The Return on Investment for Improving California's High School Graduation Rate

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Abstract

We review a large range of educational investments that might ensure more students graduate from high school in California. We identify educational interventions for which there is reasonably solid evidence of their efficacy to raise the rate of high school graduation, those for which there is promise, and those for which we have no relevant information. For each of these interventions we calculate the costs to the taxpayer of delivering the intervention. We calculate the delivery costs and the cost of producing one extra graduate. We then compare these costs to the economic benefits to the taxpayer and to the overall citizenry of California from each additional high school graduate. Under most scenarios, the economic benefits are substantially greater than the costs. However, this conclusion is sensitive to the funding source: federal governments gain significantly more from education than state and local governments, even as the latter are primarily responsible for funding.

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1. Introduction

Graduating from high school has important economic consequences: the graduates themselves benefit; taxpayers benefit; and the broader society benefits. High school graduates in California – as in all labor markets across the U.S. – earn significantly more than dropouts over their lifetime. These amounts can be expressed as present values (PV) from the perspective of a person now aged 20 and with a lifetime of productive work ahead of him or her.[1] Estimates are reported for California in a companion paper (Belfield and Levin, 2007). For each new high school graduate, California taxpayers will gain $169,000 in additional tax revenues, and a reduced burden of lower expenditures on crime, health, and welfare; these amounts are split between federal savings of $115,000 and state savings of $54,000. Collectively, the state of California will reap a social gain of $392,000 over the lifetime of each new graduate, when we take into account the costs of crime on victims and the benefits to economic competitiveness when the state has more human capital. These economic returns should make a strong case to invest in education such that many more students graduate from high school.

However, each age group of students in California includes almost 120,000 persons who will not have successfully graduated from high school by age 20 (see Carroll et al., 2005); and if GED recipients are not considered as graduates, this number rises by another 8 percent. These individuals are jeopardizing their opportunity to become economically independent, and the state is squandering large fiscal and social benefits. From the state's perspective, it would be economically advantageous to offer publicly-

[1] Present value refers to the value from the current perspective of a stream of money over time. Present values might be thought of as equivalent to Certificates of Deposit for that amount of money.

funded education programs that increase high school graduation, subject to the finance constraint that additional programs do not cost more than the benefits.

In this paper we review a large range of educational investments that might ensure that more students do graduate from high school. After reviewing these investments we divide them into categories. The first category includes educational interventions for which there is reasonably solid evidence of their efficacy to raise the rate of high school graduation. For each of these interventions we calculate the costs to the taxpayer and compare these costs to the economic benefits to the taxpayer and to the overall citizenry of California from each additional high school graduate.

The second category includes educational interventions that are promising, but presently lack rigorous evidence as to their effectiveness in raising the rate of high school graduation or what they would cost. They are considered 'promising' because they have some of the features associated with effectiveness. At the high school level, these features are: (1) small school size where students and staff know each other; (2) high levels of personalization to address students' personal and academic needs; (3) high academic expectations as part of a rigorous curriculum; (4) counseling for students with personal and educational difficulties; (5) parental engagement to support school programs; (6) extended-time school sessions; and (7) competent, well-qualified personnel committed to the school's mission. However, the specific inputs required and their costs are not known with certainty, and they will vary according to which features are emphasized. For interventions in this category we report net present values as illustrations of their promise, rather than demonstrations of actual gains.

Finally, the third category includes interventions for which there is simply too little evidence or for which an alternative frame of evaluation is needed (e.g. privatization or accountability reforms). We list these interventions for completeness.

2. Searching for Evidence of Educational Effectiveness

2.1 Methodological Challenges

At the heart of much economic evaluation lies a conundrum: despite the copious literature on the economic gains from each additional year of schooling, there is very limited evidence on what resources are needed or required to produce that extra attainment. The available evidence does not provide much guidance on what types of educational investments are optimal under a given set of circumstances (Mervis 2004), even as most economists are agreed on the proposition that some sort of investment should be made.

There are a number of reasons why the evidence on effective education interventions is thin. First, many interventions are proposed and advocated without any empirical evaluation of their effectiveness; in their review, Carneiro and Heckman (2002a, 87) conclude that "There is no shortage of policy proposals. There is, however, a shortage of empirical evidence on the efficacy of the proposed policies". In part, this reflects ideological and political beliefs as to what 'works' and the efficacy of the public school system.

Second, where evaluations are performed, they often fail to follow standard research methods. As Neumark (2006, 315) observes, "The evidence generated from local providers may fall far short of standards for convincing evidence… raising

questions about the decision-making of local providers based on this evidence, and the quality of the evidence provided to policymakers". Levin (2001) describes as "rhetorical" the methodology of most economic evaluations of education programs, with most studies only reporting the program's impact in the absence of reliable data on educational outcomes and their cost (King Rice 2002). Indeed, there is not much incentive for education providers to discover which programs are not cost-effective, as this might lead to reduced funding.

Third, evaluating educational interventions is far from straightforward. Education provision is a complex activity, involving many stakeholders, each with only partial influence over the children being educated. Overwhelmingly, family background differences determine educational outcomes, with the effects of a particular school or program significantly less important (Rumberger, 2004). Moreover, family background typically overlaps and is confounded statistically with school quality, creating difficulty in separating the influence of the former from the latter. Educational programs have diverse consequences, including the development of cognitive and non-cognitive skills (Heckman et al., 2006), and the relative importance of these skills in determining productivity and income cannot easily be weighed. Isolating causality from a single intervention is therefore challenging. For economic evaluations, complications arise because cost data are often incomplete: accounting data is often confidential; some resources are provided 'in-kind'; and funds are obtained from multiple private and public sources.

Notwithstanding the challenges, it is imperative for public policy to ascertain the fiscal and social benefits from high school graduation by determining which interventions work and whether the benefits of providing them exceed their costs.

2.2 Searching the Evidence Base

The search strategy for raising the graduation rate had two components. First, we searched the academic journals for published articles on determinants of the rate of graduation or dropout. Second, we examined web-based literature, including the research posted in educational clearinghouses that typically focuses on reviewing 'what works'.[2]

Any type of educational change that might raise the rate of graduation was considered. These included: reforms to induce systematic and large-scale organizational or institutional change (e.g. accountability mandates); policies to influence classroom conditions (e.g. reducing class size); programs applied to some children or in some settings (e.g. pre-school); and specific, small-scale treatments (e.g. peer tutoring). Because we were unsuccessful in locating interventions outside of the school (such as family engagement programs) that promsied higher graduation rates, these are not included in this study, though they should be considered as evidence on their effectiveness increases.

The research was appraised according to methodology. Experimental research is given priority, but other methods are included. Quasi-experimental research studies are considered more valid than econometric studies with controls but no method of evaluation was ruled out. Studies were also appraised according to their relevance to the education system in California.

[2] These included: www.childtrends.org; www.campbellcollaboration.org; www.whatworks.ed.gov; www.evidencebasedprograms.org; and www.promisingpractices.net.

2.3 Costing Out the Gains in High School Graduation

For each educational change that demonstrated improvements in the graduation rate, we applied a price index to account for the differences in costs in California. These costs account for the relatively higher expense of education in California relative to the national average: Chambers (1998) and Taylor and Fowler (2006) estimate that costs of providing educational services are 9.5%–12% higher than the U.S. average. Below, all cost figures are reported in California prices. These costs are calculated such that they can be appropriately compared with the economic benefits reported in Belfield and Levin (2007).

Ideally, we like to calculate costs based on the ingredients or inputs used for each intervention (see Levin and McEwan, 2001) however, this is only possible for the five selected interventions (those with demonstrated impacts on dropout rates). For the other interventions we rely on the costs reported in the evaluations. Since there is no evidence that these costs were derived using the standard ingredients method, we cannot verify their accuracy and we report these interventions separately. The evidence on effectiveness in increasing high school completion is also based upon less rigorous evaluation methods, so these results too should be considered provocative and not definitive. That is, both the costs and the effectiveness in reducing dropouts on the supplementary list of promising interventions should not be viewed with the same assurance of reliability as the five key interventions that we analyze.

Two costs for each intervention are derived. The first is the cost of implementation per student (the 'unit cost' of delivering the program to one student). The second is the cost to yield an additional high school graduate. Certainly, the latter

greatly exceeds the former because no intervention provided to a student guarantees that a potential dropout will definitely become a high school graduate; and many students who appear to be potential drop-outs would have graduated anyway. It may be necessary to offer interventions to many students to yield one additional graduate. But, if an intervention can be more closely targeted to just those students on the margin of dropping out, it is likely to be substantially more cost-effective.[3] Thus, for each intervention it is important to consider how accurately it can be targeted.

Importantly, we can only calculate average costs and not marginal costs. Strictly, the decision to invest in programs to yield extra high school graduates should consider the marginal cost; however, this cost is typically not available. For small-scale programs implemented in new settings it may be reasonable to assume that marginal cost is close to average cost. But for larger-scale programs, marginal costs may exceed average costs.[4] We include sensitivity tests for this difference below, in Section 4.

The interventions take effect at different points in a child's schooling (e.g. in pre-school or high school). So the cost of each intervention must be transformed into present values.[5] This means that they can be compared on a consistent basis of when in the course of a child's educational experience the investment must take place. For example,

[3] Such identification is challenging because many potential interventions must be provided in the pre-school or early childhood years or at adolescence rather than in high school, so the concept of "at the margin of dropping out" is hardly a straightforward targeting tool.

[4] Of course if scaling up an intervention provides the possibility of better teacher training for that intervention and organizational learning, the marginal cost could be less than the average cost of a small-scale example.

[5] Present value refers to the fact that a benefit received in the future has less value than one received at present. Therefore future benefits are discounted by a rate of interest to obtain a comparable present value. This is precisely why a lottery winner of $ 1,000,000 can get annual payments of $50,000 for 20 years adding to one million dollars in future payments or can elect to get a flat amount immediately that is more on the order of $650,000, the present value of a stream of $50,000 a year for 20 years. That is, the lottery winner can ask for the present value of the future payout. Bear in mind that if $ 650,000 is invested at an appropriate interest rate for 20 years, it will add up to $1,000,000. What we have done is converted future benefits received over many years to their present value to society for each person at age 20. For a more detailed explanation on present value, see Levin & McEwan (2001), pp. 88-94.

a pre-school investment will not yield any income gains for at least 12 years, whereas a high school investment may yield income gains in only a few years. These present values adopt the perspective of an individual student by age 20, and a 3.5% 'discount rate' was applied (see Moore et al., 2004).[6]

Finally, in these calculations of costs we show only the costs of the intervention itself for all students who receive it and for each additional graduate. In the final analysis we account for the costs of additional years of schooling that students must undertake to graduate from high school and, for those students who continue to post-secondary education, the cost of college. These additional public costs are included in the fiscal calculations in Belfield and Levin (2007).

3. Evidence on How to Raise the Rate of High School Graduation

3.1 Raising Teacher Quality

There is strong evidence that teachers vary in their effectiveness at raising student achievement (Wayne and Youngs 2003; King Rice 2003) and that the cumulative effect of having more effective teachers over the K-12 years is significant (Hanushek and Rivkin 2004; Rivkin et al. 2005). Investing in more high quality teachers may therefore be considered worthwhile.

However, the specific attributes that make for a 'high quality' teacher are not easily identifiable in advance. Practically, the one way to attract better teachers is to offer higher wages (as part of their baseline salary) and to select teachers who are most

[6] So, for a given yield of new graduates, a nominal $1,000 investment in pre-school would be 'more expensive' than a nominal $1,000 investment in a high school reform: for the former, there would be a lag of at least 12 years before the graduation rate could be affected; for the latter, the lag would only be 1-2 years.

promising and retain those who have the best student results. Although some economists believe any increase in wages will simply accrue as windfall payments to current teachers and induce no extra effort (Ballou and Podgursky, 1995), there is considerable turnover among teachers (e.g. resignations and retirements) that allow for new hires from an enhanced talent pool. Generally, it would be a very extreme position to say that increasing the wage would have zero impact on teacher quality.

A credible estimate of how an increase in wages for teachers would raise graduation rates is from Loeb and Page (2000). Using state-level panel data, Loeb and Page (2000) estimate the association between higher teacher salaries and high school graduation rates ten years later; they also perform a sub-analysis for districts in California to illustrate consistency in their findings. Their analysis improves on prior work by including controls for the *opportunity cost* (relative wages in other jobs) of teaching. Loeb and Page (2000, 406) also find 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 California $3,200 per student; however, the cost per additional graduate is $63,800 (also in present values).

An alternative to paying teachers more is to reconfigure the teacher labor force by allocating, hiring, and firing teachers according to their success in the classroom. Yet, this reconfiguration is difficult because of limited evidence on what constitutes success and how to measure it independently of other school and home influences on students. Hanushek (2006, 459) maintains that "Estimating the costs of achieving improvements in the teacher force is generally impossible based directly on current data. We simply have

limited experience with any policies that alter the incentives for hiring and retaining high quality teachers" (see also Lankford et al., 2002); however, there is plausible evidence that teachers improve with experience, at least for the first few years (Wayne and Youngs, 2003). Thus, reducing teacher turnover among novice teachers is a useful way to improve teacher quality and so student outcomes. There is some debate as to whether increasing pay levels will help retain good teachers in the profession, and ensure that they spend time teaching at-risk students. Hanushek (2006, 548) acknowledges that "Changing the quality of (the) teaching force almost certainly must rely upon either salaries and other employment terms that are directed at quality or on differential retention policies". But Ballou and Podgursky (1995) argue that increasing teacher salaries does not greatly improve teacher quality (in the absence of careful teacher selection and retention policies); and performance-related pay in teaching has not been successful (Ballou, 2001). Given this lack of consensus, reconfiguring the teacher labor force is not included in this cost-benefit analysis.

We agree that improvements in teacher salary need to be accompanied by improvements in teacher selection, professional development, and evaluation for tenure relative to the present system. However, increasing evidence suggests that higher salaries can attract greater talent, as reflected in higher test scores and college quality, for example, There is also some evidence that even these relatively narrow measures of teacher quality are related to student achievement (Levin, 1970; Wayne and Youngs, 2003; Loeb and Reininger, 2004).

3.2 Reducing Class Size

One popular policy for improving educational outcomes is to reduce class sizes. Evidence from Tennessee's Student Teacher Achievement Ratio (STAR) Project shows strong advantages from being in smaller classes: students randomly assigned to smaller classes were more likely to graduate from high school than students assigned to larger classes (Finn et al., 2005). Students in smaller classes in elementary school reported graduation rates that were 11 percentage points higher than students assigned to regular classes. The impacts were even greater – at 18 percentage points – for children eligible for free lunch.

In 1996 California implemented a class size reduction policy on a large scale, reducing average class size to 20 across 18,000 classrooms in K-3 schools across the state (Bohrnstedt and Stecher, 2002). However, initial evaluations of the policy failed to find achievement gains for students in smaller classes (in part because newly recruited teachers were less experienced and less qualified, see Ogawa et al., 1999). Recently, based on National Assessment of Educational Progress (NAEP) data, Unlu (2005) finds that California's class size reduction policy did yield significant academic gains. Also, state funding for reducing class size was relatively low, at $930 per child in 2004, in small classes (with a one-time facilities grant of $40,000). This is considerably below the costs incurred in Project STAR (and probably lower than the actual costs which had to be supplemented from local sources).

Therefore, we include class size reduction as a policy that, if adequately funded and implemented, should raise high school graduation rates. 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 'unit cost', i.e. the cost

per child affected by the change, is $14,410 (PV). With a 'yield' of 11 new graduates per 100 students, the cost per new graduate is therefore $131,000 (PV).

However, this may understate the benefits from reducing class size because students eligible for free lunch benefited considerably more. If we apply the yield of 18 new graduates, per 100 students, the cost per new graduate falls to $80,060 (PV).

3.3 Publicly-funded Pre-School

Expanding pre-school provision is possibly the most compelling investment on economic grounds. The evidence is based on high-quality research methods with full cost–benefit analyses from both the private and public perspective; and it is almost completely consistent in identifying impacts. The three most frequently cited programs are the High Scope/Perry Pre-School program, the Chicago Child–Parent Centers, and the Abecedarian program (see the review by Barnett and Belfield, 2007). Separate evaluations have found that each intervention will yield significant economic returns over the lifetimes of participants, and that these easily exceed the costs.

For California, we investigate the economic returns from pre-school from several approaches. First, we consider an application of the Perry Pre-School program for California. This program increased the high school graduation rate by 19 percentage points. The unit cost of delivering the program to one student is estimated at $13,800, with a cost per additional graduate at $72,400 (PV). Second, we repeat this method based on the results from the Chicago Child-Parent Centers. This program increased the high school graduation rate by 11 percentage points. The unit cost of delivering the program to each student was $5,200, and so the cost per additional graduate was $47,000 (PV).[7]

[7] For both pre-school programs we count the costs net of savings in special education.

In addition, an extensive investigation of the economic benefits of pre-school for California was performed by Karoly and Bigelow (2005). The researchers generate a universal pre-school program with a 70% take-up across the cohort of 550,000 four-year olds. The unit costs are $4,400 (2005 dollars) and the economic benefits are projected based on modified parameters from the Chicago-Child Parent Cent ers program. Figures are present values at age 3. The benefits – counted for all participants, not just the new graduates – amount to $11,800 per participant. The benefit–cost ratio for California is 2.62. The pay-off is even greater if benefits to the rest of the U.S. are included. Hence, this research already establishes the benefits to the state from investments in pre-school.

3.4 Head Start

Head Start represents the most significant comprehensive child development intervention by the federal government. Annual spending on Head Start in California is currently $8,400 per participant (DHHS, 2007). Recent evidence has found academic gains from Head Start, of the order of 0.10 to 0.24 standard deviations for language and cognitive abilities (see Barnett and Belfield, 2007). It is considered separately here because it is primarily a federal program rather than a state program; the return on investments in Head Start will therefore depend critically on the extent to which the state can obtain federal funding.

Economic calculations suggest that Head Start may be a good investment. In their cost–benefit analysis, Ludwig and Phillips (2007) calculate that the program pays for itself, even if the academic benefits are only 0.05 standard deviations. Over the long term, Garces et al. (2002) found increased rates of high school graduation and college attendance by 20 percentage points for White children, but not at all for African

American children. Pooling the sample, the graduation rate might be 12 percentage points higher for a present value investment of $13,600 per child; and the cost per new high school graduate would be $113,300 (PV). Finally, Ludwig and Miller (2006) estimate that doubling the amount of resources for Head Start would raise attainment by one year of education. Very approximately, each dropouts might become a high school graduate with quadruple the resource for Head Start. Expressed in present values at age 20, the commitment necessary for this would be $54,400 per child.

3.5 Secondary School Interventions: First Things First

The strongest example of a successful reform at the high school level is the Institute for Research and Reform in Education's **First Things First** (FTF). This program emphasizes small learning communities (less than 350 students), long-term teacher student relationships, mentoring, and teacher advocacy for each student with a rigorous curriculum (Quint et al., 2005). In a research study using interrupted time–series data, FTF generated higher graduation rates by 16 percentage points as a result of the intervention. Levin et al. (2007) estimate the costs of this program at $5,400 per child. Adjusting these costs for California prices, the present value unit cost of FTF is estimated at $6,100 (PV). The cost per new high school graduate is $37,800 (PV).

3.6 Secondary School Interventions: Possible Alternatives

A recent review by the 'What Works Clearinghouse' (WWC, 2006) identifies a number of secondary school programs intended to reduce the dropout rate. High quality evaluations have been conducted for each, and although the findings for each have been mixed, there is some evidence of gains in terms of reduced dropout rates. However, we are reliant on reported costs data for these interventions which cannot be verified. Therefore, we

separate these from First Things First, for which we have calculated costs according to the ingredients method. As for all the other interventions, we apply a California price index and express the costs in present values.

Achievement for Latinos through Academic Success (ALAS) is a program that assigns counselors to monitor attendance, behavior, and achievement. The counselors work with the children and their parents to ameliorate problems, offer remediation, and provide feedback on school progress. An evaluation (of this program) using an experimental research design was performed by Gandara et al. (1998). For a sample of 81 students in California, ALAS did reduce the probability of dropping out in 10th grade: whereas 86% of the ALAS participants were still enrolled, only 69% of the control group were. By 12th grade, the respective graduation rates were 32% and 27%. However, these differences – based on the small sample – were not statistically significant. If these graduation rate differences are genuine, then if the ALAS program were delivered to 100 at-risk students, five new graduates would result. The present value unit cost of the ALAS program over three years is approximately $3,200 per participant. The cost per new high school graduate is $64,000.

Career Academies are school-within-school programs intended to promote employment readiness. Students are instructed with career-related materials and supported to gain work experience at local employers, with academies operating across the U.S. (Maxwell and Rubin, 2000; for California, see Stern et al., 1989). One randomized trial evaluation for 1,764 students was conducted by Kemple and Snipes (2000). It found significant reductions in dropout rates for the sub-sample of at-risk students over the control group (21% and 32%), but no impact on those students who

were low or moderate risk. Assuming Career Academies are targeted to at-risk youth, if the program is delivered to 100 at-risk students, 11 new graduates would result. The present value unit cost of the program over three years is approximately $2,000 (California prices, 2005 dollars). The cost per additional high school graduate is therefore $18,200.

Check & Connect is a program to (a) monitor and assess student performance and (b) mentor students to improve behaviors and academic outcomes. It is implemented in school districts in Minnesota and targeted to at-risk students. An experimental evaluation was performed for 94 high school students in Minneapolis (Sinclair et al., 2005). Again, the evidence is mixed: there is no clear evidence that the program raises the graduation rate, but at least by 12th grade the dropout rate of program participants was considerably below that of the control group, at 39% compared to 58%. Assuming Check & Connect is targeted to at-risk students and the dropout differences translate into graduation rates, then a program delivered to 100 students would generate 17 new graduates. The present value unit cost of the program over four years in California would be approximately $5,160. The cost per additional high school graduate is $30,400.

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. Importantly, this is a federally-funded program, with federal spending of approximately $800 per participant; state and local agencies also contributed to the program (but these amounts are unknown). Evaluations by Constantine et al. (2006) found that high school completion rates were 9 percentage points higher for those who had participated in Talent Search. The unit cost of the program to the federal

government per participant is approximately $800; the federal cost per new high school graduate is therefore $8,900.

Twelve Together is a program offering peer support and mentoring in middle school and high school. Students participate in weekly after-school discussion groups. A randomized controlled trial of 219 8th graders in California found that the dropout rate for participants was five percentage points lower than the control group (Dynarski et al., 1998). In present values the unit cost is $4,080. The cost per additional high school graduate is therefore $81,600.

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 a selected class of 6th graders and the funding sponsors who are actively engaged with the students and the school and provide financial support 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. The cost of the program is approximately $20,400 per child enrolled, although this cost may be an understatement insofar as it does not include in-kind resources representing the considerable involvement of the sponsors and mentors. Given its limited effectiveness, the program costs over $200,000 to yield a new high school graduate.

3.7 Whole-school Reform

Whole-school reforms may change the culture and organization of a school to enhance educational outcomes; however, there are few economic analyses of whole-school reforms, despite the substantial cost involved in implementing them (Levin 2002).

One whole-school reform model which has been evaluated is **Success for All**. This reform focuses on promoting early school success among educationally at-risk

students. Success for All includes materials, training, and professional development to implement a school-wide program for grades K-5 to ensure every child will reach third grade on time. It serves approximately 1 million children in 2,000 schools. The evaluation by Borman and Hewes (2002) shows 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. Specifically, the effect size gains in reading and math were 0.3 and 0.1 respectively. These gains are about equivalent to the gains from Project STAR to reduce class size. With considerable caution, we might assume a similar yield in terms of new high school graduates. Under this assumption, the cost per student of Success for All is $3,100 over four years of elementary schooling. In present values, this is $19,100 per student or $173,400 per new high school graduate (if 11 new graduates are produced).

3.8 After School Programs and Summer School

A potentially promising policy is to offer more after school programs or (as suggested by Carneiro and Heckman, 2002a) summer school. These can directly raise attainment and may reinforce classroom learning; and summer school may ameliorate the phenomenon of 'losing ground' for minorities and lower socioeconomic students when school is not in session.

Lauer et al. (2003) review the positive impacts of out-of-school educational strategies across the U.S., but only academic test score outcomes are considered. For California, LA's BEST (Better Educated Students for Tomorrow) is the largest after-school program producing modest gains in achievement and students' attitudes towards learning (Huang, 2000). However, a recent high-quality evaluation of the 21st Century

Community Learning Centers, a $1 billion federal program, found no effects on academic achievement or homework (James-Burdumy et al., 2004). As some of LA's BEST programs follow this model, it is unlikely that after-school programs will reduce the dropout rate significantly (but see Brown et al. (2002), who project California's *After School and Education Safety Act* (2002) to generate significant economic benefits). Of course, changing the content and focus of these programs from what is presently offered could have different outcomes.

Based on an experimental field trial in Baltimore, Borman and Dowling (2006) show that summer school is effective: after two successive summer schools, the treatment group is approximately 0.5 standard deviations ahead of the control group in test scores. A meta-analysis by Cooper et al. (2000) gives an effect size gain of approximately 0.2 across the U.S. Again, we consider translating – with some caution – these gains into gains obtained from Project STAR, which yields an 11 percentage point increase in the graduation rate. Under this assumption, annual costs for the Baltimore program are estimated at $815 per student, with an additional $700 in in-kind resources. Using California prices and adjusted to present values, unit costs of summer school amount to $3,700, and the cost per new additional graduate is $34,100.

3.9 Other Educational Investments

Other policies and interventions might be considered. These other interventions might include: KIPP academies, High School Puente, Boys and Girls Clubs of America, Sacramento START, Sponsor a Scholar, AVID, the Institute for Student Achievement,

Talent Development, and Project GRAD.[8] These interventions were excluded either because there has been no rigorous evaluation, there are no effects on graduation, or because information on high school graduation was not available. Two programs reviewed by WWC (2006) are not considered here: High School Redirection is not included because it is no longer operating, and Middle College High School did not generate sufficient benefits in terms of high school graduation (WWC, 2006).

Similarly, although there is some evidence of better outcomes in smaller schools (Kuziemko, 2006), a policy to reduce school size is excluded because cost calculations are too imprecise and the specifics of what is done with smaller schools must be identified because it affects both their costs and effectiveness. Grade retention is not considered because there is general agreement that it does not pass a cost-benefit test: it imposes additional costs on a school system and appears to disadvantage the retained students (Temple et al. 2003). Also, peer tutoring is an intervention which might easily pass a cost-benefit test; indeed, Wolfe and Tefft (2004) list this as a 'most promising' intervention in their review. However, this intervention is primarily attractive because it enlists children to teach other, but also shows strong results for both tutor and tutee. Indeed, any peer-tutoring program that is effective should yield a very high rate of return.

Privatization reforms to create more options for parents and more competition between schools may be effective in raising outcomes. Specific policies might include promoting inter-district enrollments, encouraging private schools and charter schools, and the introduction of voucher programs as well as the promotion of competition between schools. However, there is very little solid evidence that privatization will raise the rate

[8] Although Project GRAD showed modest early gains in achievement, an evaluation by MDRC showed negative impacts on high school graduation (Snipes et al., 2006). Similarly, Talent Development was not included because of no evidence (CSRQ, 2006).

of high school graduation. On open enrollment programs, the Chicago lotteries analyzed by Cullen et al. (2005, Table 6) show no gains from winning a place in a preferred school in terms of dropping out in 9th or 10th grade. On private schooling, Neal (1997) does not identify any increase in attainment from attending Catholic school. Zimmer and Buddin (2005) do not find that charter schools in California are outperforming local public schools. Similarly across the U.S., there is no evidence on how voucher reforms would raise the rate of high school graduation other than by assuming the moderate gains in achievement would translate into gains in attainment (Figlio and Rouse, 2006). Several studies do find an effect of school competition on attainment (see Belfield and Levin, 2002). For example, Dee (1998) estimates a one standard deviation increase in private school places will raise the high school graduation rate by 1.7 percentage points. Yet, the costs of privatization reforms are not easily identified (Levin and Driver, 1997) and it is not clear how to increase the number of private schools within a district.

One reform that may be a good investment is to raise the standards on exit-based exams. This reform appears attractive because it might be low cost: schools already impose some form of assessment, so a replacement should not be expensive, and tougher exams mean students will have to work harder (and their time is not a cost to the public purse). Accountability frameworks may therefore help in raising achievement for some students (Hanushek and Raymond, 2005). However, imposing exit-based tests may discourage students from accumulating attainment, reducing education levels for those who expect to fail the test. The net effects – as found by Dee and Jacob (2006) – are gains for those pushed to study harder and losses for those who drop out early. The net effect on the dropout rate is therefore small.

Finally, libertarian economists might argue that tax relief (or higher incomes from greater opportunities in the labor market) would allow parents to invest their private investment in the education of their children. Thus, one educational policy might be to raise either family incomes or the economic status of youth. However, the effect of short-run changes in family income on children's educational attainment is not especially strong. (The effect of socioeconomic status on educational outcomes is powerful, but status encompasses more than income). Blau (1999) finds weak effects from current income. Carneiro and Heckman (2002b) find that 'permanent income' is important, but that 'transitory changes in income' are not significant at any age. Taylor et al. (2004) find similar effects, but that increases in permanent income are not dramatically larger than the effects of educational interventions. Duncan et al. (1998) find family income at early ages is more important than at later ages. Recently, Dahl and Lochner (2005) have identified a strong effect of family income on test scores (up to 0.2 standard deviations) through increases in the Earned Income Tax Credit. Yet, evidence on how the rate of graduation would be affected by higher family incomes is not clearly established.

California has introduced a program to provide financial incentives to a target youth group. With Cal-Learn, family support payments are related to course grades, and students who complete high school (or obtained a GED) received a $500 award. An evaluation by Mauldon et al. (2000) using an experimental research design found lower dropout rates, but that the difference in graduation was attributable to high rates of GED completion, not high school completion. As GED receipt is not equivalent to a high school graduation diploma (Murnane et al., 2000), this program is not included in the cost-benefit analysis.

Of course, we are not constrained to select just one intervention. It is possible to offer multiple interventions within the context of a wider organizational reform. As Carneiro and Heckman (2002a, 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. But, fundamental or incremental, it is still necessary to calculate the costs of any reforms and their likely effectiveness.

Finally, our review suggests some areas for prioritizing reforms. Clearly, a lot of educational investment must be spent on teaching personnel, so reforms to the teaching profession should be investigated further. Further investigation should look at what makes teachers more productive (e.g. how absenteeism and turnover rates can be reduced, or how job satisfaction can be enhanced, particularly through improvements in working conditions), as well as how better teachers raise student achievement. Also, California has a large immigrant population and more research should be performed on interventions that help those with very low levels of education or limited English.

3.10 Summary of the Costs of Educational Interventions

On this reading of the literature, there are some – but not many – educational investments that clearly demonstrate an impact on the rate of high school graduation. (Others may yield raise high school achievement, but we do not have information on the long-run economic consequences of these). Table 1 summarizes the costs and yield for each of the reforms discussed above. We divide the interventions into those for which there is demonstrated evidence of improvements in the rate of high school graduation (along with

costs calculated using the ingredients method) and those for which there is some promise but less reliable data on effectiveness and costs (Sections 3.1-3.5 versus Sections 3.6-3.8). We also consider Head Start reforms; these are separated because these are heavily dependent on federal funds. We remind the reader that all costs are summarized in present values at age 20.

In Table 1, the first column reports the unit costs, i.e. the costs per student of delivering the intervention. These range from $800 to over $50,000. The second column reports the additional numbers of graduates if the intervention was given to 100 students. These figures range from 19 down to 5 new graduates (with one Head Start intervention being structured as if it might guarantee graduation).

The final column of Table 1 shows the cost per additional graduate (column 1 multiplied by 100 divided by column 2). These costs show considerable variation: they range from $203,500 for expensive, moderate-yield *I Have a Dream*, to $18,200 for low-cost, moderate-yield *Career Academies.* (The cost for Talent Search is certainly understated, but we report this for completeness). For interventions which have demonstrated effectiveness (the top panel of Table 1) there is also a considerable spread: from $37,800 up to $131,000.

4. Cost-Benefit Analysis of Educational Interventions

4.1 Net Present Values of Effective Interventions

Here we compare the public costs for each of the education changes reported in Sections 3.1 to 3.7 with the fiscal benefits of high school graduation. The fiscal benefits of graduation are additional tax revenues from higher earnings as well as reduced government expenditures on health, crime, and welfare, net of the costs of supporting

students during their additional years of high school and (for some students) college. Adopting the same perspective – individuals currently aged 20 – we estimate the lifetime earnings and tax payments by education level. Based on a large amount of evidence, it is reasonable to assume that any differences in earnings by education level are causal. We then calculate the differences in these lifetime values between dropouts and high school graduates (who also have a probability of going on to college). A similar method is used for differences in government-funded health programs (Medi-Cal and Medicare) and for welfare receipt; for crime, we use estimates of the causal impact of crime taken from Lochner and Moretti (2004). The lifetime gains to the taxpayer for each new high school graduate are the sum of the differences in each domain. Full details of these fiscal benefits are reported in Belfield and Levin (2007).

As summarized in Table 2, state/local governments in California will obtain fiscal benefits of $53,600 per new high school graduate; and the federal government will reap an additional benefit of $115,300. Finally, the state of California would obtain total social benefits of up to $391,900 when we include state/local fiscal benefits plus social gains in terms of lower crime, higher incomes, and higher economic growth for the State.

Table 3 presents the comparison between the costs of each demonstrated intervention and the respective benefits from new high school graduates. The first two columns assume that the intervention is funded by state/local governments who are assumed to receive the state/local benefits but not the federal benefits. Thus, although the full costs per new graduate are incurred by these entities, the benefits received are only $53,600. Nevertheless, there are several interventions with demonstrated impacts on the graduate rate where these state/local benefits exceed the costs. Specifically, First Things

First and the Chicago Child-Parent Centers programs both have benefit-cost ratios greater than 1 and positive net present values (benefits minus costs).

The second panel of Table 3 shows the cost-benefit ratios when all fiscal benefits of local, state, and federal governments are included. This may be a preferred assessment if programs are funded from across government agencies, and if federal government revenues are all spent within California. It means that the economic benefits are now $189,000 per additional high school graduate. Each of the interventions with a demonstrated impact on the graduation rate has a benefit–cost ratio that is greater than 1 and so a positive net present value.

As shown in the bottom panel of Table 3, the returns to investment in Head Start are also positive. The present value unit cost of one year of Head Start is $14,500. The cost per new high school graduate is estimated at either $54,400 (extrapolating from Ludwig and Miller, 2006) or $113,300 (from Garces et al., 2002). Both of these numbers are below the federal benefits from each new high school graduate, at $115,300, and significantly below the sum of federal and state/local benefits. The benefit–cost ratio ranges from 3.11 to 1.49. It is unlikely that further state/local funding in Head Start is justified without some matching funds from federal sources.

Table 4 shows the cost-benefit ratios for the promising interventions. To repeat, we separate these interventions out because we have considerably less confidence in either the effectiveness or the costs data. Nevertheless, we report the ratios to illustrate how sensitive the results would need to be to affect the overall conclusions.

Counting only the state/local government benefits, there are several promising interventions where the fiscal benefits exceed the costs. These are Talent Search, Career

Academies, Check & Connect, and summer school programs. If we add in the federal benefits, the economic rationale for investment is strengthened further. The median benefit-cost ratio is between 2.64 and 4.95. Only two of the promising interventions fail to satisfy this economic criterion: Success for All and I Have A Dream (and the former is very close to break-even, but we are less certain of the accuracy of these data).

Finally, it is worth noting that each of these interventions easily passes a cost–benefit test if we apply as our criterion the benefits to the entire state. As shown in Table 2, these benefits amount to almost $400,000, well above the cost of even the most expensive, low-yield intervention.

4.2 Sensitivity Testing

These results are unlikely to be overturned by different assumptions. It is important to recognize that our calculations are grossly conservative in one respect: they assume that an intervention to increase the number of high school graduates will have zero impact either on students who would have graduated anyway or on students who still fail to graduate. In both cases there may be considerable benefits from academic enrichment that are not captured when restricting outcomes to additional graduates. The only benefits that are being counted are those that result from one additional student now becoming a high school graduate. Yet, it is likely that even those who still fail to graduate will have accumulated some skills, and those that would have graduated anyway will have had their skills reinforced. Hence, the overall conclusion – with a median benefit–cost ratio of 2.65 – appears to be robust.

However, these results will be significantly influenced by two factors. The first is how fast costs will rise if the intervention is expanded. Based on the benefit–cost ratios,

marginal cost will have to be more than double that of average cost for the median intervention (increasing teacher salaries). In the case of "new" interventions, there is also the possibility that costs will decline as teachers and schools implement the reform as part of their training and supervision routines. The second is the extent to which an intervention can be targeted. Throughout we have assumed that the interventions cannot be well targeted. If they can be perfectly or more precisely targeted, then the benefits will exceed the costs by very large amounts.

Finally, we recognize that it is very unlikely that a single type of investment will yield significant economic returns in each situation. Some students will be reluctant to participate and the benefits will not apply to all students (Grissmer, 2002); some programs may not be implemented faithfully in all settings (Stern et al., 1989); and some small programs may not be as effective when scaled up. Also, given the sizeable benefits to the federal government, it is important to consider how federal policies can be structured to promote high school graduation.

5. Conclusion

There are a number of potential interventions which may be effective in reducing the dropout rate in California, and these interventions should pass a cost–benefit test from the perspective of a taxpayer within the state.

Some economists and policymakers may be skeptical, contending either that public education is so inefficient that no extra resources should be allocated without a dramatic organizational reform, or that we possess zero knowledge on where to allocate resources. Our analysis does not preclude organizational reform; such reform would not

however be costless. On resource allocation, Hanushek (2004) has asked, "What if there are no best practices"? But this is too narrow a question to be useful for public policy. The quest is not for the most efficient investments, but simply for ones that yield a positive return. Our analysis shows both how much could be spent on interventions and how effective these interventions would need to be before they would yield negative returns.

We are mindful that these interventions would need to be implemented faithfully and would need to be as effective when scaled up. These conditions are not simply to meet, such that raising the graduation rate is a straightforward task. The state and local agencies must focus on effective implementation of new policies, even when they have been found to be effective and cost-effective. But as comparison, we should note that the average student will receive public funds of $170,420 for their K-12 education in California (PV). This in itself is less than the economic benefits per new high school graduate of $189,000. It might also be compared to the unit costs of the proposed interventions, few of which entail additional funding of more than 10% ($17,042) of average spending. Thus, given the low rates of graduation, most of the reforms would envision an increase in spending of less than 10%.

One promising intervention for California is further investment in pre-school (Karoly and Bigelow, 2005). Generally, it seems to be more efficient to invest early in a child's education rather than late. This is not because pre-school is 'cheaper' (it is necessary to wait at least 12 years for an impact on graduation), but rather because human capital accumulation is 'dynamic'. Higher level skills cannot be obtained without the foundation of earlier, lower level skills (on investing in young children, see Isaacs,

2007). Thus, interventions in high school to reduce the dropout rate must overcome accumulated deficiencies in academic ability. However, there are effective reforms for high school students, and these too pass a cost–benefit test. Indeed, these reforms may have two advantages: there is not a long lag between the investment and the outcome (graduation); and high school reforms can be more accurately targeted to at-risk students, using prior academic standing as an indicator of the likelihood of dropping out. There are also a set of promising interventions that – if they can be demonstrated as effective – also appear to pass a benefit–cost test.

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Table 1
Possible Interventions to Raise the Rate of High School Graduation in California

		Unit costs per student	Extra high school graduates per 100 students	Costs per additional graduate
Interventions demonstrated to raise the graduation rate:				
TSI	Increasing teacher salaries by 10% for the K-12 years	$3,190	5	$63,800
CSR – population	Reducing class sizes in elementary school across all students (Project STAR)	$14,410	11	$131,000
CSR – free lunch eligible	Reducing class sizes in elementary school for free lunch eligible students only (Project STAR)	$14,410	18	$80,060
PPP	High/Scope Perry Pre-school Program	$13,570	19	$72,370
CPC	Chicago-Child Parent Center program	$5,170	11	$47,000
FTF	First Things First high school reform	$6,050	16	$37,810
Interventions with some promise to raise the graduation rate:				
IHD	I Have A Dream program	$20,350	10	$203,480
SFA	Success for All school reform	$19,080	11	$173,420
SUM	Summer school	$3,750	11	$34,110
ALAS	Achievement for Latinos through Academic Success	$3,200	5	$64,000
CAC	Career academies for high school students	$2,000	11	$18,180
C&C	Check & Connect high school reform	$5,160	17	$30,350
TAS	Talent Search	$800	9	$8,890
12T	Twelve Together	$4,080	5	$81,600
Head Start investments:				
HS1	Increasing investments in Head Start by a factor of 4	$54,390	100	$54,390
HS2	Expanding coverage to Head Start for all eligible children	$13,600	12	$113,300

Notes: See text for explanations of each program. For Talent Search, only federal costs are available. Net present values are expressed at age 20 with a discount rate of 3.5%. Costs for promising interventions should be regarded as approximations.

Table 2
Lifetime Fiscal Savings per Expected High School Graduate in California: Federal Government

	Lifetime benefits per additional graduate [a]		
	State / local government	**Federal government**	**State of California**
Average	**$53,580**	**$115,300**	**$322,000-$391,900**

Notes: Lifetime values based on a 3.5% discount rate. Benefits include extra taxes paid and lower expenditures for health, crime, and welfare. For column 3, benefits are column 2 plus net earnings of graduates, savings to victims of crime, and externalities to economic growth. The costs of additional attainment in school and college are also included in columns 1 and 2. Average benefits are weighted for population in each group. Full information is provided in Belfield and Levin (2007).

Table 3
Cost-Benefit Ratios of Interventions Demonstrated to Increase the Rate of High School Graduation in California

	State/local funding		Matching state/local and federal funding	
	Benefit-cost ratio	**Benefits minus costs**	**Benefit-cost ratio**	**Benefits minus costs**
Demonstrated:				
FTF	1.42	$15,770	4.47	$131,070
CPC	1.14	$6,580	3.59	$121,880
TSI	0.84	-$10,220	2.65	$105,080
PPP	0.74	-$18,790	2.33	$96,510
CSR – free lunch	0.67	-$26,480	2.11	$88,820
CSR – population	0.41	-$77,420	1.29	$37,880
Head Start:				
HS1	0.99	-$810	3.11	$114,490
HS2	0.47	-$59,730	1.49	$55,570

Notes: For costs, see Table 1. For benefits, see Table 2. Net present values are expressed at age 20 with a discount rate of 3.5%.

Table 4
Cost-Benefit Ratios of Interventions that may Increase the Rate of High School Graduation in California

	State/local funding		Matching state/local and federal funding	
	Benefit-cost ratio	**Benefits minus costs**	**Benefit-cost ratio**	**Benefits minus costs**
Promising:				
TAS	6.03	$44,690	19.00	$159,990
CAC	2.95	$35,400	9.29	$150,700
C&C	1.77	$23,230	5.56	$138,530
SUM	1.57	$19,470	4.95	$134,770
ALAS	0.84	-$10,420	2.64	$104,880
12T	0.66	-$28,020	2.07	$87,280
SFA	0.31	-$119,840	0.97	-$4,540
IHD	0.26	-$149,900	0.83	-$34,600

Notes: For costs, see Table 1. For benefits, see Table 2. Net present values are expressed at age 20 with a discount rate of 3.5%.