadly, as the proportion of graduates in the population increases, so do average earnings. Therefore, having more high school graduates means higher earnings for other workers as well. In a general review of the literature, McMahon (2006) estimates these spillovers to be worth (conservatively) 37% of the total income returns to education (and perhaps as much as 61%).[17] We apply this coefficient below to our results for earnings. These full social labor market differences by education level are given in the final row of Table 3. The social value of ensuring someone is a high school graduate rather than a dropout is $324,800.

3.2 Tax Payments by Education Level

These differences in earnings by education level mean that there will be differences in tax contributions at both the state and federal level. As the largest proportion of taxes are paid to the federal government, the main fiscal benefit of having a more highly educated population is accrued nationally, not in Colorado. One interpretation is to say that any differences in federal tax payments are irrelevant to the state's decision to invest in public education. However, Colorado citizens do receive money from the federal government either directly or because it is an employer within the state. So one approach is to value only the federal dollars that Colorado receives back as spending within the state. Historically, Colorado taxpayers have paid more into the federal government than they have received back: the most recent data indicate that for every $1 paid in federal taxes, the state receives only 81 cents in federal spending.[18] Even assuming the state places no value on federal spending unless it occurs in Colorado, any federal savings are still valued by Colorado citizens at 81% of their face value.

Differences in Colorado state taxes may be calculated directly based on the tax code. The state income tax rate is flat at 4.63% (with exemptions of $3,650 for single persons and $7,300 for married

persons) and the state also obtains revenue from taxes on sales, selective sales, corporations, and other activities.[19] These other taxes raise almost exactly the same amount of revenue for the state as the state income tax does. In total, therefore, approximately 10% of per capita income is paid in state taxes.

Tax payments represent the most significant element of the fiscal burden associated with inadequate education. Therefore, we apply two methods to calculate these burdens. Our best estimate is then the average across these two methods.

In the first method, tax payments are derived directly from the Colorado resident subsample of the Current Population Survey as depicted in Table 2. These payments are federal and state tax payments after credits have been deducted. As per the earnings estimates, lifetime tax payments by education are calculated using smoothed, annual averages by age band. Three lifetime models are generated, with variations in productivity growth, the discount rate, and the taxable value of health and pension benefits. These present value amounts are given in Appendix Table 4.

For the second method, we use the national sample of earnings, disaggregated by race and sex. These earnings are then entered through the National Bureau of Economic Research tax calculator, TAXSIM9.[20] This gives the amount of federal and state tax paid; state sales, excise and corporate taxes are added on as an additional 50%.[21] These federal and state tax payment amounts are reported in Appendix Tables 5 and 6.

Table 4
Federal and Colorado State Tax Payments
Lifetime Present Value by Education Level

	High school dropouts	High school graduate (incl. GED)	Associate degree or some college	BA degree or above
Federal Tax:				
Average [a]-[c]	$65,724	$105,521	$130,814	$221,604
Gain over a high school dropout	-	$39,797	$65,089	$155,880
State Tax:				
Average [a]-[c]	$32,065	$47,537	$56,773	$86,993
Gain over a high school dropout		$15,473	$24,709	$54,929

Notes: See Appendix Tables 3, 4 and 5 for details of two methods used to calculate income differences.

We take the average from the two sets of estimates to yield our 'best' estimate of lifetime tax payments by educational attainment. These figures – expressed as present values at age 18 – are shown in Table 4. There are large differences in tax payments by education level. Whereas a high school dropout in Colorado will contribute $65,700 in federal taxes and $32,070 in state taxes, a high school graduate will contribute $105,500 and $47,500 respectively. Persons who go to college contribute even more and those who complete college will be contributing $221,600 to the federal government and $87,000 in state taxes.

Absolute differences in federal tax payments over a high school dropout amount to $39,800 for a high school graduate, $95,100 for an individual with some college, and $156,900 for a college graduate. The differences in state tax payments are also significant, at $15,500, $24,700 and $54,900 respectively.

3.3 Health Payments by Education Level

The link between health and education is also strong: individuals with more education are not only in better health but they are better able to manage their health through nutrition and exercise. There is significant research evidence on many of these relationships, including obesity and low physical mobility and extending into significant differences in longevity by education level (Cutler and Lleras-Muney, 2010; Kimbro et al., 2008). Overall, national data show that only 36% of adult high school dropouts report being in excellent or very good health; the rates for high school graduates, persons with some college, and college graduates are 51%, 60%, and 76% respectively (Pleis et al., 2009). As shown in Table 2, persons with more education are more likely to have jobs with private health insurance but the health-education gradient holds even after controlling for income (Oreopoulos and Salvanes, 2011). Finally, health disparities by education level are growing such that future generations' health status will be increasingly a function of their education level (Adler and Stewart, 2010, p.6). Some authors argue that failure to complete high school should be framed as a public health issue in itself (Freudenberg and Ruglis, 2007).

Data from the Healthy People database shows that these relationships hold equally strongly within Colorado. The links are shown in Appendix Table 7. Health screening is much more frequent for more educated persons (pap tests, colon cancer, mammograms). Diabetes rates are much lower with more education, with dropouts having diabetes at almost twice the rate of persons with some college education. The differences begin early, with low birth weight and prenatal care gradients. Finally,

obesity, sedentary lifestyles, and smoking rates are all associated with inadequate education. Medicaid and Medicare enrollments are also higher for those with less education (excluding retired persons).

These differences in health status, coupled with differences in incomes, translate into different amounts of government health expenditures, consonant with a given health status. Colorado spends 11% of Gross State Product on health care (Kaiser Health Facts, 2009). Annual Medicaid spending per enrollee in Colorado averages $6,400 annually and 13% of state residents are on Medicaid or some other form of public insurance.[22] Hence, the Colorado taxpayer is likely to save on government health programs if its citizens are educated to a greater level.

To calculate the fiscal health burdens across education levels, we apply two methods and take the average across these methods. Our first method uses the Medicaid/Medicare enrollment rates by education level from the American Community Survey and multiplies these by the average expenditure per enrollee spread over the adult working life (Sum et al., 2009b). This total is then apportioned between the federal and state governments based on their relative share of the burden.[23] Our second method adapts estimates calculated at the national level by Muennig (2007). These estimates include Medicaid and Medicare and Social Security Disability payments for those aged under 65, to which we add in direct state medical spending. We also adjust these estimates to be expressed in 2011 dollars using Colorado prices.

Table 5
Federal and State Expenditures on Health Care
Lifetime Present Values by Education Level

	High school dropouts	High school graduate (incl. GED)	Associate degree or some college	BA degree or above
Federal expenditures	$55,783	$26,179	$15,841	$4,746
Difference over HS dropout	-	$(29,604)	$(39,941)	$(51,036)
State expenditures	$46,777	$21,619	$13,147	$3,755
Difference over HS dropout	-	$(25,158)	$(33,630)	$(43,022)

Notes: Present values with 3.5% discount rate. Estimates are the average of models derived from Sum et al. (2009b) and Muennig (2007).

Table 5 shows lifetime present value public expenditures on health care by education level. These estimates are the average across our two methods. They show significant differences by education levels, with both the federal and state governments sharing the burden. Whereas lifetime expenditures by the federal government on health care for high school dropouts is estimated at

$55,800, the respective figure for high school graduates is $26,200; for college graduates, it is $4,700 on average. Therefore, the average high school dropout imposes an additional burden of $29,600 over that of a high school graduate; the size of this burden increases with the gap in education levels. There are similarly large effect for state expenditures. Dropouts will impose a lifetime burden worth $46,800, which is more than double that of high school graduates and more than ten times that imposed by college graduates. From the state's perspective, each new high school graduate yields a saving of $25,200 and each new college graduate yields a saving of $43,000 over a dropout.

These fiscal differences do not count any economic value private individuals place on being in better health. There is also a social benefit in that citizens value good health beyond what they spend to alleviate poor health. Two recent studies have calculated this broader, social value associated with better health. Using MEPS and NHIS data from 1997-2002 Muennig et al. (2010) calculate the remaining quality-adjusted life years (QALYs) of persons aged 18.[24] For high school dropouts, these QALYs amount to 37.8 and for high school graduates they are 40.2. In effect, a high school graduate reaps an additional 2.4 years of life in full health. Assuming that each QALY is conservatively worth $100,000 (Cutler and Lleras-Muney, 2010), the undiscounted gain from being a high school graduate is $240,000.[25] Alternatively, Schoeni et al. (2011) estimate annual differences in health-related quality of life across persons with different education levels. Relative to a high school dropout, they find that a high school graduate experiences 0.03 extra QALYs each year and a person with a college degree experiences 0.062 QALYs more. Given the value of a QALY at $100,000, additional education is worth $3,000 and $6,200 each year respectively. Over 40 years, these amounts are worth $120,000 and $248,000 respectively.

A very conservative estimate of the social value of health associated with inadequate education – being a high school dropout – is therefore $120,000 per person.

3.4 Crime by Education Level

Education levels are strongly correlated with criminal activity (Lochner, 2011; Oreopoulos and Salvannes, 2011; Lochner and Moretti, 2004). There is a direct link – education causes lower criminal activity – and an indirect one – education raises incomes and so the opportunity cost of crime. Recent evidence suggests that the relationship is even stronger for disadvantaged populations (Merlo and Wolpin, 2009).

Criminal activity in Colorado is given in Appendix Table 11. Relatedly, Colorado has approximately 27,900 persons in federal or state prison, as well as 56,800 persons on probation or parole and an additional 16,440 individuals in local jails. This means that 2.5% of the adult population is

involved in the criminal justice system.[26] However, there is no available data on what proportion of crimes are committed by high school dropouts and Colorado does not report the education levels of its incarcerated population. Therefore, we rely on national data on incarceration rates by education level: these show that 68% of state prison inmates did not have a high school diploma and that only 12% had any postsecondary education (Wolf Harlow, 2003).

Where crime is lower, the pressure for spending on policing, the criminal justice system, and incarceration is lessened. In 2009, the state of Colorado spent $761 million on its Corrections Department, $451 million on its Judicial Department, $49 million on its Law Department, and $250 million on it Public Safety Department. There were also federal funds appropriations within the state of $40 million. Adding in federal government expenditures raises these amounts by at least another 20%.[27] As with health care, more recent calculations yield much higher estimates of burdens than earlier studies.[28]

We use two stages to calculate the crime burden from inadequate education.[29] In the first stage we calculate the lifetime crime burden imposed either by a non-offender, a general offender or a chronic offender.[30] These categories reflect the incidence of crime across persons. Non-offenders – about 80% of the population – impose no crime burden. General offenders – about 15% of the population – commit about half of all crimes. But chronic offenders – the remaining 5% of the population – commit the remaining half of all crimes (Farrington and Welsh, 2007). Several recent studies have calculated the lifetime fiscal and social consequences of being either an offender or a chronic offender.[31] We use these estimates and adjust them to the context in Colorado. Specifically, we adjust for the rate of crime and incarceration in Colorado and for the state's relative spending on policing, the criminal justice system, and the corrections system. We also separate out the fiscal and social burdens, and further disaggregate the fiscal burden into state and federal responsibilities (Hughes, 2006). In the second stage, we relate these expenditures to the proportions of each category (non-, general, and chronic offender) by education level. The probabilities are derived from the respective incarceration rates by education level.[32]

Conservatively, we calculate that the lifetime present values of government expenditures are $52,640 per general offender and $324,960 per chronic offender. Given the distribution of crime by education level, this leads to significant differences in present value burdens. These are reported in Table 6. Per high school dropout federal expenditures on crime are $19,320 and state expenditures are $39,220. In contrast, the respective figures for high school graduates are $12,530 and $25,440. For persons with some college and for college graduates the burdens are lower still. Expressed as

differences over a high school dropout, the federal government saves $6,790 per high school graduate, $13,570 per person with some college, and $17,050 per college graduate. Reflecting the fact that the state pays the larger share of crime-related expenditures, its savings from having a more educated population are approximately double those of the federal government.

Table 6
Federal and State Expenditures on Crime
Lifetime Present Values by Education Level

	High school dropouts	High school graduate (incl. GED)	Associate degree or some college	BA degree or above
Federal expenditures	$19,316	$12,530	$5,744	$2,264
Difference over HS dropout	-	$(6,786)	$(13,572)	$(17,052)
State expenditures	$39,218	$25,439	$11,661	$4,596
Difference over HS dropout	-	$(13,778)	$(27,556)	$(34,621)
Social cost of crime	$146,334	$94,923	$43,512	$17,150
Difference over HS dropout	-	$(51,411)	$(102,882)	$(129,185)

Sources: Figures adapted from Belfield and Levin (2008). Social costs from Miller (1996).

Direct expenditures on crime are not the largest component of the burden associated with crime. Victims of crime bear the biggest loss in terms of reduced quality of life and monetary losses (including time off work); and all persons incur expenses to avoid being a crime victim of crime. However, these social costs of crime are much harder than fiscal costs to estimate with precision and current estimates almost certainly underestimate the full benefits of crime reduction.[33] The two best estimates of the social burden are those by Miller et al. (1996), who calculate that the social burden is 2.5 times as large as the fiscal burden, and Ludwig (2006), who estimates the ratio is closer to 4.5. Following convention, the more conservative ratio is applied here such that the social burdens – as reported in the final row of Table 6 – are 2.5 times the fiscal burdens. This shows the magnitude of the social value of crime reduction for Colorado.

3.5 Welfare Payments by Education Level

Higher levels of education are associated with lower reliance on welfare systems (Waldfogel et al., 2007; Grogger, 2004). As shown in Table 2 for example, a high school dropout will receive on average $380 in food stamps annually; a person with a college degree typically receives less than $15. In fact, the link between education and welfare receipt is often automatic because persons with higher incomes are not

eligible. Hence, where programs raise educational attainment and income, pressures on welfare programs will be alleviated.

There are 29,400 recipients of Colorado Works, the state's Temporary Assistance for Needy Families (TANF) program. Taking all forms of direct public assistance together, 37,470 households received welfare in 2009 in Colorado. In addition, 116,940 households across the state received food stamps and or participated in the Supplemental Nutrition Assistance Program in Colorado; this is approximately 6% of all households.[34] For Colorado Works, the federal government spends $240 million in the state annually and, through its Maintenance of Effort expenditures, the state government spends $167 million.[35] This approximates to $8,160 per recipient in federal spending and $5,680 in state spending annually (including administration costs). Spending on other welfare programs (including housing, state welfare) is added.

The precise education-welfare gradient varies from program to program and data are not available for every welfare program. We use the gradients implied in Table 2 for food stamps: specifically, 24% of high school dropouts use them; the rates for high school graduates, those with some college, and college graduates are 9%, 5%, and 1% respectively.[36] We apply these rates to receipt of Colorado Works, food stamps, housing assistance, and other state welfare programs. For Colorado Works, we use the above cost estimate per person. For food stamps, we use the cost estimates given in Table 2. For housing assistance, we use estimates from CRS (2004). Finally, we assume other state welfare programs amount to 25% of the value of federal programs (Ratcliffe et al., 2007). For these programs, based on Grogger (2004), we assume that individuals only spend eight years on welfare before becoming ineligible.[37]

Table 7
Federal and State Expenditures on Welfare
Lifetime Present Values by Education Level

	High school dropouts	High school graduate (incl. GED)	Associate degree or some college	BA degree or above
Federal expenditures	$15,183	$5,244	$2,887	$584
Difference over HS dropout	-	$(9,938)	$(12,296)	$(14,598)
State expenditures	$13,257	$4,746	$2,673	$546
Difference over HS dropout	-	$(8,510)	$(10,584)	$(12,711)

Sources: CRS (2004) and Table 2. *Notes:* Figures adjusted for Colorado prices and state welfare rules. Present values at age 18.

Table 7 shows the estimated amount of welfare payment received by education level. Dropouts obtain on average $15,180 in federal payments and $13,260 in state payments. Other education levels account for significantly less, with college graduates having almost zero reliance on welfare. The differences by education level are therefore significant: each high school graduate yields a welfare saving of $9,940 to the federal government and $8,510 to the state government; each college graduate yields a welfare saving of $15,600 and $12,710 respectively.

As a final note, no social burden is implied by these welfare payments. They are transfers from one group to another. However, it is likely that there is a social burden in terms of any stigma from welfare dependency. This stigma is not counted in this analysis because of a lack of information on its value.

3.6 Costs of Incremental Education

There is one 'negative benefit' from additional education: students who stay in school or college for longer will receive more public subsidies for their education (net of tuition payments). Strictly in terms of short run expenditures, high school dropouts and college dropouts are saving the state money. (Of course, this 'saving' is more than offset during adulthood.) Moreover, the short-run 'saving' is small, not least because many high school dropouts will enroll in other educational programs at a later date.[38]

Table 8
Federal and State Expenditures on Education Beyond High School
Lifetime Present Values by Education Level

	High school dropouts	High school graduate (incl. GED)	Associate degree or some college	BA degree or above
Federal expenditures	$(1,049)	$0	$598	$15,163
Difference over HS dropout		+$1,049	+$1,648	+$16,213
State expenditures	$(9,445)	$0	$7,950	$33,750
Difference over HS dropout		+$9,445	+$17,395	+$43,195

Sources: Colorado Department of Education, *Digest of Educational Statistics* (2009); University of Colorado budget.
Notes: Adjustments for private college enrollment. Expenditures are net of fees and other sources of revenue. Lifetime present values are reported at age 18.

We calculate these educational costs based on the pathways of the students. Each high school dropout is assumed to receive one fewer year of high school. Each person with some college is assumed to have two years of college at a two-year institution and each college graduate is assumed to have five years of college at a four-year institution. Annual state and federal costs of school and college are

calculated from: the *Digest of Education Statistics* from the National Center for Education Statistics; the Colorado Department of Education; and the University of Colorado system. These amounts are counted net of tuition fees paid by the student.[39]

Table 8 shows the additional amounts of public expenditures on education beyond high school for each of the four groups. High school dropouts yield savings of over $1,050 to the federal government and $9,450 to the state government. Straightforwardly, the high school graduate group generates zero additional expenditure beyond high school. For persons with some college, there are additional federal expenditures of $600 and state expenditures of $7,950; and for college graduates the additional expenditures are $16,210 and $33,750 respectively. Table 8 also shows the differences by education level and so the full 'savings' associated with inadequate education.

4. Economic Burdens by Education Level

4.1 Fiscal Burdens

The total fiscal burden of inadequate education is the sum of the components in Section 3. This burden in given in Table 9 divided according to the level of government (federal and state). Critically, more educated individuals contribute more in taxes and impose lower expenditures over their lifetimes. This has substantial fiscal implications.

Each high school dropout imposes a net fiscal *burden* of $23,500 to the federal government and $57,700 to the state government, i.e. dropouts draw down on government programs more than they pay in taxes. In contrast, each high school graduate imposes a small fiscal burden to the state of $4,300 but produces a fiscal gain to the federal government of $61,600. Persons who attend college contribute significantly at both the state (+$21,300) and federal (+$105,700) levels. Finally, college graduates contribute $44,300 to the state fiscal account and $198,800 to the federal account.

The critical values are the differences by education level. These are given in the middle panel of Table 9. If a high school student in the Colorado public school system graduated from high school instead of dropping out, the net effect would be a gain to the Colorado government of $53,500 and a gain to the federal government of $85,100. If, instead of dropping out a student graduated from high school and then completed college, the gains would be $102,100 and $222,400 respectively.

Table 9
Total Fiscal Expenditures
Lifetime Present Values by Education Level

	High school dropouts	High school graduate (incl. GED)	Associate degree or some college	BA degree or above
Balance of taxes paid minus government expenditures:				
Federal government	($23,509)	$61,568	$105,744	$198,847
State government	($57,742)	($4,267)	$21,342	$44,346
Difference over HS dropout:				
Federal government	-	$85,077	$129,253	$222,356
State/local government	-	$53,475	$79,084	$102,088
Burden of inadequate education per student			**$140,083**	

Sources: Tables 3-8 above and Appendix Table 9. *Notes:* 2011 dollars. Discount rate of 3.5%. *Notes:* Burden of inadequate education includes all state fiscal expenditures (except welfare) and 81% of federal expenditures. The burden also adjusts for college progression and completion rates for the lowest tercile of socioeconomic status.

From the Colorado resident's perspective, at least $122,400 is lost every time a student fails to graduate from high school.[40] This is a conservative estimate of the burden of inadequate education to the state of Colorado. The true amount is greater because high school graduates can go on to college and so accrue even larger benefits. To be conservative, we assume that each 'dropout who becomes a graduate' progresses on to college at the same rate as students in the bottom third of socio-economic status. This creates a 'progression-adjusted' high school graduate, for whom the state-level benefits are $140,100 (Table 9, bottom panel).[41] This amount is our best estimate of the burden of inadequate education in Colorado.

As given in Table 1, there are 11,500 high school dropouts in the current cohort of students in Colorado. Thus, the total burden of inadequate education for each annual cohort of Colorado public school students is $1.61 billion. This is annual lump-sum amount because there is a new cohort of students each year. To put this amount into context, we note that the Colorado state operating budget is approximately $19 billion. So the burden is equivalent to approximately 8% of the total budget.[42]

4.2 Social Burdens

The full burden of inadequate education is significantly greater than the burden on the taxpayer: this full burden includes all the broader, social implications of low attainment referred to above. Our estimates of this full burden are shown in Table 10.

The biggest loss to society occurs because of the relationship between education and increases in the productivity of the labor force as a whole. Not only do individual workers lose out, but there are also significant losses in terms of labor force spillovers. These amounts are given in row 1 of Table 10 (item [P]). The full productivity gain associated with high school graduation over dropping out is $324,800 (=$954,000-$629,200). On top of this are the burdens to government agencies for spending on health, crime, and education (item [G]) and the burden imposed on victims of crime (item [V]).[43]

Table 10
Total Social Impacts
Lifetime Present Values by Education Level

	High school dropouts	High school graduate (incl. GED)	Associate degree or some college	BA degree or above
Productivity including labor force spillovers [P]	$629,171	$953,936	$1,081,396	$1,777,809
Government expenditures on health, crime, education [G]	$136,531	$78,412	$50,726	$60,061
Social costs of crime [V]	$146,335	$94,923	$43,513	$17,150
Net social resource effect [=P-G-V]	$346,306	$780,601	$987,157	$1,700,598
Difference over high school dropout		$434,296	$640,852	$1,354,292
Difference over dropout (incl. value of better health)		$554,296	$760,852	$1,474,292
Burden of inadequate education per student			**$524,420**	

Sources: Tables 3-8 above; value of better health from Schoeni et al. (2011). *Notes:* 2011 dollars. Discount rate of 3.5%. Burden of inadequate education does not include the social value of better health. The burden also adjusts for college progression and completion rates for the lowest tercile of socioeconomic status.

The net social resource use by education level is given in row 4 of Table 10. Each high school dropout generates $346,300 in lifetime productivity net of expenditures and social costs of crime. However, a high school graduate generates $780,600 in lifetime productivity and persons who graduate

from college generate $1.70 million. Again, the critical value is the difference across education levels. The social burden that is generated as each student fails to graduate from high school is very large, at $434,300. If we include the social value of better health, the social burden per dropout easily exceeds half a million dollars in present value terms. The disparity is extremely large when we compare dropouts to persons who complete college; the social burden is over $1.35 million.

Finally, we can derive our best estimate of the overall social burden of inadequate education per student. This estimate adjusts for the probability that each high school graduate has an option to progress on to college. Adjusting for this probability, the social burden per student is estimated at $524,400 (final row, Table 10). Across the 11,500 public school students in Colorado who are predicted to drop out of high school, the aggregate social burden is $6.03 billion.

4.3 Sensitivity Analysis

Our calculations of the economic burdens of inadequate education rely on many different research studies and modeling assumptions. Although these studies are the best available, it is important to consider how sensitive our calculations are to alternative assumptions.[44]

We believe that the full economic burden is significantly above our estimates. This is so for a number of reasons:

- We have used conservative assumptions where possible. Critically, we are implicitly assuming that the valuation of non-work time is zero and almost certainly we are undervaluing the full income gains from education and under-adjusting for employment probabilities.
- In some models we have used a discount rate above that recommended by Moore et al. (2004); this reduces the present value of any benefits of education.
- We have omitted the economic distortion caused by having to raise taxes to pay for government programs.[45] This distortion may be as much as 28% of the total government spending.[46]
- We have omitted some important effects, such as teenage pregnancies and single motherhood and the social repercussions of mass incarceration.[47]
- We assume that the benefits of education that exist today will be perpetuated for current cohorts of graduates. Potentially, this could mean we have over-stated or understated the burden depending on whether the gains from education decrease or increase. Most evidence suggests that the gains will actually increase, however.[48]

Two arguments may be made on the contrary side. But neither has much merit. The first is that increasing the number of high school graduates will just mean that they have to take jobs that dropouts used to take. Most studies of the labor market find that there is 'skill-biased technological change', such that firms change how they use workers as those workers accumulate more skills. The bias is such that, as there are more educated workers, firms use a more technologically complex production. The second is that high school students may be educated in Colorado but then leave for other states to find work. This is very unlikely: in fact, Colorado 'imports' young, single persons with college degrees and does so at a rate that is the second highest in the nation. Thus, the state is not generating enough of its own skilled workers to meet demand.[49]

Overall, taking account of upward and downward biases, it seems likely that the actual sizes of the fiscal and social burdens of inadequate education are larger than our estimates.

5. Challenges Faced by Low-Income Children

Given the significant benefits of education, it is important to consider why all students are not able to take advantage of them. There are many reasons why low-income children might fail to succeed in school such that they are unable to reap the significant economic gains. These reasons are grouped into three factors: such students lack financial, family, and social capital. The literature on these factors is reviewed by Parcel et al. (2010). Clearly, such students lack financial capital but perhaps the most important element is that low-income children experience family circumstances that are far below those of middle-class children.[50]

There is considerable literature on differences in home environments across socio-economic status, as well as on how these differences translate into gaps in attainment and achievement. Many of these differences are reviewed in Levin and Belfield (2002). The most obvious home environment difference is in parental resource: many low-income children are in families with only one parent (more than one-third of Hispanic households with children and more than two-thirds of African American households, KewalRamani et al., 2007). Lower parental resource has a direct effect in reducing family income. But it is also associated with behaviors and practices that undermine educational development. These include: fewer or weaker parent-child interactions related to language and literacy; more conflict in the home; and less of a 'school-like' home (e.g. with a desk and learning materials and with a regular daily routine). Children in low-income families also receive poorer nutrition, have less access to pre-natal care (leading to low birth weight), and are less likely to have access to health insurance; as such,

they typically exhibit worse health status (on dental deficiencies and other measures of health status, see Wilder et al., 2008). This poor health status in turn affects their ability to learn in school.

Low-income families also experience out-of-school time which is less educative. This has both a quantity and quality dimension. In terms of quantity, low-income families have less access to pre-school, summer schools (camps), and after-school activities than more affluent families. In terms of quality, low-income children read less, visit fewer educational amenities (such as museums), and spend more time watching television.

A third pathway by which family circumstances mediate educational outcomes is through parent–school interactions. Low-income parents are less likely to be involved in their children's school, less likely to have chosen the school specifically, and less likely to monitor their children's performance in school (e.g. through checking home-work).

In terms of social capital, there are also significant differences in the educational resources available in the community for low-income children. Here there are two critical factors: the school resources; and the social capital within the community. Low-income students attend schools that have fewer resources for learning; this is manifest in, for example, the quality of teaching, the age of the facilities, and the availability of supports (libraries, health counseling, and mentoring as well as the availability of advanced courses in school). As noted above, funding formulae that are intended to compensate for educational deficiencies rarely close this gap in school quality. As a consequence, public funding does not offset the lack of family capital of low-income children. The second factor is the community itself: low-income children reside in neighborhoods with higher crime rates and attend more dangerous schools, as well as fewer cultural resources (such as libraries). Low-income children often move more often such that they must change school and so lose continuity in instruction.

In sum, the lack of financial, family, and social capital is a significant barrier to learning for low-income students. Critically, the home environment is the most important component of family capital: it is cumulative across the childhood years and is likely to be compounded by the other deficiencies (e.g. lack of access to pre-school). Moreover, unlike parental involvement programs, which have been shown to be effective (Senechal, 2006), it is very difficult to intervene in the home environment so as to raise family capital. Indeed, this is evident in the literature on the link between income and child development: increased family income does help children learn, but after a certain income level the effect is attenuated; and temporary changes in income do little to help children – permanent increases in family income are needed to significantly boost learning. Critically, however, there is evidence that

family capital has declined substantially over recent decades (Heckman, 2008) and this may explain why many students are unable to take advantage of the benefits of education.

Overall, there are many different risk factors facing children. Therefore, it is unlikely that a single metric – or a narrow metric such as free lunch status – will adequately encompass all these challenges. Children face multiple, sometimes compound, challenges. They often move into and out of poverty and may vary in their resilience to economic or personal disadvantages. Low income is not necessarily the single best indicator, in part because the effect of income on child development is not linear and depends on the duration of poverty.

6. Education Reforms in Colorado

Clearly, Colorado taxpayers face a very large economic burden as a result of inadequate education. Thus, if effective educational reforms can be found to raise the rate of high school graduation, these reforms should be given serious consideration. We note here that this is prompted by the efficiency implications of educational investments. It is not contingent on any notions of equity or fairness.

Here we briefly review some of the education reforms that might raise the graduation rate and estimate their operating costs for the Colorado public school system. There are many educational options, ranging from pre-school to high school, and there are potentially many others, such as health-related services, that occur outside the school but nevertheless have consequences within it. Indeed, many reforms might be needed to address the multiple, compound challenges that are described above in Section 5. Ultimately, the scope for reform is given by the pay-off: the state should be willing to spend up to the present value of benefits. To put this in context, current present value spending over the K-12 years in Colorado is $131,000. This total amount is smaller than the lifetime earnings gain reported above.

We only consider education-related reforms that are directed toward raising the high school graduation rate. Also, we restrict our analysis to reforms that have either proven or promising evidence and that have been implemented.[51] First, we give a brief description of the reform, along with citations as to its efficacy.[52] Next, we report the costs in present values, adjusted for Colorado prices using the Taylor et al. (2007) cost of education price index.[53] We use the ingredients method to calculate costs (regardless of whether the state or federal government funds intervention). These costs are reported as the cost per student and the cost per new high school graduate.[54] These costs can then be compared to the benefits. For simplicity we compare the state benefits with the costs and calculate the benefit–cost ratio. Where this ratio exceeds 1, the benefits exceed the costs. Critically, the appropriate ratio will

depend on our ability to target interventions to those on the margin of dropping out. If these can be perfectly targeted, the appropriate cost comparison is the cost per student. If programs cannot be targeted at all (i.e., they are delivered to all students), the appropriate cost comparison is the cost per high school graduate. We report both ratios and anticipate that the actual ratio will lie somewhere between the two values.

6.1 Reforms with Proven Evidence on High School Graduation

6.1.1 Increasing Teacher Pay

Where teachers are more effective, it is likely that the high school graduation rate will be improved. Although raising teacher productivity may take many forms, one straightforward approach is to look at paying teachers more. Higher pay should have several effects: it will raise the quality of the applicant pool for teaching jobs; it will reduce the quit rate; and it will make teachers more motivated to avoid losing their jobs. There is considerable literature – to complement a basic principle of economic theory – that paying people more will yield these effects. (For example, studies on attrition and pay include Baugh and Stone (1982); Podgursky et al. (2004); Imazeki (2005); Ondrick et al. (2008); and Krieg (2006). Plus, West and Chingos (2009) show that when teachers move across jobs, they are always moving to receive a higher salary). Indeed, the move toward performance-related pay is motivated by the notion that teachers will perform better if there is a reward for so doing. There may be a practical issue in ensuring that higher pay goes to the most effective teachers, but this does not contradict the general principle of economic theory and it is not relevant for the argument that higher pay will attract a better applicant pool. Indeed, Hanushek (2011, 470) recognizes that "higher levels of salaries would tend to increase the pool of potential teachers" and this would increase teacher quality (unless we assume that principals recruit based on attributes that are *negatively* associated with teacher quality).

The relationship between teacher pay and high school graduation rates has been tested using state-level panel data by Loeb and Page (2000). They report that a ten percent increase in teacher salaries across the K-12 years would increase the number of high school graduates by 5 percentage points.

In present values, paying teachers ten percent more through the K-12 years would cost Colorado $9,170 per student. Given its effectiveness at yielding high school graduates, the cost per new high school graduate is $183,330. Under perfecting targeting, the benefit–cost ratio is 15.28; with no targeting, the ratio is 0.76.

6.1.2 Reducing Class Size

There is strong research evidence that reducing class sizes, at least in the elementary grades, has powerful long-term benefits. Evidence from Tennessee's Student Teacher Achievement Ratio (STAR) Project shows that students randomly assigned to smaller classes were more likely to graduate from high school than students assigned to larger classes (Finn et al., 2005).[55] For students in smaller classes in elementary school the high school graduation rate was 11 percentage points higher than for students assigned to regular classes. For minority and low-income children the impacts were even greater, at 18 percentage points.

Our costs follow those of Project STAR in assuming a reduction in class size from 22 to 15, and that this policy is implemented for on average 2.3 years in elementary school. The present value 'unit cost', i.e. the cost per child affected by the change, is $14,330 and per graduate it is $130,260. The benefit–cost ratio ranges from 1.08 to as high as 9.78.

6.1.3 Publicly-funded Pre-School

The reform with the strongest impact on future human capital is probably the expansion of pre-school provision. In Colorado, only 20% of four-year olds is in publicly-funded preschool (and only 6% of three-year olds); and spending on the public program is less than half of state spending on Head Start.[56] A number of studies have identified not only improvements in high school graduation but also lower rates of special education and boosts in cognitive scores. Results from the Chicago Child-Parent Centers (CPC) show that this program increased the high school graduation rate by 11 percentage points (Temple and Reynolds, 2007). Results from the High Scope/Perry Pre-school program indicate a high school graduation rate that is 19 percentage points higher (Nores et al., 2005).

Our cost estimates follow those of both the CPC and High Scope programs. The unit cost of delivering these programs to each student in Colorado are estimated at $7,710 and $16,110 respectively. The cost per new graduate is $70,040 and $84,790 respectively. Thus, the benefit–cost ratios are 8.69-18.18 under perfect targeting and 1.65-2.00 under zero targeting.

6.1.4 Head Start

An alternative to state-wide investments in pre-school is to expand Head Start. Recent evidence has found academic gains from Head Start, as well as increased rates of high school graduation (see Barnett and Belfield, 2006). Higher quality Head Start may also be effective: doubling the amount of resources for Head Start has been estimated to raise attainment by one year of education (Ludwig and Miller, 2007). Although these effects are plausible, the relationship is not precise: the evidence suggests that expanding Head Start would yield a 4-12 percentage point improvement in the graduation rate.

Annual spending on Head Start in Colorado is currently $7,195 per participant.[57] In present values one year of Head Start would therefore cost $11,620 or $290,410 per new graduate (on the conservative assumption of only four new graduates). Even under these extreme assumptions the benefit–cost ratio is 0.48 or 12.06 if the program was perfectly targeted to students on the margin of dropping out.

6.1.5 Secondary School Interventions: First Things First

High school reforms typically emphasize small learning communities, such that students and teachers can work collaboratively over the high school years. One exemplar program is 'First Things First', with small learning communities of less than 350 students, long-term teacher student relationships, mentoring, and teacher advocacy for each student with a rigorous curriculum. In a research study using interrupted time–series data, FTF generated graduation rates that were 16 percentage points higher.

Levin et al. (2007) estimated the costs of this program at $5,400 per child across three years of high school. Adjusting these costs for Colorado prices, the present value unit cost of FTF is $6,130 per student or $38,280 per graduate. On these calculations, First Things First is a highly efficient program, with a benefit–cost ratio of at least 3.66 and up to 22.87.

6.2 Reforms with Potential to Increase the Rate of High School Graduation

The U.S. Department of Education's *What Works Clearinghouse* (WWC) catalogs secondary school programs that are intended to reduce the dropout rate. The catalog also includes a review of the evidence and adjudicates on its methodological quality. Currently, the WWC review of dropout prevention programs identifies two middle school reforms and four high school reforms that show "evidence of positive or potentially positive effects for at least one improvement outcome".[58] There are also related interventions that show promise in raising the graduation rate. We describe each of these briefly below.

6.2.1 Middle School Interventions

The Achievement for Latinos through Academic Success (ALAS) program assigns counselors to monitor attendance, behavior, and achievement. In an evaluation using an experimental research design ALAS was found to reduce the probability of dropping out in both 10th and 12th grade (Gandara et al., 1998). However, these differences – based on the small sample – were not statistically significant. Nevertheless, if they are genuine, the high school graduation rate would be 5 percentage points higher. Adjusting for Colorado prices, the present value unit cost of the ALAS program over three years is

approximately $3,210 per participant or $64,210 per graduate. The benefit–cost ratio is therefore at least 2.18 (up to 43.64).

Twelve Together is a program offering peer support and mentoring in middle school and high school along with weekly after-school discussion groups. A randomized controlled trial of 8th graders in California estimated that the dropout rate for participants was five percentage points lower than the control group (Dynarski et al., 1998).[59] In present values the unit cost if this program were applied in Colorado would be $4,060 per student or $81,100 per graduate. The benefit–cost ratio is at least 1.73, again absent any ability to target the program to those who would most benefit.

6.2.2 High School Interventions

Career Academies are school-within-school programs geared toward improving employment readiness through work experience. One randomized trial evaluation found significantly lower dropout rates for the sub-sample of at-risk students although no impact on students who were low or moderate risk (Kemple and Snipes, 2000). If Career Academies are targeted to at-risk youth, then the high school graduation rate would be expected to be 11 percentage points higher. Applying cost estimates from the What Works Clearinghouse, the present value unit cost of the program over three years is approximately $3,680. The benefit–cost ratio is 4.64 if the program is delivered as targeted to at-risk youth.

Check & Connect is a program to monitor and assess student performance and mentor at-risk students. In a small-scale experimental evaluation in Minneapolis, the dropout rate of participants was considerably lower than that of the control group (Sinclair et al., 2005). Potentially, the program would raise the high school graduation rate by 17 percentage points. The present value unit cost of the program over four years in Colorado would be approximately $5,140. Given its effectiveness, this program yields extremely high benefit–cost ratios of 4.64 (up to 27.27).

I Have A Dream is a program for inner-city low-income children from 6th to 12th grade. The program offers a mentor and facilitator for 6th graders and financial incentives for students who enroll in college. An evaluation by Kahne and Bailey (1999) reported graduation rates 34 percentage points higher for those in the program. However, the cost of the program would be approximately $18,890 per child enrolled or $188,900 for each student.[60] Given the expense of the program, I Have A Dream has a benefit–cost ratio of less than 1 unless it is more efficiently targeted.

Finally, Talent Development High Schools may also raise the graduation rate. [61] Based on evidence from the What Works Clearinghouse, these high schools are predicted to reduce the dropout rate by 1-2 percentage points. Although this program is relatively cheap, at $1,560 per student, it is

more costly when viewed in terms of the yield of new high school graduates at $156,290. Nevertheless, the benefit–cost ratio is close to 1 even under the most conservative assumptions.

6.2.3 Other Reforms

Talent Search is a program of academic support intended to raise the graduation rate and motivate low-income students to attend college. It serves about 380,000 students across over 400 sites. Constantine et al. (2006) found that high school completion rates were 9 percentage points higher for those who had participated in Talent Search. Adjusting for Colorado prices, the unit cost of the program to the federal government per participant is approximately $960. The contributions from state and local governments are unknown. With a yield of 9 new graduates per 100 students, the cost per graduate is very low, at $10,700. Consequently, the benefit–cost ratios easily exceed 1 for Talent Search.

Whole-school reforms may change the culture and organization of a school to enhance educational outcomes. One whole-school reform model that has been evaluated is Success for All: it focuses on promoting early school success among educationally at-risk students in grades K-5.[62] Borman and Hewes (2003) found that Success for All may be a good investment because it shows higher test scores at 8th grade, reduces special education placement, and reduces rates of grade retention. However, no high school graduation data are available, even as the test score gains are comparable to those found from Project STAR to reduce class size. Hence, it is likely that for this program the benefit–cost ratio will also exceed 1.

Also, summer schools may be effective, particularly for at-risk students who may fall behind during the summer months. Based on an experimental field trial in Baltimore, Borman and Dowling (2006) estimate that after two successive summer schools, students tested approximately 0.5 standard deviations ahead of a control group of students. This is a substantial impact and is likely to lead to higher graduation rates (as well as offer students a place to go when parents are at work). However, the precise relationship between summer school and graduation cannot easily be calculated.

Finally, the state does specify reading programs that should be implemented to help students. These interventions were selected by Title I and classroom teachers in Colorado and include: Lindamood Bell; Scholastic Read 180; Read Naturally; and, for high-need students, the Orton-Gillingham approach. We do not review the effectiveness of these programs – for which there is some research basis and which the state is obligated to use.

Instead we draw attention to the resource implications of such educational assistance. Put simply, such reading programs are likely to require significantly more resources and cannot be implemented out of existing budgets. This argument is made by Levin et al. (2007), who calculate the

full costs of three reading programs, one of which is Read 180. These costs not only include the direct services of the intervention provider, but they also require significant 'in-house' commitments by schools and districts. These commitments include: additional personnel; professional development; reorganization of facilities; computers and materials. In the case of Read 180, Levin et al. (2007) found that the cost per student varied across three sites from $285 to $1514, depending on how much in-house resource was committed. In fact, purchasing the license to utilize an intervention is often a relatively small proportion of the total amount of resource required to implement the intervention in the classroom. This consideration is heightened if the reading program relies heavily on computer-based pedagogies. Overall, it is critical to view these reading programs as investments and as such they require the necessary funding to be effective.

6.3 The Returns to Investments in Education for Colorado

On this reading of the literature, there are some educational investments that clearly demonstrate an impact on the rate of high school graduation; others are promising but their effects remain to be sufficiently corroborated; and others are plausibly motivated but have yet to be evaluated in practice.[63] The results are summarized in Table 11.

Table 11
Cost Estimates for Education Reform
Present Values at Age 18

Reform	(1) Cost per student (Colorado prices)	(2) Extra graduates per 100 students	(3) Cost per high school graduate	(4) Fiscal benefit/cost ratio (per student)	(5) Fiscal bnefit/cost ratio (per graduate)
10% increase in teacher salaries (K-12)	$9,166	5	$183,328	0.76	15.28
Class size reduction (K-3)	$14,328	11	$130,257	1.08	9.78
Chicago Child-Parent Center Program	$7,705	11	$70,044	2.00	18.18
High Scope Perry Pre-School Program	$16,111	19	$84,794	1.65	8.69
Expansion of Head Start	$11,616	4	$290,409	0.48	12.06
First Things First	$6,125	16	$38,281	3.66	22.87
ALAS	$3,210	5	$64,207	2.18	43.64
Twelve Together	$4,055	5	$81,103	1.73	34.54
Career Academies	$3,675	11	$33,409	4.19	38.12
Check & Connect	$5,137	17	$30,215	4.64	27.27
I HAVE A DREAM (G 6-12)	$18,890	10	$188,903	0.74	7.42

Talent Development High Schools	$1,563	1	$156,293	0.90	89.63
Talent Search	$963	9	$10,701	13.09	145.45

Sources: 2011 dollars to nearest $10. Discount rate of 3.5%. *Notes:* Cost per student assumes funding for the education program is entirely state sourced. Cost per high school graduate is column (1)*100 divided by column (2). For column (4) benefit/cost ratio calculated as the ratio of the state benefits per high school graduate (Table 9) divided by the costs per student in column (1). For column (5) benefit/cost ratio calculated as the ratio of the state benefits per high school graduate (Table 9) divided by the costs per high school graduate in column (3).

Generally, these interventions have benefit–cost ratios that exceed 1, i.e. the benefits exceed the costs. Indeed, where the interventions can be accurately targeted to students on the margin of dropping out, the ratios are extremely high. The gains from public investments in education interventions are likely to significantly exceed the costs.

Additional factors reinforce this conclusion. First, our assumptions have been deliberately conservative both in terms of expected impacts and in that the programs are funded entirely through state funds. Second, these reforms are being evaluated solely in terms of the new high school graduates they yield. Incremental benefits to those students who would have graduated anyway are not counted in this framework. Yet, it is plausible that these students will benefit too, perhaps by attending college instead of terminating their education after high school. Third, these interventions are also likely to generate benefits before the end of high school, e.g. in terms of reduced juvenile crime or special education placement. There is strong evidence that pre-school programs generate these effects, for example. Again, none of these benefits before graduation are counted in the above calculations. Hence, these benefit–cost ratios are likely to understate the fiscal and social savings from educational investments.

6.4 Resource Requirements to Meet Colorado Standards

An alternative way to apply our results on the burden of inadequate education is to compare it with what is being spent on education. Currently, the state spends approximately $130,000 on each student's K-12 education. This is less than the fiscal burden associated with each dropout and so is strongly suggestive that more investment might be made in effective educational programs.

More specifically, a new report has investigated what it might cost Colorado to ensure that it meets the state's standards and requirements (Augenblick et al., 2011). This costing-out study uses two methods – the successful schools method and the professional judgment panel method – to estimate the costs. The two methods yield somewhat different estimates of what needs to be spent to satisfy the state requirements. But if we take the highest of these estimates from the professional judgment panel

method, the costing-out study predicts that an additional $74,000 would need to be spent per student over the K-12 years. This amount is approximately half of the fiscal burden of inadequate education across the state and less than one-seventh of the social burden. Noting that we are comparing the most expensive cost to a conservative estimate of benefits, the Augenblick et al. (2011) model would need to generate relatively small changes in attainment to be justifiable.

7. Conclusions

Despite relatively high income levels, Colorado's high school graduation rate is around the national average. In addition, demographic shifts are such that the needs of students are increasing and the revenue base for public education is being constricted. This creates significant pressures on resources and a heightened focus on how much public investment in education is in the state's best interests.

Our analysis indicates that the economic value of extra educational attainment is strongly positive. Alternatively put, the burden of inadequate education is extremely large such that the state faces a clear choice between investments in education now or heavier debt in the future. The relationship between education and personal economic independence, as well as an array of other private advantages and social gains, is very strong and has been documented in hundreds of research studies. Indeed, the power of education is especially strong at lower levels of education, where individuals are at greater risk of low health status, of involvement in the criminal justice system, or reliance on welfare. The income effects of education are very powerful at higher levels of education too, with the pay-off to completing college being in excess of a half million dollars over the lifetime. As a final consideration, many of these relationships are becoming stronger over time as a result of dual pressure: behavior is more strongly driven by one's education; and the costs of being inadequate education are rising faster (e.g. health care costs are rising faster than inflation).

Certainly, the primary recipient of the benefits of education is the individual student. But the appropriate criterion for the government's decision about public investments is whether the fiscal and social consequences are justifiable. Our calculations indicate that the state of Colorado gains a substantial amount also. The state's fiscal balance is stronger, as persons with more education pay more in taxes and draw less upon government services. The state's economy is stronger, as more productive workers generate positive spillovers in the labor market. Finally, our estimates of these fiscal and social or economic gains easily exceed the costs of potential education reforms that might either raise the high school graduation rate or improve the college completion rate. By failing to make

sufficient investments in these and other effective educational interventions, therefore, Colorado is trading off short run budget savings for potentially much larger long run economic burdens.

End Notes

[1] We have reviewed a set of documents in relation to Antony Lobato et al. v. the State of Colorado et al. 2005 CV 4794. See Annex of Documentation Provided.
[2] Present valuation means that we adjust for the fact that money received later is worth less than money received earlier. In effect, we are capitalizing entire lifetimes into a single value at age 18. Different discount rates are applied as part of the sensitivity testing. The justification for a 3.5% discount rate is given in Moore et al. (2004).
[3] We use the Colorado Department of Labor price index at http://www.colorado.gov/cs/Satellite/CDLE-Main/CDLE/1248095317085 and http://www.bls.gov/cpi/#data.
[4] We exclude remediation for two reasons. The evidence on whether remediation pays or not is mixed (Bailey et al., 2010). Also, interventions that might address remediation challenges are likely to be different from those that address high school dropout.
[5] The rate varies with measure and dataset used. Chapman et al. (2010, Table A-1) show how event and status dropout rate measures vary, for example. Typically, state-level administrative data yield the lowest estimates and transcript data yield somewhat higher estimates (Mishel and Roy, 2006). Large surveys such as the Current Population Survey consistently find that at least 20% of the adult population does not have a high school diploma and some studies suggest that the CPS undercounts disadvantaged populations. Heckman and LaFontaine (2010) document how the graduation rate, which they estimate peaked in the 1970s, has been overstated. For a thorough discussion, see NRC/NAE (2011).
[6] NCES data puts the Colorado dropout rate in excess of 25%, but some dropouts will become graduates at a later data. Swanson (2004, Table 1) estimates that the state graduation rate is 69%, or 31st highest in nation.
[7] Some of these dropouts may obtain a high school diploma at a later date. However, many of these diplomas are GEDs, which do not have the same labor market equivalence as formal graduation from high school graduation.
[8] Retrieved April 14 2011, www.cde.state.co.us/cdefinance/FY08-09RevExp.htm.
[9] Data on Colorado state budget from http://www.colorado.gov/cs/Satellite/OSPB/GOVR/1244121587930, retrieved April 9 2011.
[10] See Curran Nield and Balfanz (2006) for a description of these needs.
[11] http://lmigateway.coworkforce.com/lmigateway/ retrieved April 5, 2011.
[12] This modeling framework has been applied using national data (see Belfield and Levin, 2007) and for states (e.g. California, Belfield and Levin (2008) and Brady et al. (2005); for Connecticut, see Sum et al. (2009ab). The framework builds on methodological and empirical work developed by Levin (1972) and by Haveman and Wolfe (1984) and is reviewed by Baum and Payea (2006).
[13] In their analysis for each state, Goetz and Rupasingha (2003) list Colorado as being in the top half of states in terms of the rate of return to education.
[14] We use eight age bands starting at 18 up to age 64. For each age band, average gross earnings are derived and these are then used to create a smoothed, annualized lifetime earnings profile for each education level.
[15] The 'other' group is assumed to have the same earnings profile as whites. This is likely to yield a conservative estimate of the true benefits of education.
[16] Comfortingly, the two methods yield reasonably similar estimates even though they are calculated in very different ways and are based on different definitions of productivity.
[17] Recent studies include Goetz and Rupasingha (2003), Abel et al. (2010); and Iranzo and Peri (2009). But these studies find the productivity spillover effect is sensitivity to how it is measured.
[18] Tax Foundation data from Census Bureau 2005 data on Consolidated Federal Funds (data retrieved March 28, 2011, from www.taxfoundation.org/files/fedspend_per_taxesbystate-20071009.pdf.
[19] Based on data from taxadmin.org, tax revenues for the state government of Colorado are: 51% from income taxes; 25% from sales tax; 14% from selective excise taxes; 4% from corporate tax; and 8% from other taxes. Therefore, state sales, excise and corporate tax revenues are approximately equal to the value of state income tax revenues. Data retrieved March 25, 2011, from www.taxadmin.org/fta/rate/09taxdis.html. Colorado has no property tax.

[20] TAXSIM calculations are not perfect. They are subject to some error with respect to expense exemptions, mortgage interest tax relief, and any employer component of tax contributions. To be conservative we assume that individuals are filing taxes singly rather than as part of a household.
[21] This addition is based on the proportions of revenues that each tax generates (see note above). This implies that persons contribute to sales and excise taxes to the same extent as they pay state income tax. Conservatively, we assume in-state residents pay only 75% of state sales taxes.
[22] This includes personal health care, hospital care, physician and clinical services, other professional services, dental services, home health care, drugs, nursing care, and other personal care. Data from www.cms.gov/NationaHealthExpendData/downloads/res-mcaid.pdf, retrieved April 1 2011. Medicaid payments per enrollee are from www.statehealthfacts.org/profileind.jsp?ind=183&cat=4&rgn=7; and federal/state spending shares for Medicaid are from www.statehealthfacts.org/profileind.jsp?ind=636&cat=4&rgn=7.
[23] The federal spending share of total Medicaid expenditures in Colorado is 59.3% (from www.statehealthfacts.org/profileind.jsp?ind=636&cat=4&rgn==7, retrieved April 3 2011).
[24] A QALY is a scale to measure health status. Perfect health is given a score of 1 and specific conditions translating into QALY values of less than one.
[25] We assume that QALYs should not be discounted because transferring them over time is not meaningful.
[26] Probation and parole data are from the U.S. Department of Justice, Bureau of Justice Statistics, Probation and Parole in the United States, 2003, Bulletin NCJ 205336 (Washington, DC: U.S. Department of Justice, July 2004, p.7. The local jail population is from the Sourcebook of Criminal Justice Statistics Online, retrieved April 4, 2011 from www.albany.edu/sourcebook/pdf/t600032005.pdf.
[27] Federal expenditures on crime and incarceration are from the Bureau of Justice Expenditure and Employment Extracts, 2006 (December 2008, NCJ224394).
[28] Also, there are tax losses from crime. Victims of crime are often unable to work for some periods; and the criminals themselves are not participating in the formal labor market (Holzer et al. 2004).
[29] To be consistent with the other calculations, these figures are pooled by gender. However, this masks the very large differences between the economic burden imposed by male and female criminal activity.
[30] In fact, because of data limitations, we do not include any expenditure beyond age 32. Longitudinal information on the lifetime burden is not available so it is not possible to know what the costs are after this age. Again, we believe that this leads to a conservative estimate of the crime burden. However, the peak ages for offending are 18-22 such that the omission of costs after age 32 is unlikely to bias our estimates significantly. However, we do include juvenile crime committed in high school. Strictly, this juvenile crime is committed before an individual drops out of high school. But there is a substantial literature on the joint decision to drop out and commit crime such that the two phenomena are strongly linked (for a discussion and review of the literature, see Belfield and Levin, 2009).
[31] See DeLisi et al. (2010); Cohen and Piquero (2009); and Belfield and Levin (2008, 2009).
[32] These probabilities are strictly those for chronic offenders and so the probabilities of being a general offender are derived from the remaining number of arrests (assuming offense multiples as per Farrington and Welsh, 2007). We assume that the group with postsecondary education is split evenly between persons with some college and college graduates.
[33] For example, the costs to victims reported in the National Crime Victimization Survey are only summed over the first six months after the crime was committed. Thus, they do not count any chronic costs. As well, none of the crime cost estimates include the psychic costs to criminals and their families from incarceration.
[34] Data from the American Community Survey, www.census.gov/prod/www/abs/pop-acs.htm, general public assistance data from Table ACSBR/09-13 and food stamp data from Table ACSBR/09-8, retrieved April 4, 2011.
[35] U.S. Department of Health and Human Services, Administration for Children and Families, Retrieved April 3, 2011 from www.acf.hhs.gov/programs/ofas/data/2009/table_b1_2009.htm. Enrollment data are from 2007. Financial data are from 2009. These amounts do not include spending on CCDF. These amounts are almost certainly conservative because they are based on all recipients, even as many recipients are dependents.
[36] We use food stamps rather than Supplemental Security Income because many persons are eligible for the latter program because of a disability.

[37] This is likely to be a conservative estimate because, although many welfare programs are time-limited, individuals participate in different programs or re-enroll under different eligibility criteria.
[38] As well, many students who attend college are not adequately prepared must take remedial courses to cover material covered before in high school. Potentially, if the high school graduation rate is improved there will also be cost implications for remediation budgets in higher education. Our calculations indicate that this effect is trivial over a given cohort and so it is not included in this analysis.
[39] State expenditures on K-12 education from www.cde.state.co.us/cdefinance/FY08-09RevExp.htm and www.cosfp.org/HomeFiles/OnePagers/CO_Natl_Per_Pupil_Funding.pdf State expenditures on college from www.sheeo.org/finance/shef/shef_data10.htm and highered.colorado.gov/Data/AtAGlance.html. For the proportion of K-12 education that is funded at the federal level, see http://www.cosfp.org/StateProfileData/2010/StateProfileDataTableA_2010.pdf, retrieved April 8, 2011.
[40] This is the full state burden plus 81% of the federal burden. As discussed above, it is reasonable for Colorado residents to value the federal burdens. Colorado residents pay federal taxes and so they would benefit from a reduced burden of inadequate education. However, Colorado taxpayers only receive 81 cents back for every dollar in federal contributions.
[41] These rates are based on attendance rates derived from NELS1988 and completion rates derived from the BPS1996-2000 as reported at www.cbcse.org/media/download_gallery/AGGREGATE_REPORT_v7.pdf, Tables 1.4 and 1.5, retrieved April 6, 2011.
[42] We do not claim that this burden can be completely eliminated or even necessarily substantially reduced. As we document below, however, there are reforms that can reduce the dropout rate significantly.
[43] The tax payment burdens are included in the measures of gross earnings used to calculate the productivity gains. The welfare payments are considered as transfers between taxpayers and recipients and so are not part of the social burden (but the administrative burden associated with making the transfer should be counted).
[44] For each domain (earnings, taxes, crime, health and welfare) we have used a range of estimates. Thus, some sensitivity testing is implicitly incorporated in our framework.
[45] This distortion is called the marginal excess tax burden (METB): a higher tax rate reduces workers' labor effort and raises the prices of goods.
[46] Allgood and Snow (1998) estimate 13-28 cents as the marginal welfare cost per dollar of a lump-sum grant. However, METB values are context specific – depending on the level of government at which taxes are collected and the price elasticity of demand of the taxed good.
[47] Approximately two-thirds of all births of dropout mothers are out of wedlock.
[48] The earnings gains from education have increased over recent decades (not least because of the decline in routine, non-cognitive jobs that are typically open to dropouts). Future demographic and labor market changes are such that the gains are likely to grow even further (Kirsch et al., 2007). Finally, the costs of health care and of incarceration have been growing at rates much faster than general inflation (Glied, 2003).
[49] Census data from www.census.gov/prod/2003pubs/censr-12.pdf, retrieved April 9 2011.
[50] Often, these experiences are described in terms of racial inequalities. A full list of childhood differences that are expressed as racial gaps is given at http://devweb.tc.columbia.edu/manager/symposium/Files/83_Rothstein.pdf.
[51] Therefore we do not consider general reform proposals, such as improving teacher quality or stronger accountability mechanisms. It is likely that raising teacher quality will raise the graduation rate, but there are many potential ways in which teacher quality might be improved. Similarly, tighter accountability may be effective but it too can be introduced in many different ways (Dee and Jacob, 2006).
[52] A full description of these reforms – and the method used to calculate costs – is given in Belfield and Levin (2007).
[53] This cost of education index shows that the cost of education in Colorado is between 72% and 98% of the national average. However, costs vary significantly by county and by population density, with costs being significantly higher in urban areas. To be conservative, we assume the reforms are implemented in the highest cost districts.
[54] Both cost figures are useful. The cost per student indicates how it would cost to yield an additional high school graduate if the intervention could be perfectly targeted to the student who is on the margin of dropping out. Perfect targeting is not possible of course, but more accurate targeting is a critical factor in improving the

efficiency of educational investments. The cost per new high school graduate assumes no targeting is undertaken: the reform is delivered to every student regardless of whether he or she will drop out or not. This cost is therefore a big overstatement of the likely cost of raising the graduation rate. Alternatively put, this cost assumes that the only benefits of the intervention are for students who become new graduates; there are assumed to be no incremental benefits for students who were going to graduate regardless.

[55] State-wide class size reduction policies (such as California's) have been less effective for two reasons. The reduction in class size is typically smaller and the amount of funding allocated to effect the reduction has been too low.

[56] Data on Colorado retrieved from http://nieer.org/yearbook/states/, retrieved April 10 2011.

[57] Head Start funding in Colorado from http://www.acf.hhs.gov/programs/ohs/about/fy2010.html, retrieved April 6, 2011.

[58] There are many other interventions that are being implemented, but for which evidence is not yet available (see http://ies.ed.gov/ncee/wwc/reports/Topicarea.aspx?tid=06). We do not consider programs that have been discontinued.

[59] See http://ies.ed.gov/ncee/wwc/pdf/WWC_Twelve_Together_031207.pdf.

[60] Moreover, this cost is likely to be an understatement because it does not include in-kind resources in terms of time commitment of the sponsors and mentors.

[61] http://www.mdrc.org/publications/388/overview.html

[62] http://www.successforall.net/.

[63] Of course, multiple interventions may be offered as part of a wider organizational reform. As Carneiro and Heckman (2002, 159) note, "Marginal improvements in school quality are likely to be ineffective in raising lifetime earnings and more fundamental changes are required if we hope to see a significant improvement in our educational system". Such fundamental change might include several of the above interventions although the costs of implementing multiple interventions simultaneously have not been calculated.

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Appendix Tables

Appendix Table 1
State Expenditures in Colorado Affected by Education Levels

Government Department	Expenditure in $ millions (2009 dollars)
Department of Corrections	$761.2
Department of Education	$4,686.9
Health Care Policy and Financing	$4,015.8
Higher Education	$2,791.6
Human Services	$2,180.2
Judicial	$450.7
Labor and Employment	$158.8
Law	$49.4
Public Safety	$249.9
Total	**$15,344.5**

Source: Colorado Governor's Office of State Planning and Budgeting, Attachment 1, November 2009.

Appendix Table 2
Gross Earnings
Lifetime Present Values by Education Level

	High School Dropout	High School Graduate	Some College	BA or above
Gross earnings (includes employer contributions):				
Model [a]	$415,276	$707,821	$771,366	$1,329,866
Model [b]	$457,308	$810,901	$949,136	$1,811,009
Model [c]	$472,958	$798,617	$893,984	$1,586,856

Source: Current Population Survey, March Supplements 2006-2010 combined. Colorado resident subsample only. Includes all persons, employed or not.
Notes: No adjustments are made for labor market participation, GED receipt, or incarceration rates. Labor market activity begins at age 18 (conditional on not being in college) and lasts until age 65. Model [a]: health and pension benefits incidence as per Colorado subsample of CPS (see Table above); discount rate 3.5%; productivity growth 1.5%. Model [b]: health and pension benefits incidence/valuation as per model [a]; discount rate 5%; productivity growth 2%. Model [c]: no adjustment for health and pension benefits incidence and valuation; discount rate 7.5%; productivity growth 1%.

Appendix Table 3
Incomes by Race and Gender
Lifetime Present Values by Education Level

	High School Dropout	High School Graduate	Some College	BA or above
Hispanic female:				
Model [a]	$443,235	$622,345	$766,359	$1,054,937
Model [b]	$341,088	$478,914	$591,088	$794,074
Model [c]	$335,555	$478,361	$585,609	$794,053
Hispanic male:				
Model [a]	$730,140	$903,799	$1,054,502	$1,652,248
Model [b]	$563,878	$665,727	$793,438	$1,235,898
Model [c]	$545,479	$679,502	$767,750	$1,190,488
White female:				
Model [a]	$404,875	$682,066	$815,248	$1,122,460
Model [b]	$307,588	$523,484	$615,237	$868,645
Model [c]	$142,626	$247,224	$284,344	$395,609
White male:				
Model [a]	$782,652	$1,031,546	$1,267,388	$1,904,685
Model [b]	$579,613	$782,220	$968,905	$1,461,390
Model [c]	$274,163	$366,563	$431,304	$616,980
Black female:				
Model [a]	$394,756	$652,714	$803,370	$1,153,090
Model [b]	$315,955	$507,431	$598,934	$868,049
Model [c]	$149,869	$237,817	$281,431	$398,359
Black male:				
Model [a]	$576,867	$888,530	$1,040,876	$1,331,138
Model [b]	$421,953	$695,873	$780,798	$1,007,230
Model [c]	$200,879	$308,147	$338,948	$446,940

Source: Current Population Survey, March Supplements 2006-2010 combined. Includes all persons, employed or not.
Notes: No adjustments are made for labor market participation, GED receipt, or incarceration rates. Labor market activity begins at age 18 (conditional on not being in college) and follows Skoog and Ciecka (2010) life tables. Model [a]: health and pension benefits incidence as per Colorado subsample of CPS (see Table above); discount rate 3.5%; productivity growth 1.5%. Model [b]: health and pension benefits incidence/valuation as per model [a]; discount rate 5%; productivity growth 2%. Model [c]: no adjustment for health and pension benefits incidence and valuation; discount rate 7.5%; productivity growth 1%. Estimates adjusted for race and sex composition of current cohorts of students in Colorado (see Table 1).

Appendix Table 4
Federal and State Tax Payments After Credits
Lifetime Present Values by Education Level

	High School Dropout	High School Graduate	Some College	BA or above
Federal Tax Payments:				
Model [a]	$25,327	$70,842	$105,812	$225,043
Model [b]	$29,201	$81,642	$123,572	$261,694
Model [c]	$9,080	$25,005	$32,841	$71,014
State Tax Payments:				
Model [a]	$9,859	$22,016	$30,105	$54,015
Model [b]	$11,256	$25,220	$34,910	$62,617
Model [c]	$3,810	$8,132	$9,867	$17,471

Source: Current Population Survey, March Supplements 2006-2010 combined. Colorado resident subsample only. Includes all persons, employed or not.

Appendix Table 5
Federal Tax Payments by Race and Gender
Lifetime Present Values by Education Level

	High School Dropout	High School Graduate	Some College	BA or above
Hispanic female:				
Model [a]	$106,235	$156,288	$189,567	$254,092
Model [b]	$87,909	$127,885	$155,469	$203,776
Model [c]	$43,364	$67,258	$78,345	$105,199
Hispanic male:				
Model [a]	$174,941	$212,670	$248,576	$395,008
Model [b]	$143,333	$178,480	$209,619	$314,887
Model [c]	$76,278	$91,574	$103,119	$146,310
White female:				
Model [a]	$99,745	$166,411	$194,837	$281,014
Model [b]	$80,036	$133,167	$159,975	$225,495
Model [c]	$39,720	$68,326	$82,971	$112,624
White male:				
Model [a]	$183,197	$247,101	$302,043	$468,767
Model [b]	$151,703	$202,802	$250,531	$365,372
Model [c]	$75,419	$104,891	$127,340	$178,094
Black female:				
Model [a]	$99,400	$158,289	$192,012	$283,400
Model [b]	$79,153	$130,494	$157,627	$224,407
Model [c]	$41,345	$69,355	$79,779	$109,754
Black male:				
Model [a]	$140,328	$215,478	$253,866	$327,762
Model [b]	$113,323	$177,515	$200,085	$261,719
Model [c]	$58,303	$89,415	$97,054	$129,981

Source: Current Population Survey, March Supplements 2006-2010 combined.
Notes: Tax payments calculated using TAXSIM9, based on incomes given in Appendix Table 3.

Appendix Table 6
State Tax Payments by Race and Gender
Lifetime Present Values by Education Level

	High School Dropout	High School Graduate	Some College	BA or above
Hispanic female:				
Model [a]	$54,822	$76,723	$93,881	$127,423
Model [b]	$43,866	$64,663	$78,676	$103,144
Model [c]	$21,949	$33,719	$40,688	$53,207
Hispanic male:				
Model [a]	$88,637	$109,752	$129,860	$196,928
Model [b]	$73,373	$87,479	$105,499	$155,943
Model [c]	$38,538	$44,917	$53,156	$75,608
White female:				
Model [a]	$50,330	$81,510	$99,282	$140,546
Model [b]	$41,145	$67,341	$80,909	$114,672
Model [c]	$20,027	$35,763	$41,706	$57,265
White male:				
Model [a]	$92,232	$127,476	$157,190	$237,040
Model [b]	$77,532	$101,546	$127,109	$182,841
Model [c]	$37,698	$52,850	$63,650	$87,193
Black female:				
Model [a]	$48,662	$80,357	$98,665	$142,697
Model [b]	$40,229	$65,362	$77,373	$112,605
Model [c]	$21,452	$33,954	$40,154	$56,234
Black male:				
Model [a]	$68,090	$112,513	$124,412	$160,988
Model [b]	$55,916	$87,632	$99,619	$131,930
Model [c]	$29,439	$44,847	$48,874	$65,635

Source: Current Population Survey, March Supplements 2006-2010 combined.
Notes: Tax payments calculated using TAXSIM9, based on incomes given in Appendix Table 3.

Appendix Table 7
Relationship between Health and Education in Colorado

	High School Dropout	High School Graduate	At Least Some College
Pap tests - Ever received (aged 18+)	94	97	99
Colorectal cancer screen in last 2 yrs (aged 50+)	22	30	35
Mammogram in last 2 years (Women aged 40+)	53	67	75
Diabetes (per 1,000 standard population)	93	68	48
Prenatal care beginning in first trimester	65	77	89
Low birth weight infants (<2,500 grams)	9.3	9.2	8.4
Healthy weight in adults (aged 20+)	26	33	44
Obesity in adults (aged 20+)	23	21	14
No leisure-time physical activity (aged 18+)	53	24	11
Cigarette smoking (aged 18+)	30	24	11

Sources: Data retrieved from DATA2010, the Healthy People 2010 Database, April 1 2011. Data from National Vital Statistics System - Mortality, CDC, NCHS; Behavioral Risk Factor Surveillance System, CDC, NCCDPHP; National Vital Statistics System Mortality and Natality, CDC, NCHS. Colorado data only.
Notes: Figures for most recent year (2002-2009), age-adjusted.

Appendix Table 8
Annual Arrests in Colorado by Crime Type and Age

	Total Arrests	Juvenile Arrests	Juvenile arrests as proportion of all arrests
Violent crime	**6,470**	**814**	**13%**
Murder and non-negligent manslaughter	166	17	10%
Forcible rape	421	67	16%
Robbery	1,088	206	19%
Aggravated assault	4,795	524	11%
Property crime	**25,826**	**7,687**	**30%**
Burglary	2,792	824	30%
Larceny-theft	21,589	6,396	30%
Motor vehicle theft	1,218	316	26%
Arson	227	151	67%
Other assaults	14,544	1,997	14%

Source: FBI Uniform Crime Report, 2009 data. Retrieved April 3 2011 from www2.fbi.gov/ucr/cius2009/data/table_69.html.

Appendix Table 9
Total Fiscal Expenditures
Lifetime Present Values by Education Level

	High school dropouts	High school graduate (incl. GED)	Associate degree or some college	BA degree or above
Federal government:				
Tax revenues	$65,724	$105,521	$130,814	$221,604
Health expenditures	$55,783	$26,179	$15,841	$4,746
Crime expenditures	$19,316	$12,530	$5,744	$2,264
Welfare expenditures	$15,183	$5,244	$2,887	$584
Education expenditures [a]	($1,049)	$0	$598	$15,163
Balance (T-H-C-W-E)	***($23,509)***	***$61,568***	***$105,744***	***$198,847***
State/local government:				
Tax revenues	$32,065	$47,537	$56,773	$86,993
Health expenditures	$46,777	$21,619	$13,147	$3,755
Crime expenditures	$39,218	$25,439	$11,661	$4,596
Welfare expenditures	$13,257	$4,746	$2,673	$546
Education expenditures [a]	($9,445)	$0	$7,950	$33,750
Balance (T-H-C-W-E)	***($57,742)***	***($4,267)***	***$21,342***	***$44,346***

Sources: Tables 3-8 above. *Notes:* 2011 dollars. Discount rate of 3.5%. [a] Expenditures beyond high school.

Annex: Documentation Provided

Deposition Transcript of Dr. Barbara Medina, Volume 1, March 10, 2011
Exhibit 150 Plaintiff-Intervenors' Amended Notice of Oral Deposition of Dr. Barbara R. Medina [sic] and Subpoena Duces Tecum, 2/22/11
Exhibit 151 Culturally and Linguistically Diverse Learners in Colorado, a State of the State 2010, 10/27/10
Exhibit 152 Colorado Department of Education Fall 2010 Pupil Membership by County, District, and Instructional Program
Exhibit 153 District English Language Acquisition Plan: The Who, Why, What and How of Plan Development
Exhibit 154 Guidebook on Designing, Delivering, and Evaluating Services for English Learners (ELs), Revised 1/10
Exhibit 155 Colorado Accommodations Manual For English Language Learners, 2009-2010
Exhibit 156 Rules For the Administration and the Assessment of Students Whose Dominant Language is Not English, Adopted 11/13/03
Exhibit 157 Colorado Academic Standards Crosswalk Information, English Language Proficiency Standards, 12/10/09
Exhibit 158 Plaintiffs' Rule 30(b)(6) Notice of Deposition of Barbara Medina, 2/7/11
Exhibit 159 District Performance Framework Report 2010
Exhibit 33 Document titled "Understanding Colorado School Finance and Categorical Program Funding"
Exhibit 42 The Colorado Department of Education English Language Proficiency Act (ELPA)
Exhibit 43 Colorado Department of Education English Language Proficiency Act (ELPA) Program 10 Year State Summary-2000-2010
Exhibit 45 Colorado Department of Education 2010 English Language Proficiency Act (ELPA) Program
Exhibit 47 Copy of ELL Request Regarding Number of Years in Mapleton by Category
Deposition Transcript of Dr. Barbara Medina, Volume 2, April 29, 2011
Exhibit 4000 Plaintiffs' Rule 30(b)(6) Notice of Deposition of Barbara Medina (Amended), 4/15/11
Exhibit 4001 Colorado Department of Education At-Risk Students Index Page
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Exhibit 4004 U.S. Department of Health and Human Services Office of the Secretary Annual Update of the HHS Poverty Guidelines, 1/20/11
Exhibit 4005 Colorado Code, Section 22-54-103, Definitions - repeal, 2011 Legislation (SB 11-157), ch. 10, Section 1-(15)
Exhibit 4006 DenverPost.com Article Titled 43"Report: Child-poverty rate increases 50 percent in Colorado," posted 7/26/10, updated 7/27/10
Exhibit 4007 Document titled "Risky Business, Building Resources For At-Risk Youth," 1999
Exhibit 4008 Omni Evaluation of NCLB Title I, 48 Part A: Supplemental Educational Services, Evaluation Year Two Report, Submitted to the Colorado Department of Education 6/10
Exhibit 4009 Colorado Department of Education, Closing the Achievement Gap Support Exhibit 4010 Colorado Department of Education CTAG Pilot
Exhibit 4011 Colorado Department of Education Turnaround and Intervention Home Page Welcome Page

Exhibit 4012 Colorado Department of Education Turnaround and Initiatives Home, CDE Turnaround Plan Page
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Exhibit 4016 PowerPoint Presentation, Colorado Statutes & Rules Pertaining to High School Dropouts, presented by Steadman and Salazar
Exhibit 4017 Expelled and At-Risk Student Services Grant Evaluation Report to the Colorado Legislature, Grant Award Period: 7/1/09 to 6/30/10
Exhibit 4018 Letter to Governor Ritter from Thomasian, 2/20/09, with attachments
Deposition Transcript of Trish Boland, Volume 1, March 31, 2011
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Exhibit 453 Communication to the Commissioner from the Mapleton superintendent
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Exhibit 4008 Omni Evaluation of NCLB Title I, 27 17 Part A: Supplemental Educational
Services, Evaluation Year Two 18 Report, Submitted to the Colorado Department of Education 6/10
"Costing Out the Resources Needed to Meet Colorado Education Standards and Requirements" Prepared by Augenblick, Palaich and Associates, Inc.
Defendants' Answers to Plaintiffs-Intervenors' First Set of Interrogatories and Requests for Production
Defendants' Answers to Plaintiffs' Interrogatories
Defendants' First and Second Supplemental Responses to Plaintiff-Intervenors' First Set of Discovery
Plaintiff-Intervenors' Answers to Defendants' Interrogatories
Plaintiffs' Answers to Defendants' Interrogatories
Plaintiff-Intervenors' First Amended Petition in Intervention
Plaintiffs' Second Amended Complaint

Data documentation:
Demographics for drop out rates, college placement, remediation rates (and anything else that replicates categories of concern)
Reports on race and education level demographics for arrests/convictions/incarcerations
Public assistance rates (TANF, food stamps, public housing, etc.), starting with the state's annual report to identify programs
Colorado Department of Criminal Justice Correctional Populations Forecasts
Demographics for Drop Out Rates in Colorado from CDE website
2009-10 Dropout Data, located at http://www.cde.state.co.us/cdereval/rv2010DropoutLinks.htm
Colorado Poverty Rate by Race/Ethnicity, states (2008-2009), U.S. (2009), located at http://www.statehealthfacts.org/profileind.jsp?ind=14&cat=1&rgn=7
Spring 2010 ED Facts State Profile – Colorado (NAEP)

CV: Henry M. Levin

Henry M. Levin
William Heard Kilpatrick Professor of Economics and Education
Co-Director, Center for Benefit-Cost Studies in Education
Director, National Center for the Study of Privatization and Education
Teachers College, Columbia University

EDUCATION

1967 Ph.D Rutgers University, Department of Economics
1962 M.A. Rutgers University, Department of Economics
1960 B.S. New York University, Marketing and Economics, Cum Laude

AREAS OF SPECIALIZATION

Economics of Education, Economics of Human Resources, Urban Economics, Public Finance, Education Policy

PRINCIPAL RESEARCH INTERESTS

Accelerated Schools for At-Risk Students, Financing Education and Economic Analysis of Education and Inequality, Cost-Effectiveness Approaches to Evaluation, Market Approaches to Education

ACADEMIC POSITIONS

1997 - Present **Teachers College, Columbia University, New York, New York**

- **2007 -** Co-Director of the Center for Benefit-Cost Studies in Education
- **1999 -** William Heard Kilpatrick Professor of Economics and Education
- **1999 -** Director, National Center for the Study for Privatization in Education
- **1997 - 1998** Visiting Professor, Economics and Education

1968 - Present **Stanford University, Stanford, CA:**

- **1999 -** David Jacks Professor of Higher Education and Economics, *Emeritus*
- **1992 - 1999** David Jacks Professor of Higher Education and Economics
- **1986 - 2000** Founder and Director Accelerated Schools Project
- **1975 - 1999** Professor of Education and Affiliated Professor in Economics and Director, Center for Educational Research at Stanford
- **1978 - 1984** Director, Institute for Research on Educational Finance and Governance
- **1969 - 1975** Associate Professor, School of Education and Affiliated Professor, Department of Economics
- **1968 - 1969** Assistant Professor of Education and Economics

1996 - Present Guest Professor, Beijing University, PRC
1996-97 Visiting Scholar, Russell Sage Foundation, New York City, New York

HONORS (abbreviated)

2008 Distinguished Lecture, Annual Meeting of the American Educational Research Association, New York City, NY

2007 Elected to National Academy of Education

2007 Lifetime Achievement Award, Division G—Social Context of Education of the American Educational Research Association

2004 Outstanding Service Award, American Education Finance Association

1998 Julius and Rosa Sachs Lecturer, Teachers College, Columbia University, New York

1992 David Jacks Professor of Higher Education and Economics, Stanford University, CA

1991 Fulbright Lecturer, Department of Economics, Universidad Metropolitana, Mexico

1990 Cited by President Bush and Secretary Lamar Alexander as leading one of three national exemplary projects in education

1989 Fulbright Professor, Department of Sociology, University of Barcelona, Spain

1985 Recipient of Alva and Gunnar Myrdal Award for Human Service, Delivery of Evaluation Research Society

ELECTIVE AND APPOINTIVE OFFICES (abbreviated)

2008 – Pres. Committee on Strengthening Benefit-Cost Methodology for the Evaluation of Early Childhood Interventions, National Research Council, National Academy of Sciences.

2007 – Pres. Instrument Expert Group, Program for International Student Assessment (PISA) Organization for Economic Co-operation and Development (OECD) Paris, France

2008 –Pres. Standing Committee on Background Variables, National Assessment of Education Progress (NAEP)

2006-2009 Comparative and International Education Society (CIES)

2008 President

2007 President - Elect

2006 Vice President

2003-Pres. Scientific Advisory Board, National Institute for Early Education Research (NIEER)

1982 President, American Evaluation Association

BOOKS

The Price We Pay: Economic and Social Consequences of Inadequate Education, Co-edited with C. Belfield (Washington, D.C.: The Brookings Institution Press, 2007).

Privatizing Educational Choice: Consequences for Parents, Schools, and Public Policy with C. Belfield (Boulder, CO: Paradigm Publishers, 2005).

Education Privatization: Causes, Consequences, and Planning Implications with C. Belfield, Fundamentals of Educational Planning Series No. 74 (Paris: International Institute for Educational Planning of UNESCO, 2003).

Readings in the Economics of Higher Education, with C. Belfield, eds (London: Edward Elgar, 2003).

Cost-Effectiveness and Educational Policy, with P. McEwan, eds (Larchmont, NY: Eye on Education, 2002).

Privatizing Education. ed (Boulder, CO: West view Press, 2001).

Cost-Effectiveness Analysis: Methods and Applications, Vol. 2, with P. McEwen. (Thousand Oaks, CA: Sage, 2001).

Economics of Education edited and translated by M. C. Tsang, Y. P. Chung, and J. Xiao. (Beijing: Peoples' Daily Press, 1995).

Making Schools Work, one of several co-contributors with principal author, E. Hanushek. (Washington, DC: The Brookings Institution, 1994).

Resource Guide for Accelerated Schools, with W. Hopfenberg et al. (San Francisco: Jossey Bass, 1993).

Effective Schools in Developing Societies, edited with M. Lockheed. (New York: Falmer Press, 1993).

Comparing Public and Private Schools: Institutions and Organizations, Vol. 1, edited with H. T. James. (Philadelphia: The Falmer Press, 1988).

Comparing Public and Private Schools: School Achievement, Vol. 2, edited with E. Haertel and H. T. James (Philadelphia: The Falmer Press, 1987).
Schooling and Work in the Democratic State, with M. Carnoy. (Stanford, CA: Stanford University Press, 1985).
Educacao e Desigualdade No Brasil, with others. (Rio de Janeiro: Editorial Vozes, 1984).
Worker Cooperatives in America, edited with R. Jackall. (Los Angeles and Berkeley: University of California Press, 1984).
Public Dollars for Private Schools: The Case of Tuition Tax Credits, co-edited with H. T. James. (Philadelphia: Temple University Press, 1983).
Financing Recurrent Education: Strategies for Improving Employment, Job Opportunities and Productivity, edited with H. Schutze. (Beverly Hills, CA: Sage Publication, 1983).
Cost-Effectiveness Analysis: A Primer. 13 Printings. (Beverly Hills, CA: Sage Publications, 1983).
The Limits of Educational Reform, with M. Carnoy. (New York: David McKay and Co., 1976).
Schools and Inequality, with others. (Cambridge, MA: MIT Press, 1971).
Community Control of Schools. (Washington, DC: The Brookings Institution, 1970). Also available in Simon and Schuster paperback.

ARTICLES (abbreviated, 2004 - Present)

"Questionnaires" Chap. IV in PISA 2009. Chapter introducing the need for and use of background information for interpreting results for PISA 2009.
Top of the Class, with others (wrote first draft and augmented by OECD staff), (Paris: OECD, 2009). Analyzes the highest performers in science from PISA 2006.
"My Comparative Education:1970-75", Comparative Education Review , Vol. 53, No. 3 (August 2009), pp. 315-327.
"The Economic Payoff to Investing in Educational Justice, Educational Researcher, Vol 38, No. 1, (2009) pp. 5-14.
"Do You Have High Metabolism?" In Carl Glickman, ed., Those Who Dared: Five Visionaries Who Changed American Education (New York: TC Press, 2009), pp. 21-48.
"Market Reforms in Education," with Clive Belfield, Gary Sykes, Barbara Schneider, & David Plank, Eds., Handbook of Educational Policy (New York: Routledge, 2009), pp. 513-527.
"Community Colleges as Learning Centers for Migrant Workers in Manufacturing Areas In China" In Rosalind Raby and Edward Valeau, eds., Community College Models: Globalization and Higher Education Reform, CERC Studies in Comparative Education (Springer Publishers, 2009),pp. 517-44.
"Educational Privatization," with Clive Belfield, International Encyclopedia of Education, Third Edition (Pergamon Press, forthcoming).
"Cost-Benefit and Cost-Effectiveness Analysis," with Clive Belfield, International Encyclopedia of Education, Third Edition (Pergamon Press, forthcoming). "Economic Perspectives on School Choice" In Mark Berends, Matthew G. Springer, Dale Ballou, and Herbert J. Walberg, eds., Handbook of Research on School Choice (Mahwah, NJ: Lawrence Erlbaum Associations, 2009).
"Remediation in the Community College: An Evaluator's Perspective," with Juan Carlos Calgano, Community College Review (January 2008), pp. 181- 207.
"Issues in Educational Privatization," In E. Fiske & H. Ladd (eds), Handbook of Research in Education Finance and Policy (New York: Routledge, 2008), pp. 391-401.
"The Social Cost of Inadequate Education for Black Males, "In Lois Weis (ed.), The Way Class Works (New York: Routledge, 2007), pp. 180-88.
"The Public Returns to Public Educational Investments in African-American Males," with Clive Belfield, Peter Muennig, & Cecilia Rouse, Economics of Education Review (2007), pp. 699-708.

"Costs of Implementing Adolescent Literacy Programs," In D. Deshler, A. S. Palincsar, G. Biancarosa, M. Nair, Informed Choices for Struggling Adolescent Readers: A Research-Based Guide to Instructional Programs and Practices, (Newark, DE: International Reading Association, 2007), Chap. 4.

"On the Relationship Between Poverty and Curriculum," North Carolina Law Review, Vol. 85, No. 5 (June 2007), pp. 1382-1418.

"Educational Vouchers for Universal Pre-Schools," with Heather Schwartz, Economics of Education Review (February 2007), pp. 3-16.

"Can Research Improve Educational Leadership?" Educational Researcher, Vol. 35(8) (November 2006), pp. 38-43.

"Why Is Educational Entrepreneurship So Difficult?" In Frederick Hess, ed., Educational Entrepreneurship (Cambridge, MA: Harvard Education Press 2006), pp. 165-182.

"Accelerated Schools and the Obstacles to School Reform," with Christine Finnan. In Mark Constas & Robert Sternberg, Eds., Translating Educational Theory and Research into Practice (Mahwah, NJ: Lawrence Erlbaum Associates 2006), Chap. 6.

"Déjà Vu All Over Again?" Education Next (Spring 2006), pp. 2-24.

"Worker Democracy and Worker Productivity" Social Justice Research 19(1) (March 2006), pp.109-121.

"Accelerating Mathematics Achievement Using Heterogeneous Grouping," with Carol Burris & Jay Heubert, American Educational Research Journal (February 2006), pp. 105-136.

"Vouchers and Public Policy: When Ideology Trumps Evidence," with Clive Belfield, American Journal of Education, Vol. 11 (August 2005), pp. 548-67.

"Issues in the Expansion of Higher Education in the People's Republic of China," with Zeyu Xu, The China Review, Vol. 5, No. 1 (Spring 2005), pp. 33-60.

"Notes on For Profit Higher Education in the United States," Peking University Education Review, Vol. 3, No. 2 (April 2005), pp. 5-7.

"Accelerated Schools for Quality Education: A Hong Kong Perspective," with John Chi-kin Lee & Pilar Soler," The Urban Review, Vol. 37, No. 1 (March 2005), pp. 63-81.

"Opportunities of and Challenges to Educational Privatization in China," Peking University Education Review, Vol 3, No. 1 (January 2005), pp. 5-10.

"Learning from School Reform," In J. Lee, L. Lo, & A. Walker, Eds., Partnership and Change: Towards School Development (Hong Kong: The Chinese University Press, 2004), pp. 31-52.

Current and Pending Grant Projects						
Status	Funder	Grant	Award	Position	Commitment	Dates
Pending	IES	Cost-Effectiveness Analysis of Educational Alternatives	$1,163,017	Primary Investigator	10% Academic Year, 2 Summer months	03/2011 - 03/2014
Current	Maastricht	Productivity in Education	$33,391	Primary Investigator	20% of 1 Summer month	11/2009 - 08/2011
Current	Ford Foundation	Designing a Charter School District	$200,000	Primary Investigator	20% Academic Year, 1 Summer month	05/2008 - 08/2010

CV: Clive R. Belfield

Clive R. Belfield

Associate Professor, Economics Department
Queens College, City University of New York
Powdermaker Hall 300R
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Clive.Belfield@qc.cuny.edu

Other Positions:

Faculty member, Graduate Center, City University of New York (1/2005–)
Adjunct Associate Professor, School of International and Public Affairs, Columbia University (9/2008–)
Co-Director, Center for Benefit-Cost Studies in Education, Teachers College (1/2007–)

Associate Editor, *Economics of Education Review* (1/2010–)

Scholarship

(A) Books

Belfield CR, and HM Levin (Editors and lead contributors) 2007. *The Price We Pay: The Costs to the Nation of Inadequate Education*, Brookings Institution Press, Washington, DC. Ms., 200pps, forthcoming.

Belfield CR, and HM Levin 2005. *Privatizing Educational Choice.* Published by Paradigm Publishers, Denver, CO.

Belfield CR. 2000. *Economic Principles for Education: Theory and Evidence*, Published by Edward Elgar, Cheltenham UK. (Choice Book of the Year).

(B) JOURNAL ARTICLES (All Refereed, Except *)

Bailey, T. and CR Belfield. 2011. The benefits of attending community college: A review of the evidence. *Community College Review*, **39**, 46-68.

Belfield, CR. 2010. The economic consequences of inadequate education for the Puerto Rican population in the United States. *Centro*, XXII, 3-26.

Belfield, CR. 2010. Over-education: what role does the firm play? *Economics of Education Review*, .

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Addison, JT and CR Belfield. 2007. Unions, training, and firm performance. *Journal of Labor Market Research*, 40, 361-381.

Belfield CR, Levin, HM, Muennig, P and C Rouse. 2007. Public investments in African American males. *Economics of Education Review*, **26**, 699-708.

Barnett, WS and Belfield CR. 2006. Early childhood education and social mobility. Princeton *Future of Children Series* **16** (2): 73-98.

Belfield CR, Nores, M, Barnett, WS, and L Schweinhart. 2006. Cost-Benefit analysis of a randomized field trial of early childhood education: the High/Scope Perry Pre-School Program. *Journal of Human Resources* **41** (1): 162-190.

Nores, M, Belfield CR, CR, Barnett, WS and L Schweinhart. 2005. Updating economic impacts of the High/Scope Perry Pre-School Program. *Educational Evaluation and Policy Analysis* **27** (3): 245-261.

Belfield CR. 2006. Vouchers and the Cleveland Scholarship Program: Little Progress So Far. *Economic Commentary, Federal Reserve Bank of Cleveland* March 1 issue.*

Belfield CR, 2005. Should Ohio invest in compulsory pre-schooling? *Economic Commentary, Federal Reserve Bank of Cleveland* February 15 issue.*

Belfield CR. 2005. Workforce Gender Effects on Firm Performance and Workers' Pay: Evidence for the United Kingdom. *Applied Economics* **37** (8): 885-891.

Belfield CR, and HM Levin. 2005. Vouchers and public policy: When ideology trumps evidence. *American Journal of Education* **111** (4): 548-567.

Belfield CR, 2005. The teacher labor market in the US: Challenges and reforms. *Educational Review* **57** (2): 175-191.

Belfield CR, and HM Levin. 2004. Should high school economics courses be compulsory? *Economics of Education Review* **23** (4): 351-360.

Addison, JT and Belfield CR. 2004. Unions and employment growth: The one constant? *Industrial Relations* **43** (2): 305-323.

Belfield CR, and HM Levin. 2004. The marketplace in education. *Review of Research in Education* **27** (4)183:218. Reprinted in Lauder et al. (Eds) *Education, Globalization, and Social Change*. Oxford University Press: Oxford, England.

Addison JT and Belfield CR. 2004. Union voice. *Journal of Labor Research*, **25**, 563-596.

Battu, HR, Belfield CR, and PJ Sloane. 2004. Transfers of human capital across the workplace: evidence for the service sector in Great Britain. *International Journal of Manpower* **25** (1): 123-138

Belfield CR, and XD Wei. 2003. Employer Size-Wage effects: Evidence from matched employer-employee survey data in the UK. *Applied Economics* **36** (3): 185-193.

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Belfield CR, and HM Levin. 2003. The Economics of Tuition Tax Credits. *Proceedings: National Tax Association* 16 (2): 61-68.

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Addison, JT and Belfield CR. 2002. What do we know about the new European Works Councils? *Scottish Journal of Political Economy* **49** (4): 418-444.

Belfield CR, and RDF Harris. 2002. How well do theories of job matching explain job satisfaction: evidence for UK graduates. *Applied Economics* **34**(5): 535-548.

Belfield CR, and HM Levin. 2002. The economics of education on judgment day. *Journal of Education Finance* **28** (Fall): 183-206.

Belfield CR, and HM Levin. 2002. Families as contractual partners in education. *UCLA Law Review* **49** (6): 1799-1824.

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Brown, C, Belfield CR, and SJ Field. 2002. Cost effectiveness of continuing professional development in health care: A critical review of the evidence. *British Medical Journal* **324** (March): 624-655.

Belfield CR, and JS Heywood. 2001. Unionization and the pattern of non-union wages: evidence for the UK. *Oxford Bulletin of Economics and Statistics* **63** (5): 577-598.

Addison, JT and Belfield CR. 2001. Updating the determinants of firm performance. *British Journal of Industrial Relations* **39** (3): 341-366.

Belfield CR, and A Fielding. 2001. Measuring the relationship between resources and higher education outcomes in the UK. *Economics of Education Review* **20**(6): 589-602.

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Belfield CR, and A Beney. 2000. What determines alumni generosity? Evidence for the UK *Education* **8**(1): 65-83.

Battu, HR, Belfield CR, and PJ Sloane. 1999. Over-education among graduates: A cohort view. *Education Economics* **7**(1):21-38.

(C) Chapters In Books

Belfield, CR. 2010. Markets versus monopolies in education. In Welner, K, Hinchey, PH, Molnar, A and D Weitzman (Eds). *Think Tank Research Quality: Lessons for Policymakers, the media, and the public.* Information Age Publishing, Charlotte, North Carolina.

Belfield, CR. 2010. A school privatization primer for Michigan school officials, media, and residents. In Welner, K, Hinchey, PH, Molnar, A and D Weitzman (Eds). *Think Tank Research Quality: Lessons for Policymakers, the media, and the public.* Information Age Publishing, Charlotte, North Carolina.

Belfield C and Levin H M. 2010. Cost–Benefit Analysis and Cost–Effectiveness Analysis. In: Penelope Peterson, Eva Baker, Barry McGaw, (Editors), International Encyclopedia of Education. volume 2, pp. 199-203. Oxford: Elsevier.

Belfield, CR and HM Levin. 2010. The marketplace in education. Entry in *Encyclopaedia of Education Research.*

Belfield, CR and HM Levin. 2009. Investments in k-12 education: What works? In Reynolds et al. *Cost-effective early childhood programs in the first decade: A human capital integration*. New York: Cambridge University Press.

Belfield CR. 2008. Can pre-school improve life in America's cities? In Turner, M, Wial, H and H Wolman. *Urban and Regional Policy and Its Effects.* Brookings Institution: Washington DC.

Belfield CR. 2008. Effective investments to raise human capital. In A Vining and D Weimer. *Investing in the Disadvantaged: What do we know about the efficiency of pulic policies.* Georgetown University Press.

Belfield CR. 2008. Home-schooling. For the *Handbook of School Choice* edited by Behrendts, Ballou and Goldring (forthcoming).

Belfield CR, and HM Levin. 2007. Chapters 1 and 2. In *The Price We Pay: The Costs to the Nation of Inadequate Education*, Brookings Institution Press, Washington, DC.

Belfield CR, 2007. Chapter 10: The promise of pre-school. In *The Price We Pay: The Costs to the Nation of Inadequate Education*, Brookings Institution Press, Washington, DC.

Addison, JT and Belfield CR. 2007. Union voice. In *What Do Unions Do? The Evidence Twenty Years Later*. Bennett, JT and BE Kaufman (Eds). Published by Transactions Press in 2007, pages 238-274.

Belfield CR. 2007. Introduction. Special Issue on 'The Economics of Early Childhood Education', *Economics of Education Review* **26** (1): 1-2.

Belfield CR. 2007. Home-schooling. Entry in the *Handbook of Education Finance* (Fiske and Ladd, Eds) Forthcoming.

Belfield CR, and F Samson. 2005. Education privatization. In H Johnson (Ed.) *Authentic Education Reform.* Erlbaum Publishers, pages 25-52.

Belfield CR, 2005. Home-schoolers' performance on the SAT. In BS Cooper (Editor). *Home Schooling in Full View*. Information Age Publishing, pages 167-177.

Belfield CR, and JS Heywood. 2004. Wage discrimination in competitive markets: evidence for the United Kingdom. Chapter in JS Heywood and J Peoples (Eds.) *Product Market Structure and Labor Market Treatment* (SUNY Press 2006) Chapter 3, pages 39-58.

Belfield CR, and JS Heywood. 2003. The desire for unionization, HRM practices, and coworkers. Chapter in PV Wunnava (Ed.) *The Role of Unions* (ME Sharpe, Inc.) Chapter 9, pages 251-279.

Addison, JT and Belfield CR, 2003. Updating the evidence on the impact of unions. Chapter in PV Wunnava (Ed.) *The Role of Unions* (ME Sharpe, Inc.) Chapter 10, pages 281-319.

Belfield CR, and CA Brown. 2002. The cost-effectiveness of lectures: what does the experimental evidence say? In HM Levin and PJ McEwan (Editors). *2002 Yearbook of the American Education Finance Association*. (Eye on Education: New York) Chapter 8, pages 139-156.

(D) Book Reviews

Belfield, CR. 2011. Book review of *Multiple Account Benefit Cost Analysis.* In *American Journal of Evaluation* (forthcoming).

Belfield, CR. 2010. Book review of *Statehouses, Courthouses, and Schoolhouses.* In *Education Economics* (forthcoming).

Belfield CR. 2006. Book review *What's the Good of Education?* In *Educational Review* **58**(3):370-371

Belfield CR. 2004. Book review *Incentive-based budgeting systems in public universities.* In *Economic Journal* **114**: F158-F159.

Belfield CR. 2004. Book review *The Ideology of Education. The Commonwealth, the Market, and America's Schools* In *Educational Review* **56** (2): 224-225

Belfield CR. 2002. Book review *High School Career Academies. A Pathway to Educational Reform in Urban School Districts?* In *Economics of Education Review* **21**: 297.

(E) Oral Papers And Addresses (* Denotes Invited)

The role of for-profit colleges in student default. Teachers College seminar (3/11).

The returns to breastfeeding. Columbia University seminar, QMMS (11/10).

Cost-benefit analysis of education policy. MacArthur Foundation Seminar on Cost-Benefit Analysis, Washington, DC (9/2010).*

The returns to early education. AEFA conference, Richmond, VA (3/2010).

Comment: Returns to education for immigrants. Future of Children Symposium, Princeton University, NJ (3/2010).*

Costs analysis in education. MacArthur Foundation Seminar on Cost-Benefit Analysis, Washington, DC (9/2009).*

The economic value of pre-school. Equity in Education Forum, Teachers College, Columbia University (4/2009).*

The economic benefits of high school graduation. Federal Reserve Bank of New York, New York (6/2007)

Investments in high school graduation for New York. *Somos El Futuro* Conference, Albany, NY (4/2007)

Early childhood education and urban policy. Brookings Conference on Urban Life, Washington, DC (3/2007) *

Adam Smith goes to college. Seminar for Economics Honors Society, QC. (9/2006)

The link between education and crime. International conference in the economics of education, Dijon, France (6/2006)

The future for education vouchers: the Cleveland Scholarship and Tutoring Program. Education and Economic Development Conference, Federal Reserve Bank, Cleveland, OH (11/2005) *

Selling the sizzle as well as the steak: The impact of competition among restaurants in Manhattan. CUNY Graduate School Seminar (11/2005)

Early childhood education and economic opportunity. Future of Children Symposium, Princeton University, NJ (10/2005) *

The consequences for social inequities from universal pre-schooling. Equity Symposium, Teachers College, Columbia University (10/2005) *

Intergenerational benefits of pre-K investments. Committee for Economic Development, Invest in Kids Program, Washington, DC (4/2005) *

Cost-Benefit analysis of a randomized field trial of early childhood education: the High/Scope Perry Pre-School Program. School of Social Work, Columbia University (2/2005) *

Micro-economic benefits of pre-school. Committee for Economic Development Conference, Washington, DC (12/2004) *

Cost-Benefit analysis of a randomized field trial of early childhood education: the High/Scope Perry Pre-School Program. QC Economics Dept. Seminar (11/2004)

Cost-Benefit analysis of a randomized field trial of early childhood education: the High/Scope Perry Pre-School Program. Federal Reserve Bank of Cleveland Conference on Economics and Education, Cleveland, OH (11/2004)

The costs to the nation of inadequate education. Association of Public Policy Analysis and Management Conference, Atlanta, GA (10/2004)

Education privatization. Education Writers Association. San Francisco, CA (4/2004) *

Investments in early education for New York state. State legislature conference room presentation, Albany, NY (3/2004) *

Peer effects on SAT scores. American Education Finance Association conference, Denver, CO (3/2004)

Vouchers and the market for education. Conference on the Economics of Education, Cologne, Germany (5/2004).

The economics of tuition tax credits. National Tax Association conference, Orlando, FL (3/2004)

Vouchers and the market for education. Portuguese Education Association, Lisbon, Portugal (5/2003)

Vouchers after the Supreme Court decision. ECS Annual Conference, Denver, CO (7/2003)

The economics of a compulsory curriculum. American Education Finance Association conference, Salt Lake City, UT (3/2003)

School finance on judgment day. American Education Finance Association conference, Albuquerque, NM (3/2002)

Contractual partners in education. UCLA Law School Conference, Los Angeles, CA (3/2002)

(F) Reports And Other Works

Belfield, CR and HM Levin. 2009. High School Dropouts and the Economic Losses from Juvenile Crime in California. California Dropout Research Project, University of California, Santa Barbara.

Belfield, CR and HM Levin. 2008. The Return on Investment for Improving California's High School Graduation Rate. California Dropout Research Project, University of California, Santa Barbara.

Belfield, CR. 2009. Editor of a Festschrift Special Issue on 'Economics of education', *Economics of Education Review*. Articles by scholars from Rutgers University, Northwestern, Wellesley, UCSB, Teachers College.

Belfield CR. 2007. Editor of Special Issue on 'The Economics of Early Childhood Education', *Economics of Education Review.* Articles by Levin and Schwartz (Teachers College), Currie and Neidell (Columbia University), Reynolds (Wisconsin- Madison), Loeb (Stanford University), Barnett (Rutgers), Chang (University of North Carolina), Henry (Georgia State).

Belfield CR, and H Schwartz. 2007. The benefits of pre-school to the school system. Research paper, National Institute for Early Education Research, Rutgers University.

Belfield CR, and A Neveu. 2006. The macroeconomic consequences of pre-school. Research paper, National Institute for Early Education Research, Rutgers University.

Belfield CR. 2006. International review of early childhood education policies. OECD Annual Report, background paper.

Belfield CR. 2005. (Editor). *Modern Classics in the Economics of Education: Edited Volume of Pre-published Papers*, pp500, published by Edward Elgar, Cheltenham.

Belfield CR, 2004. Democratic education across school types in the US: Evidence from NHES 1999. *Educational Policy Analysis Archives*.

Belfield CR, 2004. Modelling school choice: A comparison of public, private–independent, private–religious and home-schooled students. *Educational Policy Analysis Archives.*

Belfield CR, and HM Levin (Editors) 2002. *The Economics of Higher Education: Edited Volume of Pre-published Papers*, pp500, published by Edward Elgar, Cheltenham.

Belfield CR, and HM Levin 2002. *Educational Privatization: Causes, Consequences, and Planning Implications (Outline for Fundamentals of Educational Planning, IIEP Series)*, UNESCO, Paris.

Belfield CR, 1997. PhD Thesis. A Critical Evaluation of the Banking and Currency School Debate in British Monetary Thought. Exeter University, England. Unpublished.

(G) Works in progress

Belfield, CR. 2010. Family expenditures on early education: An evaluation over the decade. Revise and Resubmit, *Early Childhood Research Quality.*

Belfield, CR and T Bailey. 2010. The returns to investments in community college education. Submission, *Community College Review.*

Belfield, CR and I Kelly. 2010. The effect of breastfeeding on child outcomes: An evaluation using the ECLS-B. Working paper.

Belfield, CR and J Heywood. 2010. The wage returns to early childhood credentials. Working paper.

Belfield, CR. 2010. The advantages of early education. Working paper.

Grants:

(1) Performance-Related Pay for Teachers: Determinants and Consequences (2005)
PSC-CUNY Award [$3,700]

(2) The Macroeconomics of Pre-schooling (2005-06)
National Institute for Early Education Research, Rutgers University [$29,613]
Employment for QC undergraduate (Adina Goldstein); CUNY graduate students (Andre Neveu, Molly Sherlock).

(3) State-level Economic Modelling of Pre-school (2006-07)
National Institute for Early Education Research, Rutgers University [$42,308]
Employment for CUNY graduate students (Andre Neveu, Molly Sherlock).

Higher Education:

1990	BA Honors Economics	University of Durham, UK
1993	MA Economics	University of Saskatchewan, Canada
1997	PhD Economics	University of Exeter, UK

Teaching Responsibilities:

Courses taught since 2004:

ECO100	Economics and Society
ECO102	Microeconomics
ECO205	Price Theory
ECO228W	Economics of the Environment (developed new course)
ECO391	Independent Study
ECO392W	Honors Seminar in Economics (developed new course)

In addition, I teach Cost-Benefit Analysis, a graduate class at the School of International and Public Affairs, Columbia University. Previously, I have taught at Teachers College; the Bloustein School of Public Policy, Rutgers University; the Economics Depts of the University of Birmingham, England and the University of Saskatchewan. I have also developed courses in The Economics of Education and Cost-Benefit Analysis for the undergraduate level at Queens College.

Service At Queens College

(A) College/University

Assistant Chair, BBA program (1/2007–present)
Chair, Economics Department Outcomes Assessment Committee (4/2006–present)
Member, Graduate Center faculty, Economics (1/2005–present)
Chair, Barham Scholarship Committee (4/2006–present)

Prior positions include: Member, Personnel and Budget Committee, Economics Dept (9/2007-12/2009); Chair, Summer program (1/2007–2009); Economics Department Representative, Academic Senate (9/2006–2008); Chair, Economics Department Curriculum Committee (1/2007–2009); Department representative, Social Sciences Interdisciplinary Research Committee (2006); Member, Honors program, Queens College (1/2005–2008).

(B) Professional Service

Associate Editor, *Economics of Education Review*, (1/2010–present)

Member, Editorial Board, *Education Review* (2001–present). Membership of: American Economic Association (1997–); American Educational Research Association (2000–2003); and American Educational Finance Association (2001–2004, 2007-).

Review panellist for funded projects: Institute for Educational Sciences, US Department of Education (2003–2009); Pew Charitable Trusts (4/2006); Center for Benefit-Cost Analysis, University of Washington; Social Sciences and Humanities Research Council, Canada.

Workshops: Costs analysis. Ford Foundation, New York (10/2009); Education privatization. Authentic Education Reform, School of Education, QC (10/2004); Education privatization and urban school reform. Ford Foundation, New York (10/2004); Early childcare education: Lessons from the research. Rose Tremaine Foundation, Washington, DC, (11/2004); Special education and pre-schooling. Rose Tremaine Foundation, Washington, DC, (1/2006);

Article refereeing for peer-reviewed journals. These include: *Journal of Labor Economics*, *Southern Economic Journal*, *Applied Economics*, *Economics of Education Review* and *Journal of Policy Analysis and Management*, *Australian Journal of Economics*, *Educational Economic Research*.

Manuscript/proposal reviewing for: Oxford University Press; Yale University Press; Smith Richardson Foundation; Edward Elgar Publishing; U.S. Department of Education; and the National Science Foundation

I have also served as an expert witness on school choice and the economics of education in three legal cases.

(C) Community Service

Public presentations:
The costs of high school dropouts. Connecticut Advisory Committee on Civil Rights (4/2010) ; Education research. Benefit-Cost Analysis Conference, Washington, DC (11/2009); The Costs of Inadequate Education. Host: Congressman Charles Rangel, Chairman, Ways & Means Committee, Capitol Building, US Congress, Washington, DC. (4/2007); Open Forum on Educational Investments, Englewood Public School District (3/2007); Investing in Universal Pre-School, Maryland State Dept of Education (12/2006); Early childcare education: Economic analysis for Massachusetts. Strategies for Children Advocacy Group, Boston, MA (1/2005); The educational effects of school start times. New Canaan League of Women Voters, New Canaan, CT, (1/2005); Home-schooling. Education Writers Assoc. Conference, St. Petersburg, FL (5/2005); The economic impacts of pre-schooling. Grantmakers for Children, Youth and Families Conference, Denver, CO, (9/2005); Pre-schooling in Washington DC. Seminar, National Press Club (6/2006); Early childcare education: Economic analysis. Childcare Circuit Network of Childcare Workers, Boston, MA (12/2004).

Working dinner, Public Administration Select Committee, British House of Commons, New York (11/2006)
Testimony, Economic benefits of early childhood education, to NY City Council Committee on the *Campaign for Fiscal Equity* lawsuit, Baruch College, NY (12/2004)

Member, *Invest in Kids* Working Group, Committee for Economic Development, Washington, DC, (2004-2008)

(D) Media And Public Outreach

Research on the costs of dropping out of high school profiled and mentioned in various media, including *Education Week*, *Diverse*, *Newswise.com*, *Times Herald Record, Paducah Sun*, *Los Angeles Times* (1/2007-). Interview, NPR 'Marketplace' (6/2006). Research mentioned in Op-ed by Richard Riley, *New York Times* (1/2006). Research mentioned in news article by Pat Healey, *New York Times* (5/2007). Review of work as an Editorial in *Boston Globe* (1/2005). Review of work in *Milwaukee Journal Sentinel* (9/2005), *Cleveland Plain Dealer* (11/2005), *Louisiana Advocate* (11/2005), *Akron Beacon Journal* (9/2005). The costs of home-schooling. Posted on www.bankrate.com website (3/2005). Interview, Cleveland NPR radio (3/2005). Research on education tuition tax credits cited in *Salt Lake Tribune* (1/2005). Research on early childhood education mentioned (but not attributed) in *New York Times*, *Salt Lake Tribune*, *Dallas Morning News, Wall Street Journal*.

Past Employment:

Assistant Professor, Economics Department (9/2004–8/2008), Queens College, City University of New York

Research Fellow [part-time] (9/2004-4/07), Teachers College, Columbia University

Research Fellow [full-time] (2001-04), Teachers College, Columbia University

Adjunct faculty, Public Policy school (2003), Rutgers University, NJ

Adjunct Associate Professor (2001-03), Teachers College, Columbia University

Honorary Senior Research Fellow (8/2000-4/2006), School of Education, University of Birmingham, Birmingham, England B15 2TT

Research fellow (1996-2001), University of Birmingham, UK

Teaching assistant (1995-96), University of Exeter, UK

Full-time professor (1994-95), University of Saskatchewan, Canada

References:

References are available on request.

List of Publications (2001-2011): Henry M. Levin

BOOKS

The Price We Pay: Economic and Social Consequences of Inadequate Education, Co-edited with C. Belfield (Washington, D.C.: The Brookings Institution Press, 2007).

Privatizing Educational Choice: Consequences for Parents, Schools, and Public Policy with C. Belfield (Boulder, CO: Paradigm Publishers, 2005).

Education Privatization: Causes, Consequences, and Planning Implications with C. Belfield, Fundamentals of Educational Planning Series No. 74 (Paris: International Institute for Educational Planning of UNESCO, 2003).

Readings in the Economics of Higher Education, with C. Belfield, eds (London: Edward Elgar, 2003).

Cost-Effectiveness and Educational Policy, with P. McEwan, eds (Larchmont, NY: Eye on Education, 2002).

Privatizing Education. ed (Boulder, CO: West view Press, 2001).

Cost-Effectiveness Analysis: Methods and Applications, Vol. 2, with P. McEwen. (Thousand Oaks, CA: Sage, 2001).

"Questionnaires" Chap. IV in PISA 2009. Chapter introducing the need for and use of background information for interpreting results for PISA 2009.

Top of the Class, with others (wrote first draft and augmented by OECD staff), (Paris: OECD, 2009). Analyzes the highest performers in science from PISA 2006.

"My Comparative Education:1970-75", Comparative Education Review , Vol. 53, No. 3 (August 2009), pp. 315-327.

"The Economic Payoff to Investing in Educational Justice, Educational Researcher, Vol 38, No. 1, (2009) pp. 5-14.

"Do You Have High Metabolism?" In Carl Glickman, ed., Those Who Dared: Five Visionaries Who Changed American Education (New York: TC Press, 2009), pp. 21-48.

"Market Reforms in Education," with Clive Belfield, Gary Sykes, Barbara Schneider, & David Plank, Eds., Handbook of Educational Policy (New York: Routledge, 2009), pp. 513-527.

"Community Colleges as Learning Centers for Migrant Workers in Manufacturing Areas In China" In Rosalind Raby and Edward Valeau, eds., Community College Models: Globalization and Higher Education Reform, CERC Studies in Comparative Education (Springer Publishers, 2009),pp. 517-44.

"Educational Privatization," with Clive Belfield, International Encyclopedia of Education, Third Edition (Pergamon Press, forthcoming).

"Cost-Benefit and Cost-Effectiveness Analysis," with Clive Belfield, International Encyclopedia of Education, Third Edition (Pergamon Press, forthcoming). "Economic Perspectives on School Choice" In Mark Berends, Matthew G. Springer, Dale Ballou, and Herbert J. Walberg, eds., Handbook of Research on School Choice (Mahwah, NJ: Lawrence Erlbaum Associations, 2009).

"Remediation in the Community College: An Evaluator's Perspective," with Juan Carlos Calgano, Community College Review (January 2008), pp. 181- 207.

"Issues in Educational Privatization," In E. Fiske & H. Ladd (eds), Handbook of Research in Education Finance and Policy (New York: Routledge, 2008), pp. 391-401.

"The Social Cost of Inadequate Education for Black Males, "In Lois Weis (ed.), The Way Class Works (New York: Routledge, 2007), pp. 180-88.

"The Public Returns to Public Educational Investments in African-American Males," with Clive Belfield, Peter Muennig, & Cecilia Rouse, Economics of Education Review (2007), pp. 699-708.

"Costs of Implementing Adolescent Literacy Programs," In D. Deshler, A. S. Palincsar, G.

Biancarosa, M. Nair, Informed Choices for Struggling Adolescent Readers: A Research-Based Guide to Instructional Programs and Practices, (Newark, DE: International Reading Association, 2007), Chap. 4.

"On the Relationship Between Poverty and Curriculum," North Carolina Law Review, Vol. 85, No. 5 (June 2007), pp. 1382-1418.

"Educational Vouchers for Universal Pre-Schools," with Heather Schwartz, Economics of Education Review (February 2007), pp. 3-16.

"Can Research Improve Educational Leadership?" Educational Researcher, Vol. 35(8) (November 2006), pp. 38-43.

"Why Is Educational Entrepreneurship So Difficult?" In Frederick Hess, ed., Educational Entrepreneurship (Cambridge, MA: Harvard Education Press 2006), pp. 165-182.

"Accelerated Schools and the Obstacles to School Reform," with Christine Finnan. In Mark Constas & Robert Sternberg, Eds., Translating Educational Theory and Research into Practice (Mahwah, NJ: Lawrence Erlbaum Associates 2006), Chap. 6.

"Déjà Vu All Over Again?" Education Next (Spring 2006), pp. 2-24.

"Worker Democracy and Worker Productivity" Social Justice Research 19(1) (March 2006), pp.109-121.

"Accelerating Mathematics Achievement Using Heterogeneous Grouping," with Carol Burris & Jay Heubert, American Educational Research Journal (February 2006), pp. 105-136.

"Vouchers and Public Policy: When Ideology Trumps Evidence," with Clive Belfield, American Journal of Education, Vol. 11 (August 2005), pp. 548-67.

"Issues in the Expansion of Higher Education in the People's Republic of China," with Zeyu Xu, The China Review, Vol. 5, No. 1 (Spring 2005), pp. 33-60.

"Notes on For Profit Higher Education in the United States," Peking University Education Review, Vol. 3, No. 2 (April 2005), pp. 5-7.

"Accelerated Schools for Quality Education: A Hong Kong Perspective," with John Chi-kin Lee & Pilar Soler," The Urban Review, Vol. 37, No. 1 (March 2005), pp. 63-81.

"Opportunities of and Challenges to Educational Privatization in China," Peking University Education Review, Vol 3, No. 1 (January 2005), pp. 5-10.

"Learning from School Reform," In J. Lee, L. Lo, & A. Walker, Eds., Partnership and Change: Towards School Development (Hong Kong: The Chinese University Press, 2004), pp. 31-52.

"Math Acceleration for All," with C. Burris & J. Heubert, *Educational Leadership*, Vol 61, No 5 (February 2004), pp. 68-71.

"Cost-Benefit Analysis," *Encyclopedia of Evaluation*, Sandra Mathison, Ed. (Thousand Oaks, CA: Sage Publications 2004), pp. 86-90. Short entries on "Cost", p. 86, and "Cost-Effectiveness Analysis", p. 90.

"Multiple Choice Questions: The Road Ahead for Policy and Governance" Noel Epstein, Ed. To be published in volume on school governance (Brookings Institution, 2004).

"Cost-Effectiveness as an Evaluation Tool," with P. McEwan, In T. Kellaghan & D. Stufflebeam (eds), *International Handbook of Educational Evaluation* (Boston: Kluwer Academic Publishers, 2003), Chap. 7.

"A Comprehensive Framework for the Evaluation of Educational Vouchers," *Educational Evaluation and Policy Analysis*, Vol. 24, No. 3 (Fall 2002), pp. 159-74.

"The Gordian Knot of Educational Reform," *Curriculum Inquiry*, Vol. 32, No. 4 (Winter 2002), pp. 471-82.

"The Economics of Education on Judgment Day," with C. Belfield, *Journal of Educational Finance*, Vol. 28, No. 2 (Fall 2002), pp. 183-206.

"Does the Supreme Court Decision on Vouchers Really Matter for Education Reform?" with Clive Belfield. At www.tcrecord.org also www.ncspe.org.

"The Potential of For-Profit Schools for Educational Reform" To be published in conference volume edited by M. Kourilsky. *Presented at IEEE Educational Entrepreneurship Conference* (June 6-7, 2002) UCLA. Also available at www.ncspe.org.

"Post-Compulsory Entitlement: Vouchers for Life-Long Learning," In Dieter Dohmen & Birgitt A. Cleuvers, Eds., *Financing of Further Education and Lifelong Learning* (Bielefeld, FRG: Bertelsmann, 2003), pp. 56-72. Also available at www.ncspe.org.

"The Effects of Competition on Educational Outcomes: A Review of U.S. Evidence," with C. Belfield, *Review of Educational Research*, Vol. 72, No. 2 (Summer 2002), pp. 279-341.

"Families as Contractual Partners in Education," with C. Belfield, *UCLA Law Review*, Vol. 46, No. 6 (August 2002), pp. 1799-1824.

"Accelerated Schools," *Encyclopedia of Education, Second Edition* (Macmillan Reference, 2002), pp. 23-25..

"Cost-Effectiveness in Education," *Encyclopedia of Education, Second Edition* (Macmillan Reference, forthcoming), pp 495-498.

"Issues in Designing Cost-Effectiveness Comparisons of Whole School Reforms" In H. M. Levin and P. McEwan, Ed., *Cost-Effectiveness Studies in Education*, Yearbook of the American Educational Finance Association (Larchmont, NY: Eye on Education, 2002), pp. 71-96.

"Educating for a Commonwealth," *Educational Researcher*, Vol. 30, No. 6 (August/September 2001), pp. 30-33.

"An Interview with Henry Levin: A Concern with Disadvantaged Students," by Mark F. Goldberg, *Phi Delta Kappan* (April 2001), pp. 632-634.

"Bear Market," *Education Matters*. Peterson, P., Finn, C., and Greene, J. (eds.) (Hoover Institution: Stanford, CA., Spring 2001) Vol. 1, No. 1, pp. 6-16.

"Educational Reform in 2010: Indeterminacy," S. Tobias (ed.), *Education in 2010*. (New York: College Board).

"Waiting for Godot: Cost-Effectiveness Analysis in Education." In R. Light, (ed.), *Evaluation Findings That Surprise in New Directions for Program Evaluation*, No. 90 (Summer 2001), pp. 55-68.

"A Comprehensive Framework for Evaluating Educational Vouchers," In J. Oelkers, ed., *Futures of Education*. (New York: Lang, 2001), pp. 181-202.

"Pedagogical Changes for Educational Futures of Industrializing Countries," *Comparative Education Review*, Vol. 45, No. 4 (November 2001), pp. 537-560.

"High-Stakes Testing and Economic Productivity." In G. Orfield and M. Korrnhaber, (eds.), *Raising Standards or Raising Barriers? Inequality and High Stakes Testing In Public Education.* (New York: Century Foundation, 2001), pp. 39-49.

List of Publications (2001-2011): Clive R. Belfield

Books:

Belfield CR, and HM Levin (Editors and lead contributors) 2007. *The Price We Pay: The Costs to the Nation of Inadequate Education*, Brookings Institution Press, Washington, DC. Ms., 200pps, forthcoming.

Belfield CR, and HM Levin 2005. *Privatizing Educational Choice.* Published by Paradigm Publishers, Denver, CO.

Journal articles:

Bailey, T. and CR Belfield. 2011. The benefits of attending community college: A review of the evidence. *Community College Review*, **39**, 46-68.

Belfield, CR. 2010. The economic consequences of inadequate education for the Puerto Rican population in the United States. *Centro*, XXII, 3-26.

Belfield, CR. 2010. Over-education: what role does the firm play? *Economics of Education Review*, .

Addison JT and Belfield CR. 2008. The determinants of performance appraisal systems: A note (Do Brown and Heywood's results for Australia hold up for Britain?). *British Journal of Industrial Relations*, **46**, 521-531.

Belfield CR, and J Heywood. 2008. Performance-related pay for teachers. *Economics of Education Review,* **27**, 243-252.

Addison, JT and CR Belfield. 2007. Unions, training, and firm performance. *Journal of Labor Market Research*, 40, 361-381.

Belfield CR, Levin, HM, Muennig, P and C Rouse. 2007. Public investments in African American males. *Economics of Education Review*, **26**, 699-708.

Barnett, WS and Belfield CR. 2006. Early childhood education and social mobility. Princeton *Future of Children Series* **16** (2): 73-98.

Belfield CR, Nores, M, Barnett, WS, and L Schweinhart. 2006. Cost-Benefit analysis of a randomized field trial of early childhood education: the High/Scope Perry Pre-School Program. *Journal of Human Resources* **41** (1): 162-190.

Nores, M, Belfield CR, CR, Barnett, WS and L Schweinhart. 2005. Updating economic impacts of the High/Scope Perry Pre-School Program. *Educational Evaluation and Policy Analysis* **27** (3): 245-261.

Belfield CR. 2006. Vouchers and the Cleveland Scholarship Program: Little Progress So Far. *Economic Commentary, Federal Reserve Bank of Cleveland* March 1 issue.*

Belfield CR, 2005. Should Ohio invest in compulsory pre-schooling? *Economic Commentary, Federal Reserve Bank of Cleveland* February 15 issue.*

Belfield CR. 2005. Workforce Gender Effects on Firm Performance and Workers' Pay: Evidence for the United Kingdom. *Applied Economics* **37** (8): 885-891.

Belfield CR, and HM Levin. 2005. Vouchers and public policy: When ideology trumps evidence. *American Journal of Education* **111** (4): 548-567.

Belfield CR, 2005. The teacher labor market in the US: Challenges and reforms. *Educational Review* **57** (2): 175-191.

Belfield CR, and HM Levin. 2004. Should high school economics courses be compulsory? *Economics of Education Review* **23** (4): 351-360.

Addison, JT and Belfield CR. 2004. Unions and employment growth: The one constant? *Industrial Relations* **43** (2): 305-323.

Belfield CR, and HM Levin. 2004. The marketplace in education. *Review of Research in Education* **27** (4)183:218. Reprinted in Lauder et al. (Eds) *Education, Globalization, and Social Change*. Oxford University Press: Oxford, England.

Addison JT and Belfield CR. 2004. Union voice. *Journal of Labor Research*, **25**, 563-596.

Battu, HR, Belfield CR, and PJ Sloane. 2004. Transfers of human capital across the workplace: evidence for the service sector in Great Britain. *International Journal of Manpower* **25** (1): 123-138

Belfield CR, and XD Wei. 2003. Employer Size-Wage effects: Evidence from matched employer-employee survey data in the UK. *Applied Economics* **36** (3): 185-193.

Battu, HR, Belfield CR, and PJ Sloane. 2003. Human capital spillovers in the workplace: Evidence for Great Britain. *Oxford Bulletin of Economics and Statistics* 65 (5): 575-594.

Belfield CR, and HM Levin. 2003. The Economics of Tuition Tax Credits. *Proceedings: National Tax Association* 16 (2): 61-68.

Belfield CR, and HM Levin. 2003. The effects of competition on educational outcomes: a review of US evidence. *Review of Educational Research* **72** (2): 279-341.

Addison, JT and Belfield CR. 2002. What do we know about the new European Works Councils? *Scottish Journal of Political Economy* **49** (4): 418-444.

Belfield CR, and RDF Harris. 2002. How well do theories of job matching explain job satisfaction: evidence for UK graduates. *Applied Economics* **34**(5): 535-548.

Belfield CR, and HM Levin. 2002. The economics of education on judgment day. *Journal of Education Finance* **28** (Fall): 183-206.

Belfield CR, and HM Levin. 2002. Families as contractual partners in education. *UCLA Law Review* **49** (6): 1799-1824.

Belfield CR, 2002. Political preferences and the privatization of education: evidence for the UK. *Education Economics* **11**: 155-168.

Brown, C, Belfield CR, and SJ Field. 2002. Cost effectiveness of continuing professional development in health care: A critical review of the evidence. *British Medical Journal* **324** (March): 624-655.

Belfield CR, and JS Heywood. 2001. Unionization and the pattern of non-union wages: evidence for the UK. *Oxford Bulletin of Economics and Statistics* **63** (5): 577-598.

Addison, JT and Belfield CR. 2001. Updating the determinants of firm performance. *British Journal of Industrial Relations* **39** (3): 341-366.

Belfield CR, and A Fielding. 2001. Measuring the relationship between resources and higher education outcomes in the UK. *Economics of Education Review* **20**(6): 589-602.

Expert Testimony (2007-2011): Henry M. Levin

Arizona	"Espinosa"--testimony at trial.
Washington State	"McCleary"--Deposition.
South Carolina	"Abbeyville"--deposition and testimony at trial.
Georgia	"CASFG"--deposition.

Expert Testimony (2007-2011): Clive R. Belfield

Abbott vs. Burke, New Jersey State Education Funding January 2009 Education expert (deposition and testimony)

Kogut vs. Messina, child custody case, March 2009 Education expert (deposition and testimony)

Lally vs. Lally, child custody case, December 2008 Education expert (deposition only)