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CALIFORNIA'S FISCAL RETURNS ON INVESTMENTS IN HIGHER EDUCATION*

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ABSTRACT

The ongoing budget crisis in California raises many questions about the most effective ways to allocate resources in ways which sustain future investments. In this paper, we consider two questions: What are the benefits to the state for investing in higher education? And, how do current educational investments create an environment which supports future needs? Drawing on current and historic data on returns to education for individuals, income tax regimes, state investments in higher education, progress and completion patterns, and mechanisms which translate individual impacts into date revenues and expenditures, we conclude that the benefits of higher education extend well beyond the direct payoff for students and include substantial gains to the state.

California has experienced enormous changes in the labor market, state finances, and higher education over the past five years. Jobs have grown increasingly scarce and our unemployment rate has more than doubled from the 5% rate of 2006, peaking at 12.5% in late 2010, and slipping below 12% only recently. Younger Californians have been hit most heavily. The fraction of college-age youth with a job fell from 65% to 51% between 2007 and 2011. The decreased employment rate was split evenly among those who cannot find a job and those who gave up looking for one. The opportunity to trade, or at least mitigate, the loss of employment opportunities by providing more training and education is also threatened. Faced with its budgetary crisis, the state is slashing its support for public higher education, with nearly $3 billion total in higher education cuts to our public community colleges and universities since 2007-2008.[1]

The nearly 2.8 million young adults in their prime college-going years (ages 20-24) is one of the largest age groups counted in California in the 2010 Census, outnumbered only by those aged 15-19, on whom future decisions about college-going weigh most heavily. Together, the sheer size of these two young population groups highlights the urgency of higher education access and success in California. Notably, these two groups also represent the future of California's ethnic composition, with Latinos[2] representing more than 45% of the total and non-Hispanic whites falling to less than a third of the group.[3]

Economic downturns pose threats to Californians, both individually and as a state. As individuals, we confront job loss, wage stagnation, and difficulties balancing our incomes against incoming bills. As a state, we deal with similar issues, experiencing declining tax revenues, weighing against the increased demands for social services that accompany hard economic times. Our past investments in education, however, help to buffer these competing demands. In hard times, it is the least educated who experience the greatest declines in employment and earnings, which act both to depress state revenues and put stress on the public resources required to ameliorate the worst effects of the recession for our citizens.

Below we contrast the lifetime effects of educational attainment in California in 2005 and 2010, from the boom era to the depth of the recession. To place these differences into their historical context, these effects are later contrasted from gains seen between 1980 and 2010. Because of California's increasing diversity, we also delineate the ways in which these outcomes differ by ethnicity.[4]

* The authors are grateful to the Campaign for College Opportunity (http://www.collegecampaign.org/) for their funding, feedback and support, and for publishing results from this and earlier research exploring California's changing demographics and its implication for higher education.

Table 1 Californians with a College Education are significantly better off in 2010

Lifetime Outcomes	Advantage Relative to High School Graduates, 2010			
	Less than High School	High School	College, No BA	BA or more
Years Unemployed	+.7 years	4.0 years	- .4 years	-1.5 years
Years Employed	-7 years	25 years	+ 3 years	+ 6.8 years
Earnings, 25-64	-$380,000	$856,000	+ $340,000	+ $1,340,000
Income, 25-64	-$400,000	$1,073,000	+ $377,000	+ $1,511,000
Years in Poverty	+ 4.8 years	5.9 years	- 1.7 years	- 3.9 years
Years on Cash Aid	+3.7 years	2.8 years	- .9 years	- 2.1 years
Incarcerated	+1.5 years	.9 years	-.5 years	-.8 years

In 2010[5], relative to those with only a high school degree, those completing at least a Baccalaureate (BA) can expect to spend an additional seven years working. While working, they will earn more; between the ages of 25 and 64 they can anticipate earning an additional $1.3 million in wages and salary, and receive more than an additional $1.5 million in total personal income, which includes all other income from sources such as rentals, investments, or transfer programs.

These college "completers" will also put fewer demands on the state's safety net. On average, they are likely to spend two fewer years receiving aid, four fewer years in poverty, and will spend 10 fewer months incarcerated. As might be expected, the recession has widened the gulf between the more highly educated and those with only a high school degree (or less).

Between the boom period at the middle of the decade and the most recent recession, the relative advantage of a bachelor's degree has grown, adding around $112,000 to lifetime earnings (on top of the $1,340,000 advantage that holders of bachelor's degree already held in 2005). The advantage also includes additional benefits:

- For individuals in decreased time unemployed and poor.
- For the state in decreased costs for providing aid by shaving off 4 months of aid receipt, reducing 10 months in poverty, and adding another year and half of employment.

Table 2 The Advantage of a College Education has Grown in the Past 5 Years

	Change in Advantage Relative to HS Graduates between 2005-2010	
	College, No BA	BA or more
Years Unemployed	- 2 months	- 9 months
Years Employed	+ 9 months	+ 1.6 year
Earnings, 25-64	+ $32,000	+ $112,000
Income, 25-64	+ $21,000	+ $60,000
Years in Poverty	-3 months	-10 months
Years on Cash Aid	-1 month	-4 months

The lifetime gains from higher education summarized in Table 2 reflect averages across ethnicities. Race and ethnicity figure prominently in projections for Californians' demand for higher education and expected levels of educational attainment. Increasing college enrollment among population groups with historically low rates of participation and completion will be a critical factor in maintaining a workforce with skills required by future labor markets. Estimates from 2010 indicate that attainment of higher education yields benefits for members of all population groups, but both the starting points and extent of gains within each group differ. The tables that follow illustrate these differences with respect to lifetime income and poverty, the key indicators which drive returns to the state. Quite simply, college pays off for every Californian, regardless of ethnicity. The advantage for earning a baccalaureate degree, relative to a native-born non-Hispanic white high school graduate, yields about $1.2 million for African Americans, $1.5 million more for native-born Asians, and about $1.1 million dollars more for native-born Latinos.

Table 3 College Education – The Million Dollar Pay Off

Income relative to NH White with a HS Diploma	Less than HS	HS Diploma	Some College	BA+
Native Born				
NH White	-$416,000	$0	$431,000	$1,921,000
NH Black	-$749,000	-$322,000	$73,000	$1,169,000
Asian/PI	-$491,000	-$230,000	$259000	$1,525,000
Hispanic	-$508,000	-$186,000	$176,000	$1,178,000
Foreign Born				
NH White	-$594,000	-$195,000	$458,000	$1,754,000
Asian/PI	-$626,000	-$437,000	-$194,000	$731,000
Hispanic	-$572,000	-$257,000	$31,000	$602,000

With greater lifetime income, one can also expect that individuals will spend less time in poverty. Table 4 highlights the decreased time spent in poverty by race, identifying the number of years that members of ethnic and nativity groups can expect to spend in poverty depending on the different levels of education when compared to native-born non-Hispanic white high school graduates. These differences reflect the impact of education in reducing the risk of poverty, but also show the independent impact of ethnicity and nativity. Native born, non-Hispanic whites who fail to finish high school can expect more than five additional years in poverty relative to their non-Hispanic white peers who do finish high school, a gap which grows to more than 12 years for African Americans who fail to finish high school when compared to those same native white high school graduates.

Table 4 Californians with a college education spend significantly less time in poverty

Year in Poverty relative to NH White with a HS Diploma	Less than HS	HS Diploma	Some College	BA+
Native Born				
NH White	5.12	0.00	-1.59	-3.49
NH Black	12.04	3.76	1.59	-2.17
Asian/PI	2.86	-0.39	-2.28	-3.71
Hispanic	3.43	0.09	-1.60	-3.65
Foreign Born				
NH White	0.49	-0.45	-1.53	-2.83
Asian/PI	3.66	-0.16	0.50	-3.12
Hispanic	4.78	3.05	-0.54	-3.97

Although differences by ethnicity highlight the effects of factors other than education on these outcomes, the differences within population groups are remarkably similar, and provide a more natural comparison for evaluating the effects of education. Following in Tables 5 and 6, rather than comparing outcomes to those of native-born non-Hispanic whites, differences are shown relative to high school graduates from the same ethnicity, and trends in those education-based differences shown since 1980.

Focusing on the bottom line for each population group identifies the current extent to which these outcomes differ by education. While some variation exists, the ranges are quite similar, with failure to earn a high school diploma depressing expected income by 25%-45%, attending some college yielding gains of 34%-48%, and earning a BA or more yielding gains of 129% to 172%. Looking across years within each population group suggests how these gaps have steadily grown over the last decades at both ends of the educational spectrum, with steady declines in lifetime income for those without a high school degree relative to graduates, and equally steady increases in the payoffs for college completion.

These results indicate that education pays off significantly. It pays off even more in bad times than in good, when the costs of less education are accentuated. And there is a tremendous advantage to those who complete college over those who have some

college education without graduation. The returns to education differ by ethnicity, but all ethnic groups gain substantially from college-going and these gains to education have steadily increased over time.

Table 5 Lifetime income for college graduates has continued to increase over the past three decades.

		Less than HS	Some College	BA or More
Non-Hispanic White	1980	-$211,000	$294,000	$1,046,000
	1990	-$329,000	$378,000	$1,413,000
	2000	-$419,000	$407,000	$1,711,000
	2010	-$409,000	$421,000	$1,773,000
Non-Hispanic Black	1980	-$224,000	$252,000	$810,000
	1990	-$264,000	$370,000	$1,119,000
	2000	-$288,000	$392,000	$1,307,000
	2010	-$397,000	$388,000	$1,486,000
Asian/Pacific Islander	1980	-$254,000	$265,000	$861,000
	1990	-$341,000	$415,000	$1,203,000
	2000	-$364,000	$434,000	$1,454,000
	2010	-$238,000	$458,000	$1,640,000
Hispanic	1980	-$239,000	$280,000	$861,000
	1990	-$315,000	$355,000	$1,157,000
	2000	-$337,000	$366,000	$1,309,000
	2010	-$335,000	$356,000	$1,352,000

Table 6 Lifetime poverty for college graduates has continued to decrease over the past three decades

		Less than HS	Some College	BA or More
Non-Hispanic White	1980	2.22	-0.46	-0.94
	1990	3.25	-0.93	-1.64
	2000	5.18	-1.74	-3.02
	2010	5.12	-1.59	-3.49
Non-Hispanic Black	1980	4.00	-2.36	-4.00
	1990	4.11	-3.50	-5.65
	2000	6.41	-4.98	-7.76
	2010	8.28	-2.17	-5.93
Asian/Pacific Islander	1980	2.85	-0.91	-1.24
	1990	4.11	-1.39	-2.04
	2000	5.08	-2.16	-3.07
	2010	3.25	-1.89	-3.33
Hispanic	1980	3.66	-0.94	-1.48
	1990	4.35	-1.66	-2.33
	2000	5.35	-2.33	-3.52
	2010	3.34	-1.67	-3.74

Reaping the Tax Benefits of an Education

The state relies on taxes to provide services and create and maintain the infrastructure that support the economic and physical well-being of its citizens and businesses. Personal income taxes have accounted for slightly over half of that revenue (52%), followed by sales and revenue taxes (29%), and corporate income taxes (about 11%). This total bill reflects about $2,800 per filed return, around $3,100 per household, or around $2,000 per adult age 25-64.[6]

When average incomes for Californians increase as a result of more-skilled and better paid workers, we expect that available tax revenues can also increase. Over the course of the last four decades, total tax revenue as a fraction of personal income has steadily ranged around 7.5%, only rarely falling below 7% or exceeding 8%.

Translating the income advantage earned through college entry and completion into revenue suggests that transitioning between high school graduation into college yields the state nearly $30,000 more in revenue over the course of the individual's work-life. If that person earns a BA or higher degree, it garners the state $108,000.[7]

The state also reaps savings, with differences in lifetime years in poverty with college attendance yielding savings of around $5,000, and a college degree yielding savings of $11,000 over the course of an individual's work-life. Savings from decreased incarceration rates provide savings roughly double that in size, with a $10,000 difference between high school graduates and those with some college, increasing to a $23,000 difference for those who earn their BAs.

In total, including lower expenditures and higher revenues, college entry ultimately yields around $45,000 to the state, and a bachelor's degree yields the state more than $140,000 per individual.

Table 7 Lifetime Differences in Tax Revenue and Expenditures relative to High School graduates, (Average 2005-2010, in 2010)

Revenue	Some College	Bachelor's or more	Total
Per Capita Model	$45,000	$141,000	$112,000
Current Tax Model	$47,000	$204,000	$156,000

In reality, however, taxes are not drawn equally across earners. Income taxes in California, for example, are quite progressive, with the top 20% of households paying a substantially greater proportion of their income in state personal income tax than the bottom 40%.[8] Sales taxes, on the other hand, tend to be regressive, and the bottom 40% of households pays a higher fraction of their income on such taxes than does the best-off 20%. Of course, even under the more regressive sales tax regime, those with higher incomes pay more in taxes absolutely—it is simply a smaller proportion of their income. In California, personal income taxes account for slightly over half of general funds revenues (although the range it has accounted for has varied between 40% and 60% since 1990) and sales taxes account for another 30% of revenues (having ranged from 26% to 38% during the same period).[9] Weighting total state tax revenues to incorporate both the current levels of progressiveness of the income tax schedule and the regressiveness of sales tax revenues results in higher estimates of totals returns to educational investments than those which assume a flat tax rate.

Applying current levels of tax progressivity increases the lifetime gains: those with some college will, between greater tax payments and lower demands, yield the state nearly $50,000 over their work-life, and those with a BA will yield the state an additional $156,000 beyond that. Adjusting for the mix and relative levels of progressivity found in current tax structures suggests similar levels of gain to the state for those who leave college without a four-year degree, but substantially higher returns—over $200,000— for those who complete a BA.[10]

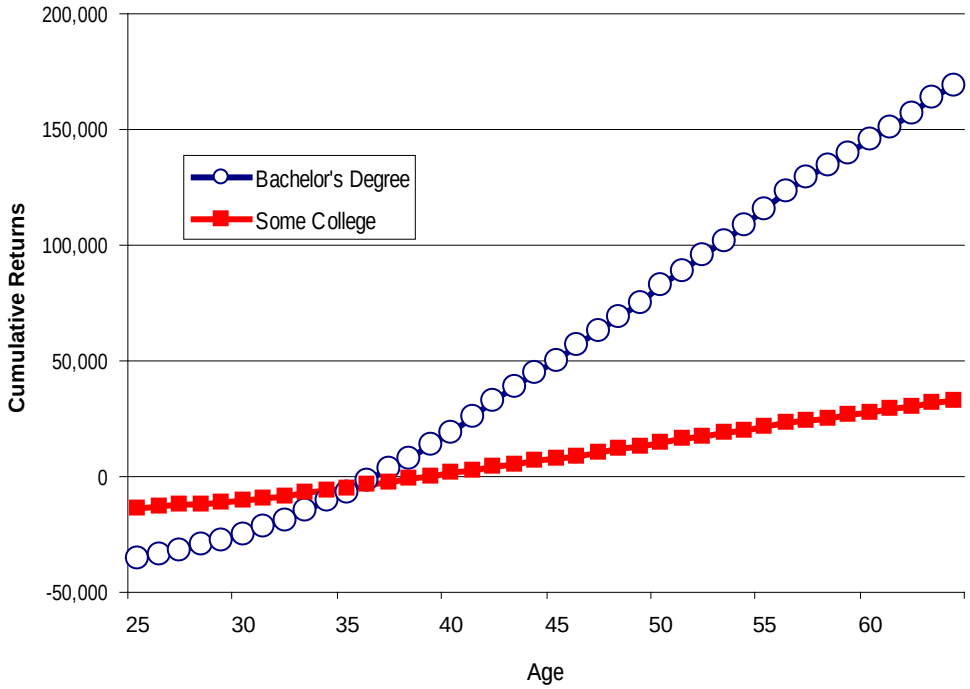
These returns require an initial investment on the part of the state. Based upon average historical state general fund support per student full time equivalent (FTE) [11] to identify state costs per entrant and graduate in the UCs and CSUs [12], we identified returns to the state for their investment in education.[13] Use of those average costs suggests that the state nets about $4.50 for each dollar investment in higher education.[14]

Cumulative Returns

Both rewards and costs differ for those who enter college from those who complete their baccalaureate degree. On average, those who complete college spend 2.3 years more in school attaining their degree, and consequently cost the state 2.6 times more (slightly more than $20,000) than those who fail to complete their degree. As shown earlier, completers also provide much

larger returns to the state, and effectively return five dollars to the state for every additional dollar invested in their completion, a rate of return double that of those who fail to finish.[15] The fraction of students who enter the four-year system but fail to complete their degree is substantial—about 30% considering both freshman entrants and transfer at CSUs and UCs. If one in every five of those students who failed to complete could instead earn their degree, it would increase average return to the state for its educational investments from 4.5 dollars to 4.65 dollars.

Figure 1 Completing College pays off more for the State



Discounting the Future

Even though an investment may bring in more than it costs, individuals and institutions may choose to forgo those investments to devote spending on more pressing or immediate needs. There can be good reasons not to invest: borrowing funds can be costly, other investments may offer more immediate payoffs, and uncertainty about the future may make a preference for near-term consumption more attractive. While the investments made by the state in education seem particularly attractive, they also pay back over a fairly long time frame. To adjust for the lag in time between when an investment is made and when it pays off, analysts usually discount the returns by a certain rate each year.[16] This rate of return, reflecting a 2% discount rate, is shown in the first panel of Table 8. An alternative way of summarizing returns to educational investments is to identify a "break-even" discount rate which shows how much we would have to discount our future returns before our initial investment and the discounted return balanced exactly.[17] The second panel summarizes the gain to the state by identifying the Internal Rate of Return (IRR), suggesting a discounting at nearly 10% would be necessary before the yields on educational investments returned only the original investment.[18]

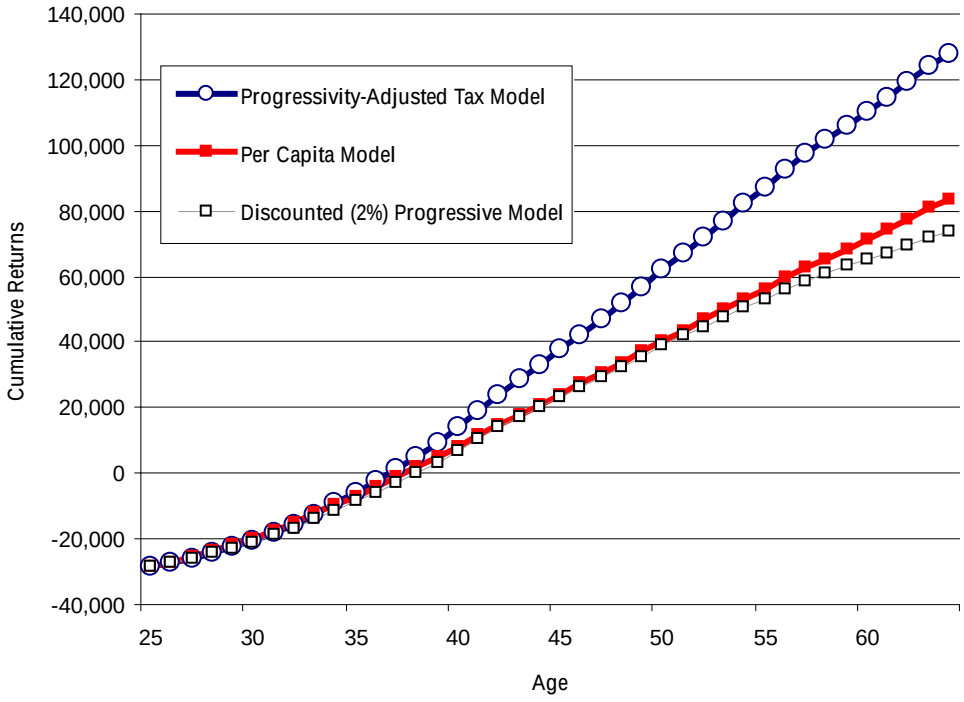
Table 8 Discounted Returns

	College Entry	College Completion	Total
No Discount	2.4	4.8	4.5
2 Percent	1.3	2.8	2.6
Internal Rate of Return	7.2	10.4	10
Cost Increase Ratio for Tipping Point at 2% Discount	2.3	3.8	3.6

A third way we can evaluate our investment's return is to ask, if the total amount of our return did not change, but our initial investment had to be much higher, how much larger would our initial investment have to be before it simply broke even? If, for example, the investment needed for each student to earn a baccalaureate degree increased, how much more expensive would it have to be before it no longer makes sense to invest in those students? In the third panel of Table 8, using the 2% discount rate, we find that costs would need to more than triple for the same outcome before they failed to return the state's original investment.

In short, the returns from investments in education for values within the range of discounting are consistently positive, and suggest that, after paying back the initial investment and adjusting returns for uncertainty and preferences for quicker returns, returns on educational investments are large. Furthermore, we would have to discount our educational investments heavily before they would simply "pay for themselves." Finally, even if the costs necessary to achieve the current levels of return increased, they would need to more than triple before returns reached a break even point.[19]

Figure 2 Projected Returns under Alternative Models



Cumulative Returns

Figure 2 shows the returns over time based on our original model of returns through taxes reflecting a fixed per capita rate, the substantial increase in returns resulting from closer alignment to the progressivity of California tax revenues, and the extent to which discounting those returns affect the timing and level of returns. While the payback from the investment in higher education is not immediate, it is relatively quick. By age 38, the state's initial investment will be repaid in full. For the next 30 years that these individuals spend working until they retire, they effectively produce a "bonus" to the state in terms of tax contributions.

Our current investments in education are part of a continued and long-term strategy in building state infrastructure. They are not only an investment in the future—they are an investment made possible by the state's returns on our past educational investments. The hole that would exist in California's budget, absent those past investments, exceeds the current level of general funds directed toward higher education in California. In other words, decreasing investments in higher education today is likely to substantially decrease state revenues in the years to come.

Estimates of the return on investment in this report are based on synthetic cohorts. For example, to estimate the anticipated impact of education for current generation of young adults when they are 50 years old, we look at the actual differences by education among adults who are already 50 years old, anticipating those effects will be similar. By adding up all of the effects for adults over their working age years—from 25 to 64—we identify a total lifetime impact.

Instead of projecting those benefits into the future, we can instead align current benefits by age with past baccalaureates granted in the UCs and CSUs. For example, in 2010, 33 year-olds who earned their degrees around eight years ago net the state about $3,000 relative to a high school graduate, while each 55 year-old who graduated around 30 years earlier netted the state around $5,000 relative to a high school graduate of the same age.

Applying these contemporary age-specific returns to the past streams of graduates from the UCs and CSUs suggest ongoing returns to the state averaging around $12 billion dollars annually, considering only the returns from those who completed baccalaureates at UCs and CSUs.[20] This is well above the general fund expenditures for the UC, CSU, and the CCC systems combined.[21] The returns to the state's original investments in those graduates more than supports a substantially larger system from which those original graduates benefited.

Conclusion

The next generation of college graduates will contribute significantly to the future of the state and its residents. By the time today's college graduates reach age 50 they will have repaid the nearly $4.5 billion dollars the state originally invested in them, plus an additional $10 billion.

As the state seeks to balance the budget, it must consider the investment value, the rate of return that is inherent in certain expenditures; in this case, the funding of higher education. This report concludes that the investment in education is critical to the ultimate success of California. Tough decision today will reap significant rewards in the future, helping to ensure the long-term prosperity of the state and its citizens.

Supporting funding for higher education is not a single year budget line item, but an investment in our human capital that yields significant returns and promises to provide Californians with continued opportunity and hope for a better economic future.

Context for this Brief

Six years ago—well before the housing meltdown and deepest recession since the 1930's—we examined the costs and returns to the state for their investments in higher education. We concluded that the state of California nets three dollars in increased taxes and decreased expenditures for every dollar the state invests in putting students in and through college, based on analyses from three data sources. The 2000 Census allowed us to examine relationships between education and outcomes like labor force participation, employment, earnings, incarceration, and poverty for Californians at different points in their lives. Rates of college-going, completion, and total years of schooling per degree earned in the public sector were identified from data from the California Postsecondary Education Commission and the three segments for public higher education in California. Historical budget information for California let us associate costs to the state for both these educational investments and outcomes. Together, these data suggested that initial investments in providing opportunities for higher education paid off for the state steadily throughout those students' working age lives, both in the form of larger tax revenues and decreased demand for public services.

These dramatic changes prompted us to update and expand our analyses on the state's return on investment in education, drawing upon more recent data which capture some of the effects of the recession, using a longer span of data to place the

relative advantages earned in the post-secondary setting into historical perspective, evaluating the mix of revenues sources for the state and impact of their relative progressivity on returns, and considering the effects of discounting future returns at various rates.

References

[1] Legislative Analyst's Office The 2012-13 Budget: Analysis of the Governor's Higher Education Proposal. http://lao.ca.gov/analysis/2012/highered/higher-ed-020812.pdf

[2] In this report, we use the terms Latino, which is more commonly preferred in California, and Hispanic, which is broadly used by the Census Bureau and statistical agencies, interchangeably.

[3] The employment status of 19-24 year-old Californians is strongly shaped by both educational attainment and ethnicity: unemployment rates in this group range from around 12-14% for non-Hispanic whites and Asians, to 16-17% among Latinos, and around 29% for African-Americans. The range by educational attainment is similar, rising from 13% among those who had some postsecondary education, to 21% among those who stopped with a high school degree, to more than 30% among those who failed to finish high school.

[4] Our research in 2005, reflecting 2000 Census data, showed that stark differences exist by educational attainment in involvement in the labor force, employment, earnings, assets and financial wellbeing, as well as dependence on assistance programs and incarceration. Those detailed findings, as well as a fuller description of the methodologies used to derive our estimates of savings to the state, are reported in Brady, H., Hout, M., & Stiles, J. (2005). Return on investment: Educational choices and Demographic change in California's future. Berkeley: University of California, Berkeley, Survey Research Center. A brief description of our methodology and ways it has been extended since the 2005 report are explained under Methodology & Method for Calculating the Return on Investment in this report.

[5] Estimates for 2010 are based on the 2010 American Community Survey, and reflect income earned in the prior 12 months.

[6] Analyses from the CPS suggest about 90% of the personal tax burden is carried by this age group.

[7] Based on a simple tax of 7.5% on the difference in income. We revisit the issue of estimating changes in revenue using a variety of methods in section 2.

[8] According to estimates from ITEP, the top quintile pays a greater share in income tax than the bottom two quintiles by a factor of about 10:1, while the bottom two quintiles pay a greater share of their income in sales taxes by a ratio of about 3:1.

[9] Together, personal income tax and state sales taxes typically account for around 80% of General Fund revenues, although the fraction has dipped below 70% and above 90% in the last decade. During the last decade, personal and corporate income taxes account for around 63% of the total revenues.

[10] To estimate returns under current tax structure, we modeled tax revenues separately for personal income, corporate income, and sales taxes, and apportioned the total revenue to match the fractions each contributes to the state general fund. Expenses were estimated in the same fashion as for our 2005 report. For both revenues and expenses, effects were verified using several different models for attributing tax burdens. Effects were also evaluated for more and less progressive tax structures, such as those relying exclusively on income taxes or solely on sales taxes. Progressivity matters a great deal, but even under the most regressive system large positive returns to educational investments were found.

[11] CSU and UC use the term "full-time-equivalent" enrollment (FTE) to describe units of student workload measure for funding purposes for the systems, with one FTE representing 30 semester units or 45 quarter units.

[12] Costs in the CCC system are not included in these estimates. The mission of the CCC system is broader than transfer preparation, public financing more reliant on non-general fund sources, and attribution of outcomes and returns for those who enroll but fail to transfer are more difficult to quantify. These factors make analyses which parallel those for the four-year institutions problematic to compare. However, Shulock, N & Moore, C. (2010), Divided we Fail, California State University Institute for Higher Education Leadership & Policy, suggests that, for degree seekers in the CCCs, 40% accrue 30 or more credits, and 23% transfer to the four-year setting. If average college-going returns are assumed only for the 17% who accrue 30 credits and do not subsequently transfer, these returns still cover all state general fund CCC investments for the entire cohort of degree-seekers, both successful and not, twice over. This suggests that the separation of the treatment of costs and returns in the CCCs from the return on investment we focus on in this report does not lead to an overstatement of that return on investment.

[13] A description of that model and the sources used to construct it are found under Methodology & Method for Calculating the Return on Investment in this report. A fuller description of the development of the model is described in Brady, H., Hout, M., & Stiles, J. (2005). Return on

investment: Educational Choices and Demographic change in California's future. Berkeley: University of California, Berkeley, Survey Research Center.

[14] One alternative to the use of historical average costs is the use of marginal costs, as actually used by the state to fund additional enrollments. Those costs are significantly lower and would, in turn, suggest returns of more than $5 dollars for every dollar invested. Of course, any decrease in state educational investments will mechanically increase the rate of return, as long as the decrease in not matched by equivalent declines in college entry and completion. In the very short run, effects of funding changes may be buffered or absorbed in ways which permanent changes in funding cannot be.

[15] Returns are estimates based on the current tax model.

[16] Applying a discount rate to the stream of returns an investment earns of its lifetime, and summing those discounted returns less the investment, will yield the investments Net Present Value (NPV). Calculating a NPV requires selection of a discount rate—how much we want to disregard returns that occur later in time rather than sooner—and identifies how good an investment is at that level of discounting. For any discount rate chosen, a NPV of zero indicates that the investment neither gains nor loses money. As Table 6 shows, the NPV for investment which educational investments which are not discounted at all are high, yielding 3.6 dollars over and above each original dollar invested, returns more than two additional dollars for each invested when discounting at 2%, and still more than doubles the original investment at a 4% discount rate. Traditionally, forensic economists (economists who specialize in valuation of lost earnings over an individual's life) use a real discount rate between 1% and 3% per year.

[17] That rate, the point at which the NPV for an investment is zero, is the called the Internal Rate of Return (IRR), and indicates how much we would need to discount future returns before our "profit" drops to zero.

[18] It is important to note that these represent true rates of return after adjustment for inflation.

[19] These figures assume, of course, as these more costly students still receive they same degree of benefits from increased education as their less expensive counterparts.

[20] California gains, as well, from the ability to attract highly credentialed and qualified workers, but these estimates consider only baccalaureates granted from UCs and CSUs. The estimates also ignore the returns from those who attended, but stopped short of a baccalaureate.

[21] Annual general fund expenditures on the UC, CSU, and CCC systems have averaged about 9.3 billion dollars over the last 5 years.

[22] This framework has also been used by Jennifer Cheeseman and Eric Newberger (2002) in The Big Payoff: Educational Attainment and Synthetic Estimates of Work-Life Earnings, Current Population Report 23-210, and more recently by Tiffany Julian and Robert Kominski (2011) Education and Synthetic Work-Life Earnings Estimates, American Community Survey Reports ACS-14, although that research is focused on earnings of year-round full-time workers.

[23] State of California Franchise Tax Board Annual Report—Statistical Appendix Tables (2008, 2009, 2010). https://www.ftb.ca.gov/aboutftb/plans_reports.shtml

[24] Institute on Taxation and Economic Policy, Who Pays? A Distributional Analysis of the Tax Systems in All 50 States. 3rd edition, November 2009.

[25] Receipt based on estimates from the American Community Survey, costs per recipient reflect the figures reported in the Legislative Analyst's Office CalFacts:California's Economy and Budget in Perspective for recent years.

[26] General Fund Expenditures per FTE from California Postsecondary Education Commission Fiscal Profiles 2010; completion rates calculated from University of California Statfinder (http://statfinder. ucop.edu/) and California State University Graduation Rates Consortium for Student Retention Data Exchange (CSRDE, http://www.asd.calstate.edu/csrde/index.shtml).

Appendix A: Methodology & Method for Calculating the Return on Investment

As in our 2005 report *Return on Investment: Educational Choices and Demographic Change in California's Future*, we use a synthetic work-life model to estimate summaries and trajectories for economic characteristics associated with education.[22] Based on these age-specific characteristics, differentiated by ethnicity and nativity, we attribute revenues and costs to the state for the population reflecting expected contributions to the state through taxes and expected expenses and support required from the state based on poverty status and incarceration rates. Results in this report are based on a model which attributes tax revenues from three sources: personal income taxes, sales taxes, and corporate taxes, each weighted to represent the fraction that revenue stream contributes to the state General Fund. Attribution of personal income taxes were based on total income reported in the American Community Survey (ACS) for 2005-2010, differentiated by marital status and presence of dependents to proxy filing status, and linked by percentile ranking with reported rates and tax amounts reported for Californians by the Franchise Tax Board.[23] Attribution of sales tax and corporate income tax were based on estimates of the fraction of family income paid by income percentiles compiled by the Institute on Taxation and Economic Policy.[24] For comparative purposes, a "flat tax" rate, fixed at the same fraction of income for all individuals regardless of total income, was also estimated and reported.

Costs to the state from social support programs are based on poverty status identified from reported income and family size in the American Community survey, linked to total average state expenses for Medi-Cal, CalWORKs, and the state SSI supplement. Additional measures based on self-reported receipt of TANF, Medicaid and SSI tied to program-specific costs were also estimated [25], yielding results very similar to the broader poverty-based estimates. Rates of incarceration were identified from the ACS, and average costs per year of incarceration were applied to those rates.

Characteristics associated with both costs and revenues reflect age-specific rates by ethnicity, educational attainment, and nativity. Projected returns to the state reported reflect these estimated costs and revenues weighted to the ethnic composition of California's 18-24 year old population.

Initial investments in education are based on current General Fund contributions per FTE in the CSU and UC systems, based on progression and completion rates for direct entrants and transfers from the California Community College (CCC) system.[26] Contributions from investments in the CCC system are not included in the results because parallel data and methods were not appropriate. CCC investments were evaluated to ensure that segregating these costs did not inflate the return on investment. This evaluation suggest that reasonable estimates of the returns earned by CCC students who earned at least 30 units, but did not subsequently transfer (whose returns are included in the reported results), were sufficient to cover the General Fund investment in CCC FTEs of the 'degree seeking' cohort whose goals and behavior were most closely compatible with the baccalaureate-oriented focus of this model.

Appendix B: Are Synthetic-Cohort Estimates Biased?

Our estimates of the return on investment for California reflect the differences among Californians with different amounts of education. Our actual quantity of interest, though, is the average difference in pay and employment that people would experience if they had more or less education than they do. This quantity is, in fact, unobservable because people cannot rerun their lives, getting a different amount of education in the rerun just to see what difference it made. Social scientists simulate what would happen in reruns by statistical adjustments that match each person in a study with another who resembles them in important aspects but differs in education. The matching yields a good estimate of education's effect if the differences between matched individuals reflect the systematic differences caused by education and random differences that are uncorrelated with education (and thus ignorable for the purposes of estimating the effect of education). Bias arises when an excluded factor contributes not only to the random difference between individuals but also to the difference attributed to education. For that to occur the excluded factor must be (a) important for the outcome and (b) correlated with education. Bias is a matter of degree; its size is the product of (a) and (b). Bias exaggerates our estimate of the effect of education if the product of (a) and (b) is positive; bias depletes our estimate of the effect of education if the product of (a) and (b) is negative.

In our analysis of the American Community Survey (ACS) we matched people on age and racial ancestry and compared differences by education. Age and ancestry are important, but people differ in myriad other ways. The two most important factors to consider are upbringing and ability. They matter for earnings and employment, and they are correlated with education. Excluding them from our synthetic cohort estimates will lead us to exaggerate the value of education if they matter for earnings and employment for people with the same level of education. On the one hand, we have no choice but to exclude them; the ACS

contains no measures of either upbringing or ability. On the other hand, if the estimates of educational differences are too big, then we should recalibrate our results with a suitable deflator.

Research from as early as the 1970s and as recently as this year gives us confidence that we have correctly calibrated the causal effect of education. Statistical studies that include measures of upbringing and ability describe a "causal chain" from upbringing and ability to education to income and employment. They conclude that while upbringing and ability affect who gets advanced education and who drops out early, they have no subsequent, direct effect on income or employment; it is all mediated by education (Hauser, Sewell, and Tsai 1983; Fischer et al. 1996). Using standard multivariate models, Hauser et al. (1983) found that upbringing and ability were weakly correlated with income and employment net of education, but that small net correlation disappeared once they removed the random variation due to measurement error. Their study used uncommonly complete data for a sample of Wisconsin high school graduates (class of 1957). Less complete national data show the same patterns for the information available (Jencks, Crouse, and Mueser 1983) so experts have decided that the causal chain found in Wisconsin works that way elsewhere too (Campbell 1983; Fischer et al. 1996).

If education completely mediates the effects of upbringing and ability, then excluding them is not a serious limitation for our study. But it is such a serious issue that we should not rely exclusively on a single study from almost thirty years ago.
Natural experiments analyzed by economists are another approach to assessing the bias in our synthetic cohort estimates of the effect of education. Natural experiments occur when sudden changes in educational policy, in effect, randomly assign people to more education than they would have undertaken on their own. For example many states increased the mandatory age of school attendance in the twentieth century. As people do not choose their year of birth, being born in a year of change is just like being randomly assigned to a treatment while being born the year before is like being randomly assigned to the control group. People born in the treatment and control years have the same distributions of upbringing and ability so excluding those factors is of no consequence in the natural experiment. Close comparisons of this sort yield estimates of the effect of education on earnings and employment less prone to excluded-variable bias than ordinary estimates are (e.g., Angrist and Krueger 1991). Our colleague David Card reviewed studies of this kind in existence as of 1999. They all showed that estimates of the sort we have here, based on limited matches by age and racial ancestry, did not overstate the effect of education. If anything, they understated it as the estimates based on natural experiments were slightly larger than the estimates based on the kind of data we have here. Hout (2012) recently updated Card's review and reached the same conclusion. Although designed to control for the excluded effects of ability, these instrumental variable studies, in fact, rule out bias from all excluded variables.

Rather than rely solely on the research literature, although it is quite convincing, we undertook some original analyses to add to the work of others. The Genera Social Survey (GSS), begun in 1972 and ongoing, contains several measures of upbringing but none of ability prior to the completion of education. The GSS includes a ten-word vocabulary quiz but that measures one small aspect of ability at the time of the interview. It is correlated with the ability that contributed to education but is also a consequence of that education so it is not well suited to separating the causal effect of education from its non-causal correlation with earnings and employment.
We regressed family income, personal earnings, and employment on education (the same four categories we used in the synthetic cohort analysis) for each combination of racial ancestry (the same four categories we used in the synthetic cohort analysis) and age (the same eight categories we used in the synthetic cohort analysis) to replicate the synthetic cohort analysis in our report. The effect of education in each of these regressions is represented by three coefficients that measure how much higher or lower family income, personal income, and employment are for (1) people with less education than a high school diploma, (2) some college, or (3) a college degree or higher, compared with the reference level of education — a high school diploma. We then redid the regressions adding gender and four measures of upbringing — father's education (same four categories as the person's own education), mother's education (same four categories), family type (four categories: two biological parents, mother only, father only, all other), and number of siblings — to the equation.

In all we computed 192 regressions each of which yielded three coefficients, far too much information to digest if presented in tabular form. So we devised a chart that could answer the question of whether our synthetic cohort estimates overstate the effect of education. We arrayed the coefficients corresponding to the synthetic cohort estimates on the horizontal axis of a scatterplot; we arrayed the corresponding coefficients that adjust for upbringing on the vertical axis. We made one of these plots for each dependent variable. If there is no bias in the synthetic cohort estimates, then controlling for upbringing makes no different and the points for each pair of estimates will align close to a line connecting all the points for which $y = x$, sloping upward with a slope near 1.0. If there is complete bias, then the coefficients from the second set of regressions will be practically zero and the points for each pair of estimates will align close to a line parallel to the y-axis, near $y = 0$. If there is some bias, then the second set of estimates will be closer to zero than the first set but not actually zero; the points for each pair of estimates will slant upward but with a slope significantly less than 1.0.

The results of this analysis suggest that there is little or no bias in our synthetic cohort analysis from the exclusion of upbringing from the model. All of three plots in Figure 1 show that the estimates that control for upbringing very closely resemble those that, like our synthetic cohort estimates, ignore upbringing. There are three sets of coefficients (for less than high school diploma, some college, and college degree) in each of three panels (family income, personal income, and employment), yielding nine slopes that can be compared to 1.0 (the expected value under the null hypothesis of no bias). The nine slopes are 1.09*, 1.04, 1.03, 0.92, 0.92*, 0.96, 0.86*, 0.99, and 0.92 (the starred ones are significantly different from 1.0 in a two-tailed test). Two are significantly below 1.0, indicating an 8 percent bias in the estimate of the effect of some college on personal earnings and a 14 percent bias in the estimate of the effect of high school dropout on employment. There is a significant reverse bias in the coefficient for the effect of high school dropout on family income. Critically, none of the three coefficients for the gap between college graduates and high school graduates are significantly biased. Most of our conclusions rely on those coefficients. Another gauge of how small the bias is, is to calculate the fit of the coefficients with respect to the y = x line. The nine fit statistics — analogous to the squared correlation coefficient (r2) in a regression model where the expected value of y is x — are 0.96, 0.97, 0.98, 0.94, 0.94, 0.95, 0.93, 0.94, and 0.95, moving from left to right across the figure. Overall, the bias is small and ignorable.
Excluded variable bias is not the only potential source of error in our estimates. It is possible that the rate of return estimated with and without a given variable is the same on average but that the effect of education differs across values of the excluded variable. This is a form of heterogeneity bias. Failing to account for the heterogeneity of returns could lead us to the wrong conclusions. Our calculations build in substantial heterogeneity by age and racial ancestry. If upbringing and ability interact with education, though, we might be overstating or understating the potential returns to investment in higher education.

Recent research (Brand and Xie 2010; Torche 2011) has uncovered significant heterogeneity in returns to higher education. They find that the young people least likely to attend college and attain four-year degree actually gain more from it if they beat the odds and earn a BA than the young people who are "on-track" for college from an early age. This "negative selection" research is controversial (see Hout 2012 for a discussion), but it was first found in the 1980s (Hout 1984) and appears to be robust.

If negative selection is as significant in California as it is in the nation as a whole (and in Wisconsin — Brand and Xie (2010) used both national and Wisconsin data in their study), then our calculations about recent trends at current levels of enrollment are accurate but our extrapolation to returns on expanded enrollments actually understate the likely gains California could achieve from expanding higher education opportunity. Here is how to think about it. The research says that young people who are less likely to attend benefit more. If California expands CSU and UC enrollment, the new students will mostly be the young people less likely to attend. Thus the new recruits will probably benefit more than graduates from ten years ago did. And when individuals reap higher returns on their educational investments, California does too through higher taxes collected and fewer services rendered.

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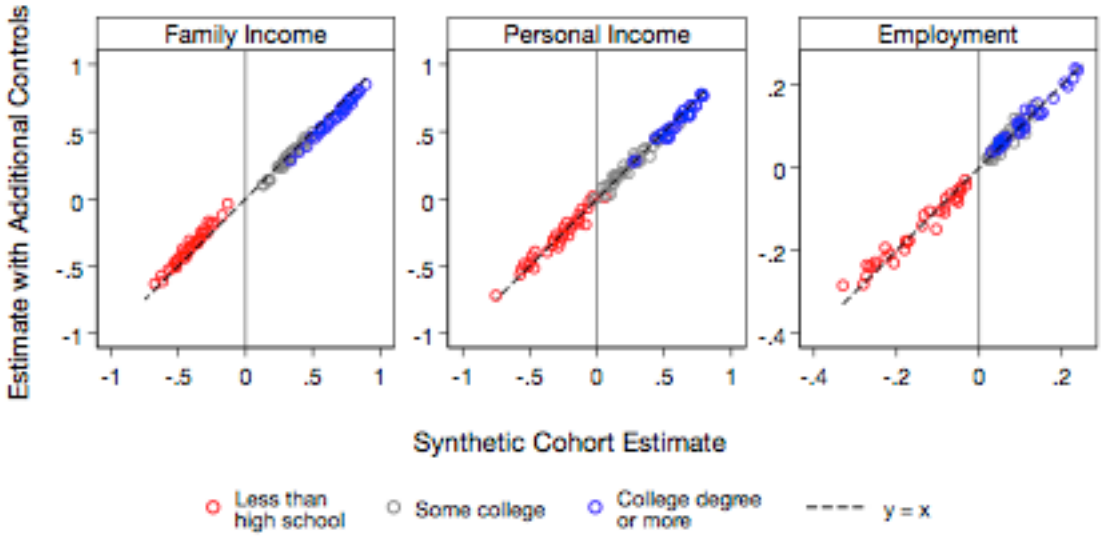

Figure B-1. Comparison between Synthetic Cohort Estimates Calculated per the Methods in Our Report and After Adjustment for Additional Control Variables. Source: Authors' calculations from the General Social Surveys, 2000–2010.