# Return on Investment: Educational Choices and Demographic Change in California's Future

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**Note to discussant/readers: The primary findings and overview of methodology are all reported in Chapter 1 (pages 1-24). The remaining chapters provide details and support of these analyses, with primary findings and caveats identified at the end of each chapter, but are intended as support materials.**

**Authorship**

Authors are listed in alphabetical order.

The Chapter 1 summary is most heavily indebted to the direction and writing of Henry Brady, with the assistance and support of Michael Hout and Jon Stiles. The model of educational inheritance in Chapter 2 was developed and estimated by Michael Hout, while development of the remaining components of the demographic projections for that chapter was led by Jon Stiles, who also took primary responsibility for the text. The analysis and writing of the chapters on educational benefits (Chapter 3) , the educational pipeline and costs (Chapter 4) and the costs and benefits to the state (Chapter 5) was undertaken by Jon Stiles with review by Mike Hout and Henry Brady, and support by Shannon Gleeson and Iris Hui. Shannon's work was particularly essential in analyses of the benefits of education, as was Iris's work with the educational pipeline.

Abstract: California has experienced immense shifts in demographic composition in recent decades, stemming from patterns of international immigration. Increases in populations which have traditionally experienced less educational success account for much of the past and anticipated growth. Coupled with differing returns to education by ethnicity, these shifts have important implications for individual well-being, demand for state services and state revenues. Using a projection methodology which incorporates educational attainment and nativity in addition to the standard elements of age, race/ethnicity, and sex, we examine the trends in composition of cohorts in the ages attending secondary and post-secondary school. We then use these projections to model the effects of four different regimes of student progress in the educational pipeline on state investments in post-secondary education and subsequent financial returns to the state.

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*Californians think of their home as the Golden State, the "Good Society" and the "Golden Dream by the Sea". But California is sliding from exceptional to ordinary, and from "great" to "good enough". The challenge motivating this study is what to do about this slide. The twenty five percent advantage California held over other states in personal income and educational attainment in 1960 has shrunk to several percentage points in 2005. This study shows that educational investments can help restore California's greatness and preserve its high quality of life while returning more in benefits to the state than they will cost in expenditures.*

*This chapter summarizes the study and uses simple facts and figures to illustrate its major findings. The subsequent chapters (2-5) present the careful arguments and crucial evidence needed to substantiate these findings.* ***In those chapters we show in detail how investments in education are expected to return three dollars in net benefits (more taxes for the state and less spending for social services and prisons) for every dollar put into education****.*

*We develop and confirm this conclusion by providing innovative and detailed projections of the future demographics of California, by developing analyses that tie college-going to a wide array of outcomes that allow for a comprehensive cost-benefit analysis, and by considering where the educational pipeline might be changed to provide the maximum benefits for educational investments. Each step of the analysis uses and extends powerful and robust demographic and economic methods that, when put together, represent the most fully articulated, even-handed, and sophisticated picture ever produced of how higher education matters for California.*

# Chapter 1
# The Challenge, the Context, and the Content of this Study

> "The western rim of a continent, which a century ago was as much legend as land to a handful of pioneers, now assumes the role of leader on that continent. … We have always been pioneers and sons of pioneers, a vigorous, dynamic people who respect tradition, but scorn the status quo… Through the turmoil of change, and sometimes chaos, Californians have pressed on toward the good society—not for the few, not for the many, but for all."
>
> Governor Edmund G. "Pat" Brown, January 7, 1963

> "I see California as the Golden Dream by the sea.… For millions of people around the world, California has always glimmered with hope and glowed with opportunity. Millions of people around the world send their dreams to California with the hope their lives will follow."
>
> Governor Arnold Schwarzenegger, November 11, 2003

For the forty years between the inaugural addresses by Governor Pat Brown in 1963 and Governor Arnold Schwarzenegger in 2003, California has been rightly regarded as one of America's richest and most highly educated states. But public policy decisions and the ongoing "turmoil of change" mentioned by Governor Brown in 1963 have produced enormous shifts in California's human and economic landscape. *As a result,*

*California is sliding towards being just average in its income and educational attainment, and Californians must decide what to do about it.* Californians must decide whether they want their state to continue to be one of the nation's richest, most dynamic, and best places to live—worthy of its title of the "Golden State," or whether they will be satisfied with living in a large, but only average state with reduced opportunities for education and for success and with a lower quality of life.[1]

The Golden State has lost its luster. Among the nation's leaders in economic performance and wealth in 1960, California now ranks only slightly above average. As documented throughout this report, education was then and is now one of the major engines of progress and opportunity in California. To reclaim national leadership California must invest more in its colleges and universities and take the steps necessary to get more of its secondary students prepared for college-level work. This is the main conclusion from our efforts to forecast California's economic future from what we know about demographic and educational patterns in the state.

In 1960, California's per capita personal income was 25 percent above that of the rest of the country. The underlying source of this wealth was education. Californians were also more than 25 percent more likely than those in the rest of the country to be high school graduates and to have a college education. In the past forty years, California's wealth and education relative to the rest of the United States have declined towards the mean for the rest of the country, although the state is not yet merely average. This decline continues, but it is not inevitable. Our projections show that investment in secondary and post-secondary education can reverse the downward trend.

Right now and for the next decade, California has an age distribution that favors educational investment. This cohort of young people represents a precious opportunity. California will see a large increase in the number of its young people who will be deciding how far to pursue their education, and for the next few decades it will continue to have a large population of young people who can be educated well or badly. Public policies can be designed to help them attain more education and to make lifelong investments that will help them and the State of California succeed and prosper. *In our detailed analyses, we show that reasonable and attainable shifts in our efforts to make it possible for students to enter college and to get them to graduate can continue to make California, as Governor Schwarzenegger said in his inaugural, "glimmer with hope and to glow with opportunity".*

[1] In *CA 2025: It's Your Choice* (Public Policy Institute of California, 2005), Mark Baldassare and Ellen Hanak put it this way in their opening paragraph: "California is being reshaped by a changing population, a globalizing economy, and fantastic new technologies that are redefining our relationships and our sense of geography. The grand universities, highways, and water systems that fueled prosperity for recent generations are now stretched beyond their capacities. The reforms most critically needed are threatened by major obstacles in leadership and governance, finance, and equity, influence, and participation. We haven't reached a crisis point, but trends and forces are gathering that could seriously erode the quality of life in California in the next two decades. Thoughtful systematic action is needed."

**California: Looking to the Future**

We consider four scenarios for public higher education, ranging from highly constrained to more expansive, which explore the effects of changes in rates of high school graduation, college-going, and college completion.

- Fixed Capacity Scenario – In this scenario, the state's capacity for serving higher education students does not increase over time as the young population grows—it remains the same as in 2003. This would depart from historic trends in which capacity has increased, but it might occur due to budgetary stringencies.

- Current Conditions Scenario – In this scenario, current ethnicity-specific rates of high school graduation, college-going, and college completion proceed at the same rate in the future as they do currently. This is our "baseline" scenario which models the continuation of existing conditions.

- Increased College Going Scenario – In this scenario, high school completions and entry to college gradually trend upwards over the next two decades at reasonable levels from current rates.

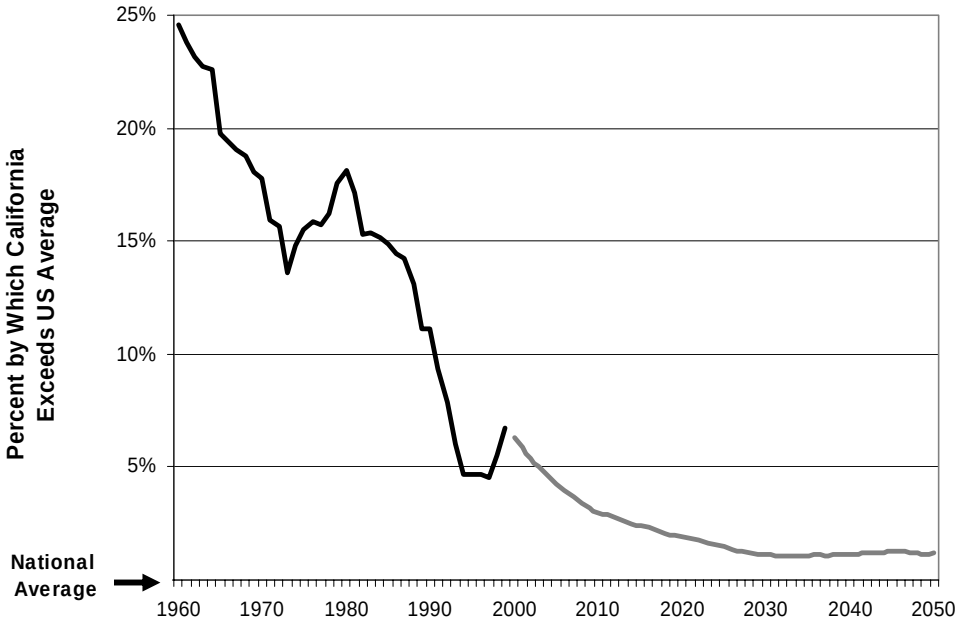
- Improved Completion Scenario -- Finally, in this scenario, we assume both "increased college going" and greater efficiencies in getting students who enter public colleges to complete their programs.

Using robust demographic and economic techniques in combination with detailed demographic projections produced using some innovative methods, we can examine a broad variety of the consequences each scenario would entail. We can calculate the increased income from more education, and the reduced governmental expenditures. We can also determine how much each scenario would cost the state in increased funding for higher education, and we can compare the results according to the net benefits they produce for the state.

Three pictures summarize our concerns and our findings. Figure 1.1 shows how California's per capita income has changed relative to the rest of the country since 1960 and it projects where California will be in 2050. Whereas Californian's average personal income was 25 percent above the national average in 1960, this relative advantage has declined – with some fits and starts depending upon the business cycle—in the last forty-five years to where Californians average income was only six percent above the national average in 2004. Our projections suggest that it could decline to be essentially at the average by 2030 and at most one or two percentage points above the average.[2] As California moves towards being average, the quality of life in California erodes as well.

[2] We are being far from alarmist in noting this possibility, and some analysts suggest a far more threatening future. A recent report "*As America Becomes More Diverse: The Impact of State Higher Education Inequality*" by Patrick J. Kelly at the National Center for Higher Education Management Systems, predicts a decline in California's per capita income that would push the state below the national average by 2020.

**Figure 1.1—California's Per Capita Personal Income Compared to the United States —1960-1999 (actual) and 2000-2050 (projected)**

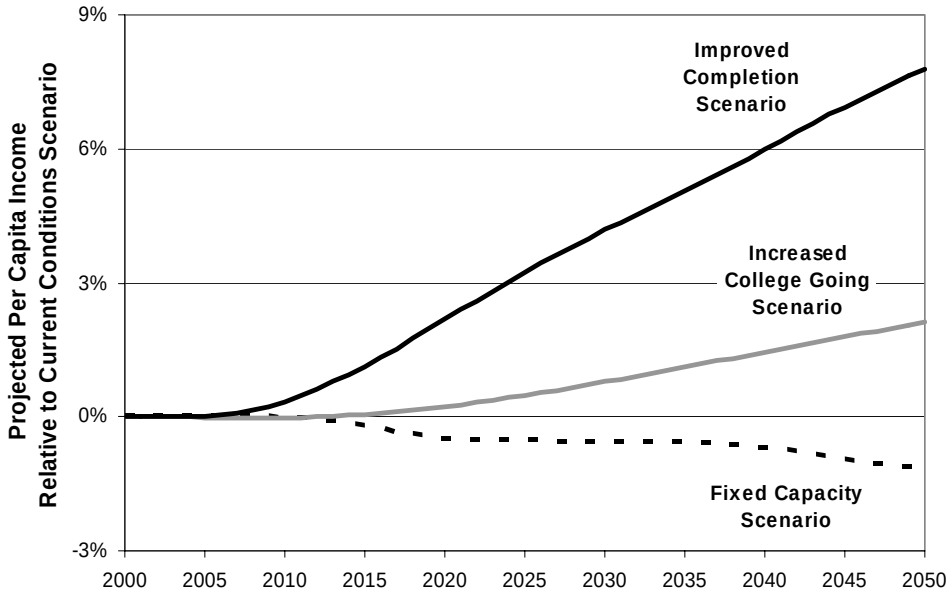



**Source: Data from 1960-1999 from U.S. Bureau of Economic Analysis**
**Data from 2000-2050 based on projections**

Figure 1.2 shows the impacts of our three educational scenarios relative to the "current conditions" scenario for college going and graduation.[3] Figure 1.2 tells a very clear story: investments in education can not only maintain California's current position, they can also increase California's per-capita income. Whereas "fixed capacity" for California higher education at 2003 levels would push income downwards relative to the Current Rates scenario and perhaps push California below average compared to the rest of the nation, "increased college-going" would, by about 2010, start to lift California back up above the national average, and adding "improved completion" would have a dramatically positive effect in making California richer and, of course, better educated. The result will be a better California with a higher quality of life.

[3] The "current conditions" scenario is also our best approximation to the assumptions that lead to the decline in relative per-capita income in Figure1.1. However, the projections in Figure 1.1 rely upon a different methodology than those in Figure 1.2, because Figure 1.1 must not only project California income but also income in the rest of the United States.

**Figure 1.2—California Per Capita Income for Three Alternative Scenarios Relative to the "Current Conditions" Scenario**



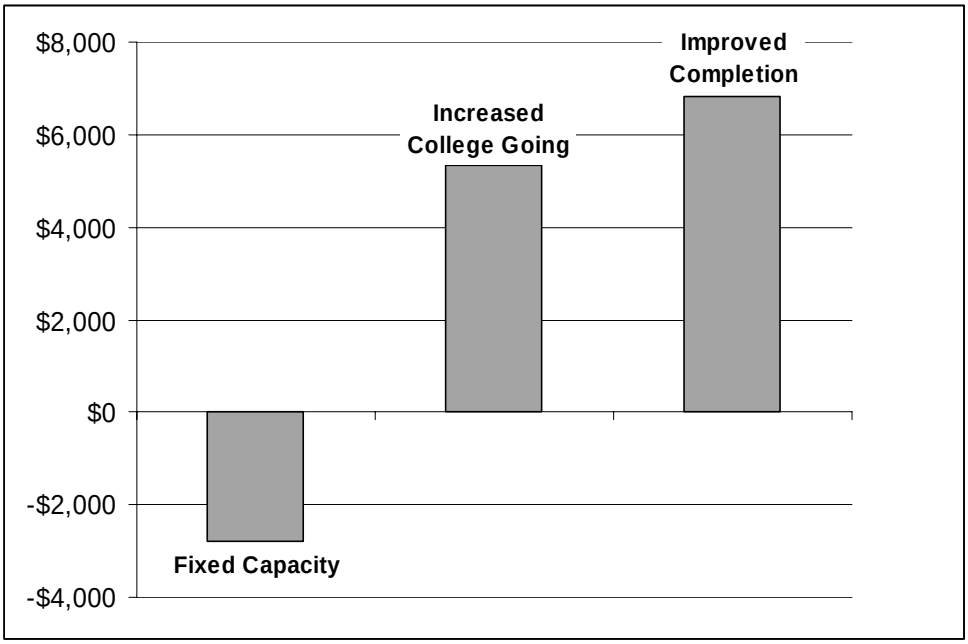

Finally, Figure 1.3 shows that investments in higher education will not only increase people's incomes, they will also be cost-effective for the state because of the increased taxes and lower governmental program costs which result when Californians have higher incomes. Each bar in Figure 1.3 indicates the amount saved for each eighteen year-old in 2015 over the course of the person's lifetime if the specific scenario ("fixed capacity", "increased college-going", or "improved completions") is implemented instead of the baseline "current conditions" scenario.[4] The figure shows that the "fixed capacity" scenario actually leads to net losses to the state of $2,793 for each eighteen year old. This outcome happens because reducing higher education capacity diminishes subsequent earnings which, in turn, decreases tax revenues and increases governmental costs due to poverty and crime. But there are substantial net benefits of $5,329 and $6,820 compared to the baseline for each of these eighteen year olds for the "increased college-going" and "improved completion" scenarios. These net benefits are sizeable, and they are robust to reasonable alternative assumptions about costs and benefits[5]. As a result, even if costs are a bit more than we estimate or gross benefits are a bit less, the net benefits will still be positive. These gains would result from both increases in tax

[4] That is, the chart considers the expenditures for the Current Conditions scenario as the baseline amount that the state is willing to spend on higher education, and it indicates what the impact would be of implementing each of the alternative scenarios—one in which capacity was reduced (Fixed Capacity), another in which it was increased to allow for more college going (Increased College Going), and a third in which there was more college going and improved completion rates (Improved Completion).

[5] Throughout this report, we steer a reasonable "middle path" in terms of the estimation of costs and benefits: reasonable adjustments suggested in the literature could both inflate and deflate returns.

revenues resulting from higher levels of personal income and from declines in the demand for state support of poverty-related programs and correctional costs.

**Figure 1.3 Net Lifetime Fiscal Benefits to the State for Each 18 year-old in 2015 relative to the baseline "Current Conditions" scenario**




Our findings are quite clear and very powerful: *California's declining per-capita personal income relative to the national average can be reversed by setting realistic goals for greater investments in public higher education. Moreover, these investments will pay for themselves in increased tax revenues and decreased expenditures for social welfare, crime control, and other expenditures. The rest of this report documents these findings.*

## The Turmoil of Change: Challenges and Opportunities Facing California

In 1960, the population of California was approaching sixteen million and was still smaller than that of New York. The state was, like the rest of the country, experiencing the post-war baby boom, and more than a third of California's population (35 percent) was under age 18. Educating these young people posed an extraordinary challenge to the state and to the nation, but California was already profiting from the high-level of education of its residents. In 1960, over half of the California adults 25 and older (52 percent) had graduated from high school compared to only 41 percent for the rest of the United States, and 10 percent had completed 4 years of college compared to only 8 percent for the rest of the US. With its highly educated workforce, per capita personal income stood at $13,924 (in 2000 dollars), compared to only $11,139 for the rest of the United States.[6] In terms of ancestry, the state was overwhelmingly white and

[6] Figures adjusted to 2000 dollars using the CPI-U-RS.

native-born: Eighty-four percent of the population was non-Hispanic[7] white, nine percent Hispanic, six percent Black, and two percent Asian, and only 8.5 percent of the population was foreign-born. Fourteen percent of the population still lived in rural areas.

By 2000, the population more than doubled to 34 million, making California the most populous state in the union by a margin of more than 13 million over the next largest state. California's population had shifted somewhat toward older ages, with 27 percent under the age of 18 and nearly 11 percent 65 and older (compared to 9 percent in 1960), but the shift upwards in age in California was somewhat smaller than in other states. Whereas the rest of the country had gone from 36 percent under the age of 18 in 1960 to 25 percent in 2000 (an absolute drop of 11 percent), California had gone from 35 percent to 27 percent (an absolute drop of only 8 percent). *These young people are California's future, and they provide both an opportunity and a challenge.*

California also changed in other ways during this period. It became a "minority-majority" state: less than half the population (47 percent) in 2000 was non-Hispanic white; about one-third (32 percent) was Hispanic, one-eighth was Asian, and 7 percent was Black. One quarter of the population (26 percent) was foreign-born. Far fewer persons live in rural areas—only six percent of the total. Educational attainment increased substantially, with 82 percent of the adults holding a high school degree, and 28 percent having obtained a BA or more, and per capita personal income increased to $32,464.

In short, despite extensive and important demographic changes in the preceding forty years, in 2003 Governor Schwarzenegger could still fittingly identify California as "the golden dream by the sea," and assert that "California has always glimmered with hope and glowed with opportunity." Yet this achievement did not "just happen." California is exceptional because of governmental policies that have invested in state infrastructure and in human capital. These policies have provided businesses with the highly skilled workers they need to excel, and they have produced a rich and prosperous state. But in 2005, it is no longer clear that California can maintain its exceptionalism in the face of continuing change and, if it can, how it can best achieve that goal.

**California, 1970-2004 and Beyond: An End to Exceptionalism?**

Although per capita income and educational levels have increased substantially in California since 1960, the degree to which they distinguish California from the rest of the country has diminished. As shown in Figure 1.1, between 1960 and 2004, per capita income in California has declined from a level 25 percent higher than in the nation as a whole to a level only 6 percent above the national average.

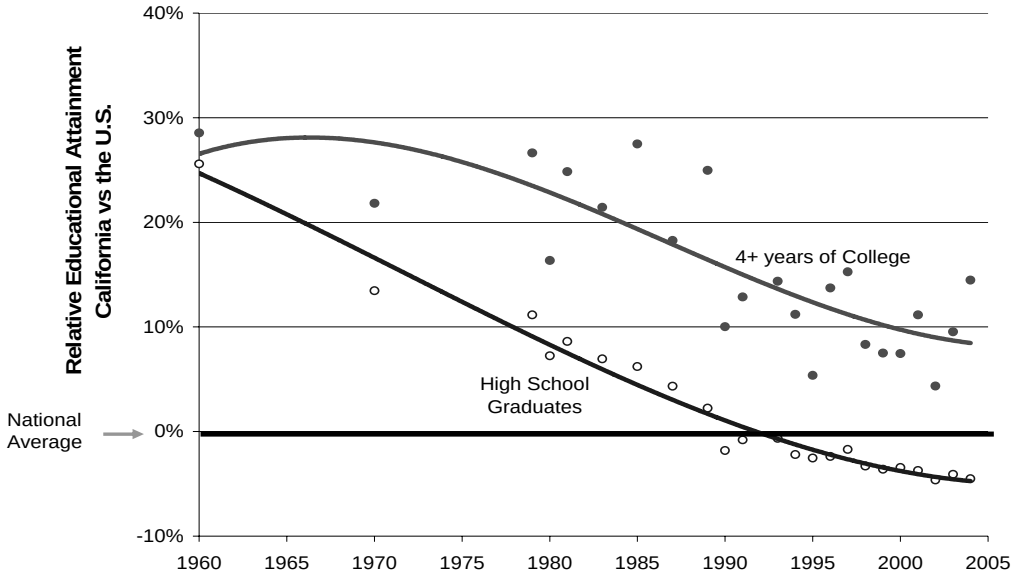
During the same period, the educational advantage that California held over the rest of the US declined as well (see Figure 1.4). Consider, for example, the percent of adults with four years of college. California started the period with a rate 25 percent above the national average and ended less than 10 percent above the national average.

[7] In 1960, Hispanic origin was classified based upon lists of Spanish surnames.

With respect to the fraction of adults who completed high school, California's advantage slipped from 25 percent above the national average in 1960 to 5 percent ***below*** the national average in 2004. It is true, of course, that during this time national rates of educational attainment increased as other states "caught-up" to California and the nation as a whole became better educated, but this still means that California is becoming more and more average. And it raises the question addressed by this report: Is California better-off being just average or should it strive to be above average?

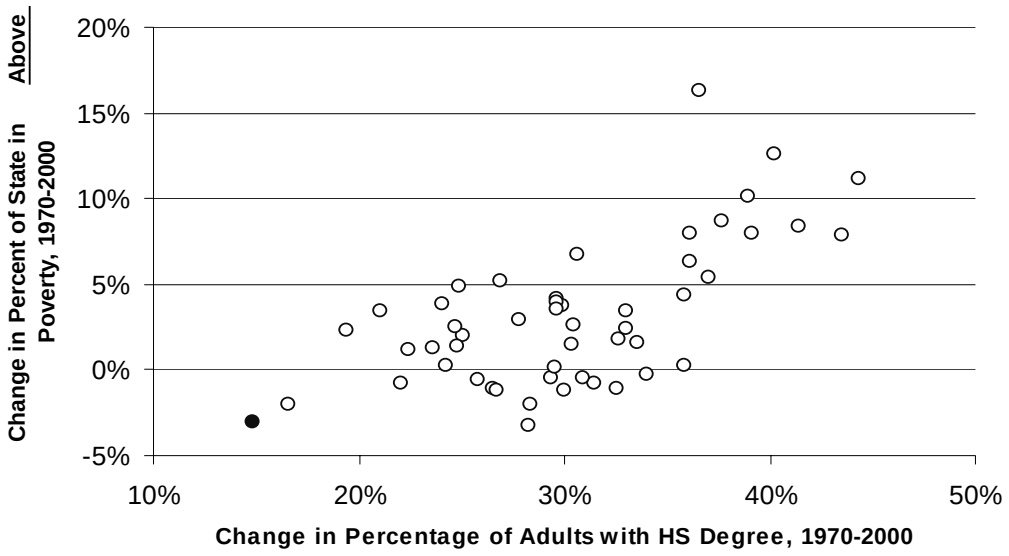
One reason for these shifts is the large-scale immigration to California among both the most educated who are attracted by the state's universities and jobs and the least educated who are attracted by its abundance of low-wage jobs. The first group has helped to keep the fraction of California adults with four years of college above the national average. The second group has contributed to California's falling below the national average in the fraction of adults completing high school. Both groups have children who are part of the large group of young people who can contribute to California's future if they get a high quality education. As we show later in the report, educating the children of those with the least education present the greatest challenge and the greatest opportunity.

**Figure 1.4: Californians' Educational Attainment Relative to National Averages, 1960-2005**




**Sources: Published figures from P-60 series Census reports, and Statistical Abstract, various years**
**Educational Attainment of Adults Age 25 and Older**

**Figure 1.5: Changes in Poverty Rates and Educational Attainment at the State level, 1970-2000**

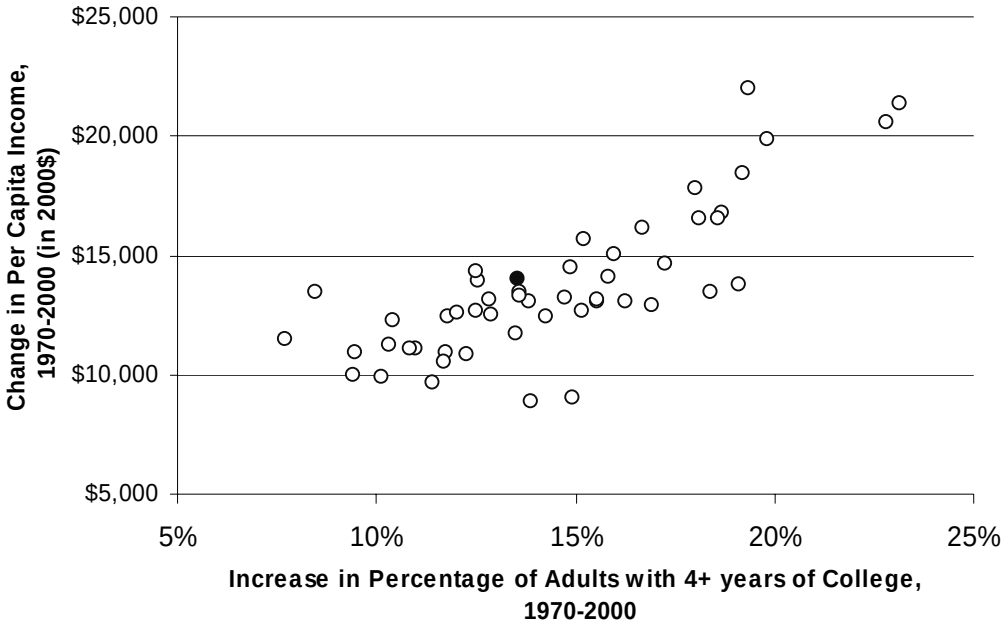



Source: Authors' estimates from IPUMS state samples, 1970-2000. The simple correlations of the change in poverty rate with the change in percent of adults with less than a HS degree is .653. **California is represented by the solid circle in the bottom left-hand corner.**

The trends in income and education are closely related. At the state level, the association between aggregate measures of economic well-being like per capita income or poverty rates and the average educational attainment of adults in the state is very strong.[8] The association between *changes* in educational levels and *changes* in economic well-being is equally strong. As shown in Figure 1.5, between 1970 and 2000, every one percentage point increase in high school graduates was matched by nearly half a percentage point (.43) increase in the percentage of people above the poverty line. Note that California (the solid circle at the lower left-hand corner in Figure 1.5) had the worst performance over these years: its increase in high school graduates was the lowest in the nation and the poverty rate actually increased instead of declining as in most other states.

[8] The relationships in Figures 1.5 and 1.6 are, strictly speaking, just cross-sectional associations which do not prove causation, but they are very suggestive associations. Nor is our choice to graph poverty rates against high school dropouts, and per capita income against college graduates, meant to imply that only high school completion matters for poverty, and only college completion matters for high income. Change in both educational measures is associated with change in both measures of economic well-being. Our review of the literature on income and educational attainment in Chapter 3 and our own analyses will provide abundant evidence for a strong causal relationship between education and income which considers multiple levels of education and multiple outcomes. Hence, while these figures do not constitute our proof for the importance of education, they provide a realistic illustration of its power to determine income and poverty.

**Figure 1.6: Changes in Per Capita Income and Educational Attainment at the State level, 1970-2000**




Source: Authors' estimates from IPUMS state samples, 1970-2000, and BEA SPI series.
The simple correlation of the change in per capita income with the change in percent of adults age 25 and older with four or more years of college is .797. **California is represented by the solid circle.**

Figure 1.6 shows that there is also a strong relationship between changes in college-going and changes in per-capita income. Every one percentage point increase in college completion is matched by an increase of nearly $700 in per capita income. Here California performed better, although it is still only towards middle of the pack.

### *California, 2000-2050: A Choice of Paths*

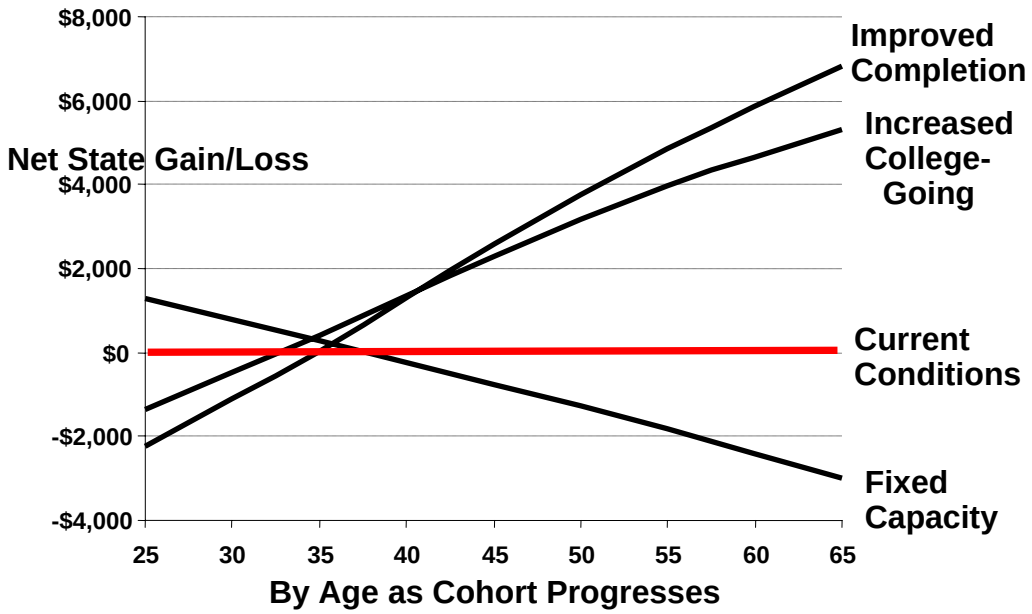
These relative declines in the educational attainment of Californians with the attendant declines in economic well-being are a cause for concern. This concern is well-placed, but the problem is remediable through state policies of support for education. Our analyses indicate that reasonable and attainable levels of investment in public education systems in California could achieve striking results. In addition to the direct benefits to Californians these investments could provide, these investments would also return roughly three times more income to the state coffers than they would initially require. These gains would result from both increases in tax revenues resulting from higher levels of personal income and from declines in the demand for state support of poverty-related programs and correctional costs.

To achieve these results, we must intervene in the educational "pipeline" and increase both the number of students who get to each point and the rates at which they complete their work. Although interventions at many points in this pipeline could increase the skills, credentials, and levels of human capital that accompany investments in education, we focus on interventions that directly affect higher education. For example, increases in the number of adults with baccalaureates can result from increases in the number of students who enter college (college-going rates) or improvements in the fraction of college goers who earn a degree (college completion rates). Similarly, college going rates can be affected by increasing the fraction of high school graduates who go on to college, or by increasing the pool of graduates who could go on to college by increasing high school graduation rates. In Chapter 4, to illustrate what happens from improvements at different points in the educational pipeline, we summarize impacts for some scenarios incorporating changes in high school completion rates, college going rates and college completion rates, as well as a scenario which shows the effect of fixing post-secondary capacity at current levels which would constrict the flow.

Figure 1.3 has shown that the two scenarios that call for more investment in higher education through "increased college-going" and "improved completion" lead to substantial overall benefits for the state, while the scenario of reduced investment by simply maintaining a "fixed capacity" leads to net losses to the state. Because higher education investments come "up-front" and require time to pay for themselves, these scenarios produce costs and benefits at different times. Figure 1.7 compares the cumulative net state gain or loss per individual for each scenario against the "current conditions" scenario. The "fixed capacity" scenario leads to initial savings compared to "current conditions" because it reduces state expenditures on higher education, but those short-term benefits lead to long-term costs. The other two scenarios which involve more investment in education, lead to short-term costs but substantial long-term benefits. Hence, although interventions at different points in the educational pipeline require different expenditures, each scenario requiring additional educational investment returns that investment fairly quickly and continues to provide returns to individuals and the state through the remainder of people's lives.

We also show that one of the challenges facing California is to provide educational opportunity to those rapidly increasing populations which have traditionally acquired fewer years of education and credentials. Those educational disadvantages translate to economic and social disparities whose impact will increase as these populations grow. These educational disadvantages also lead to declines in state revenues at the same time as they drive up demands for state services. Because ethnic groups in California differ in the rates at which they progress through each part of the pipeline, and because they also differ in the extent to which additional education affects income, we model both the costs and effects of educational changes separately by ethnicity for each scenario. We lay the foundation for these models in Chapter 3, where we examine ethnic differences in returns to education and success in California's secondary and post-secondary educational systems.

Figure 1.7. Cumulative Gain/Loss to the State under Selected Educational Scenarios




Those analyses reveal differences in educational success at every stage of education: in high school completion, in college-going rates and in college completion rates. High school graduation rates are 15-20 percentage points higher for non-Hispanic whites than for Hispanic or Black Californians, although rates for Asians exceed that of all other groups. We find similar differences at the post-secondary level, both in level of success and the route followed to earn a degree. We expect nearly 80 percent of Asians to go to college, more than a quarter directly to UCs, and anticipate that 43 percent of Asians with eventually earn a BA at a public state university. In contrast, we estimate that fewer than one third of Hispanic eighteen year-olds will go on to college (most of whom will enter a CCC), only 15 percent will eventually reach a public four-year institution, and less than one in ten will earn a BA there. Black eighteen year-olds do much better at entering college, nearly equaling the average rate, but suffer from the lowest transfer rates from the CCCs and highest attrition rates if they do eventually enter a UC or CSU. As a result, the likelihood that they will eventually earn a BA is virtually identical to that of Hispanics. Rates for non-Hispanic whites parallel the overall rates remarkably closely, falling between the extraordinary accomplishments of Asians and the less successful records for Blacks and Hispanics.

Investment in higher education pays off slightly more for some ethnic groups than for others, but in every group, the rate of return on investment is positive and substantial. The lifetime earnings for an individual with a baccalaureate is about double that of an ethnic compatriot who stops with a high school degree, and about three times that of someone who fails to finish high school. Gains are not only realized in terms of income, but also in years of employment, occupation, home ownership, the value of one's home, and better living conditions. Bad outcomes – poverty, welfare dependence, and risk of

incarceration – all decline dramatically as educational attainment increases. Because the state taxes personal income for the bulk of its revenue and spends tax money on poverty-related and incarceration-related programs, the state gains too if it invests in its citizens' human capital.

To some extent, shifts in the population toward educationally disadvantaged ethnic groups will be offset by trends toward increasing educational attainment by all groups. Chapter 4 documents some of the gains in educational outcomes apparent in California over the last two decades, particularly among Hispanics. Chapter 2 discusses the demographic underpinnings of these trends, by identifying the extent to which children's educational destinations vary by their own parents' education and ethnicity. In addition, Chapter 2, by examining the extent to which mortality, fertility, and migration differ by ethnicity, nativity, and education, shows the expected demographic composition of California over the next five decades, and the factors shaping that composition.

These details of our analysis provide policy-makers with a road-map for thinking about the groups and the locations where they might intervene in the educational process to improve college going, college progress, and college graduation. Our results indicate how important it is for California to find ways to enhance higher education outcomes for its biggest and fastest growing ethnic group – Hispanics. The economic future of California rises or falls depending on whether the state succeeds in improving college completion rates among Hispanics.

Incremental change is all California needs. Our results show that reversing California's decline relative to the rest of the nation is possible by setting reasonable educational policy targets. What remains is for policy-makers to devise programs that will meet these targets.

**Overview of Methodology**

In the rest of this chapter, we provide an overview of our methodology. We skim over many details which are covered in subsequent chapters, but we try to provide enough information so that the general reader will understand what we have done.

Our methodology involves four major steps:

(1) Demographic Step
- Choosing demographic categories (including education, of course)
- Making demographic projections based upon demographic categories

(2) Outcomes Step
- Choosing outcomes of interest
- Linking outcomes to demographic categories (especially education)

(3) Educational Pipeline Step
- Describing the educational pipeline

- Determining the costs of education

(4) Scenario Analysis
- Choosing specific educational interventions for scenario analysis
- Applying outcomes analysis to modified educational flows to determine results of scenarios
- Assessing the costs and benefits of scenarios

In the demographic step, we define the state's population in terms of a set of useful demographic categories which, of course, must include education, and we project the results into the future. In the outcome steps, we identify outcomes of interest and we determine how outcomes are related to demographic categories so that we will be able to project outcomes when demographics change. In the educational pipeline step we describe the flows of students through the educational pipeline in California, and we determine how much public higher education costs the state of California. We also identify places where we can intervene to change educational flows. In the scenario analysis, we begin by choosing specific interventions which change the educational outcomes in California in a specified way. Then we apply the outcome analysis to the modified educational flows to determine the result of the scenarios. Finally, we use the resulting data to assess the costs and benefits of scenarios.

Choosing Demographic Categories – For obvious biological reasons, age and sex are important demographic categories for projecting populations into the future. In addition, some of the major components of population projections such as fertility and mobility depend upon other characteristics such as race and ethnicity which are usually considered as well. Since we are concerned with educational attainment, parental education and nativity are important. Parental education is a very strong predictor of children's educational attainment so we include it. We also detail projections by nativity because natives and non-natives differ markedly in fertility and educational attainment, and because we wish to separate net migration into its international and domestic components for further modeling. The manner in which we incorporate educational attainment relies on the attribution of an individual's final level of educational attainment, as well as the current educational level. Current and completed educational attainment are incorporated both as outcomes of interest, and also because education is strongly tied to fertility, patterns of migration to California, and social outcomes of analytic interest. Hence, we consider not only the usual factors such as age, sex, race, and ethnicity, but also factors such as nativity and parental education that are seldom examined but that are important for understanding California's future.

By adding these factors we strengthen our analysis, but we must also face three substantial problems. First, it is hard to get suitable data on nativity and especially parental education. We must mix and match datasets to get what we want, and we employ a very broad range of data. Second, having a large number of demographic categories complicates the analysis. Third, linking parental education poses special problems which we overcome using sophisticated modeling procedures.

Making Demographic Projections –We make detailed projections of the demographic composition of California's population by these categories so that we can identify the primary demographic characteristics of the people who will live in California for the next forty-five years. These projections use a *cohort-component* method to estimate the size and composition of California's population over this period. The basic cohort component method divides the population into different *cohorts* -- individuals who share the same set of characteristics -- and apply a schedule of demographic transitions to derive the size of equivalently defined cohorts at some point in the future. The schedules of demographic transitions reflect the *components* of demographic change attributable to mortality, fertility, and migration.

For the basic model, our projection involves the estimation of the four inputs to our model -- the base year population, the fertility rates used to calculate new births, the mortality rate used to decrement the population, and migration into and out of California. In particular, we:

1. Identify the size of the population by age, sex, ethnicity, nativity and period of entry, and current and future educational attainment in the base year (2000);
2. Estimate age-specific fertility rates by race/ethnicity, nativity and educational attainment;
3. Estimate annual survival rates, specific by ethnicity, age and sex, applicable to the population, and;
4. Estimate the domestic and international rates of immigration and emigration, specific by race/ethnicity, nativity and period of entry, age and education.

Projection of the size and composition of the population in subsequent years simply reflects the application of inputs 2, 3, and 4 to the base year population. The result of this process yields a projection of the population by race/ethnicity, nativity, age and sex in the year following the baseline. Each of the groups defined in the projection are also assigned educational distributions. Populations in subsequent years can be projected by substituting the projected population for the base population iteratively.

The quality of the projected characteristics rests upon both the invariance of the characteristic within the defined cohort over time and the accurate projection of the size of the cohort over time. Improvements in estimates of the projected characteristic can come from:

A. More detailed distinctions in the cohorts which improve cohort-specific characteristic invariance over time (e.g. splitting a basic "birth year-sex" cohort into a "birth year-sex-race" cohort in the belief that different ethnic groups are and will continue to be different in terms of fertility, migration, or mortality.)
B. More accurate estimates of any or all of the inputs to the projection, which, if those rates are consistent over time, will yield a more accurate cohort composition of the population in the future.

C. Imposition of constraints on the demographic components used in the projection to fit expectations of future trends (e.g. assuming that fertility norms will converge over time for different groups, or that mortality will decline for selected ages).

In line with A, we incorporate three additional points of detail in the construction of our cohorts: first, distinctions based on race and Hispanic origin; second, preserving the native-born and foreign-born (and recency of entry) distinction, and; finally, incorporating levels of educational attainment as separate cohort identifiers. The first of these three elaborations is fairly common, the second is more rare, and the third quite unusual.

Improvements which we are attempting through approach B include differentiating components of net migration into those attributable to domestic and international migration, using multiple sources for estimation of migration, utilizing multiple sources for fertility and mortality regimes and enhanced fitting of fertility regimes by nativity and education. We also compare our inputs to those from multiple sources.

Finally, for C we constrain mortality outcomes to match the Census Bureau's middle range estimate. More generally, we compare our projections with those from other sources to make sure that our methodology is producing reasonable results.

Choosing Outcomes of Interest: Typologies, Measures and Sources – The cohort characteristics that we use to differentiate people—age, sex, ethnicity, nativity, and education—also structure many other important life experiences. The kinds of jobs we can find, the money we earn for our efforts in the labor market, the housing conditions and lifestyle we can purchase with those earnings, the savings we accumulate for retirement, and the likelihood that we will live in poverty or rely on transfer payments for basic needs are only some of the many outcomes which emerge from the interplay of these basic characteristics.

To organize our discussion of these effects, we differentiate three classes of effects: *personal* benefits, *collective* benefits, and *fiscal* effects – changes in revenues and expenditures for the state. In terms of personal benefits, we consider items that we expect individuals to directly benefit from: a good job, good wages, ownership of one's home (and, of course, Californians' home away from home, the automobile), and freedom from overcrowding and poverty.

Collective benefits are those which we gain from indirectly through changes in the environment in which we live and work or which inhere in relationships between many individuals or groups. We consider such items as an educated population, high levels of citizenship, low levels of inequality, high levels of facility with a common language, or high proportions of the population registered and willing to vote.

In the state's eyes, a central concern is its fiscal health – its ability to fund operations through tax revenues and, to the extent possible, minimize the costs of the programs it operates. Education affects this interest in two ways. First, by increasing the average income of the state's residents, the state can either increase its tax revenue while maintaining a constant tax rate, or it can maintain a constant level of income while reducing tax rates. The second impact of education on the state's cash balance is through reduced spending. Increased education has measurable effects on the need for means-tested transfer programs, such as the California Work Opportunities and Responsibility to Kids Program (CalWORKs), Supplementary Security Income (SSI), or poverty-related supports like Medi-Cal, the program for health care and long-term care for low income residents in California. Educational attainment also influences rates of incarceration, in which the more poorly educated are heavily over-represented. We provide some estimates of some of the elements of those revenues and expenditures.

Linking Outcomes to Demographic Categories (Especially Education) – For each of these outcome measures and for each of the seven ethnicity/nativity categories, we estimated the relationship between the outcome and the demographic characteristics using a separate logistic or ordinary least squares (OLS) regressions. In each case, the outcome variable was regressed on age (linear and quadratic terms), sex, educational attainment, interactions between age and sex, age and education, and sex and education. Reduced form estimates were calculated and compared with raw measures for the baseline projection over time as a verification check.

With these estimates, it is possible to estimate any one of the outcomes for any one of the demographic categories. For example, we can determine the likely income for a 34 year old native-born Hispanic male with a high school degree or a 55 year-old foreign born white female with a college degree. Furthermore, we can "change" each person's educational attainment and see what difference it makes in the outcome variable.

Then the question arises: How do we summarize the effects of a change in education? Educational attainment has implications at all stages in a life cycle, but especially after age 25 when most people have achieved their maximum education. As a result, we focus on outcomes for adults, particularly those ages 25 and over. We use these adults to construct a synthetic cohort[9] which can be used to estimate the differences in outcomes which emerge by education over the course of an individual's life. This approach starts with a cross-sectional sample and takes a 'snapshot' of conditions for a group at each year of age, and combines those snapshots to create a movie of that groups' expected life course. It has the advantage that it summarizes information in an interpretable form, and it standardizes for age differences between groups. We define groups on the basis of educational attainment and ethnicity/nativity, and we report outcomes within ethnic/nativity groups relative to a 'base' educational category. We

[9] The concept of a synthetic cohort is a common one used in demographic analysis. A synthetic cohort applies the rates of a given time period over the entire projected lifetime of a group of people, as they age through life. Though it makes an unrealistic assumption that rates will not change throughout time in the future, synthetic cohort analyses provide a useful way to assess the implications of the continuation of current conditions.

derive these synthetic estimates by estimating the mean value of the outcome for each year of age and by summing those values separately for men and women in each of our ethnic categories.

The synthetic outcome represents what the average Californian of a particular ethnicity, gender and education could expect to experience over their adult years if the relationship between that outcome and age does not change over time. If, for example, we are considering the impact of education on employment, we estimate the likelihood that an individual will be employed at each age, and sum across the relevant ages. The sum will reflect the number of years (out of the forty possible years between ages 25 and 64) that we expect that individual to be employed. If the outcome of interest is instead income, we sum the age-specific mean income for a stratum, and the result reflects the total income (in constant dollars) that an individual in that stratum could expect to receive between the age of 25 and 64.

Synthetic cohort estimates emphasize the effects of currently prevailing associations between education and outcomes. As such, they may overstate or understate the very real effects that education will have on peoples' lives as they experience them in "real-time" over the next half-century. It could be argued, for instance, that as more and more adults go to college and earn baccalaureates and advanced degrees, payoffs will decline as the supply increases. All available evidence suggests, however, that future demands for educational credentials in the workplace are outstripping the supply, and trends from the last three decades imply *increasing,* not declining, differentiation by education. If we were to project the growing returns to education from the last three decades forward to the next three decades, our results would imply even more strongly that California needs to invest more in college and university education.

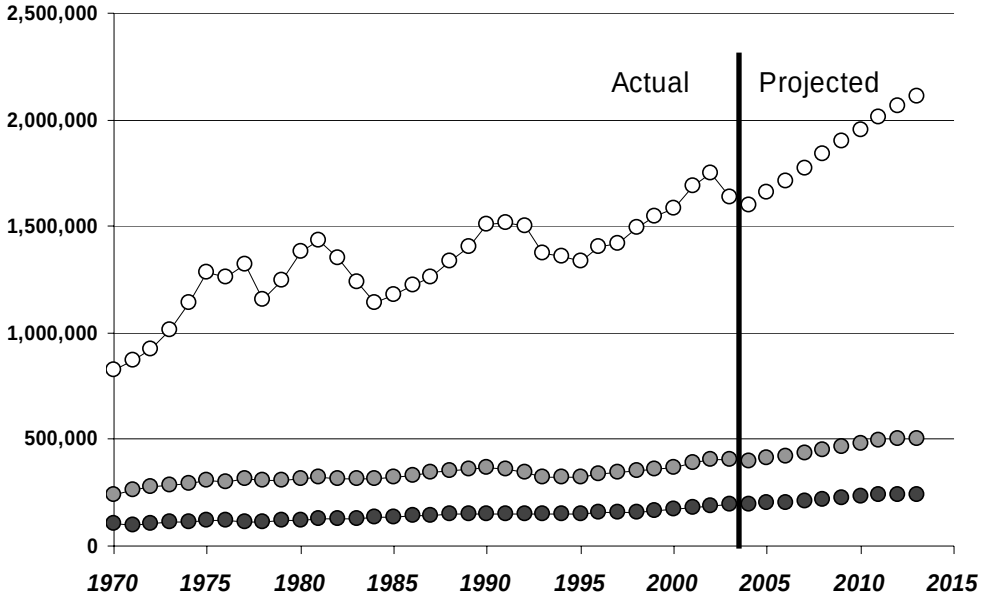
Describing the Educational Pipeline – The synthetic cohort approach provides a way to describe the impact of education and educational changes. But what changes in education should we consider? And what is a realistic baseline model of what will happen in public higher education and in high school graduations in the next fifty years? And what does this model look like when broken down by ethnic group?

In California, the Master Plan, initially established in 1960, created the framework within which public higher education was to be developed. The Master Plan created a three-tiered system of post-secondary education in California. The University of California (UC) system serves as the state's primary research institution, provides doctoral-level education and degrees, and draws upon the top one-eighth of high school graduates for its incoming freshmen body. The California State University (CSU) system is focused on undergraduate and professional education, grants baccalaureate, masters and professional-level degrees, and draws from the top one-third of high school graduates. The California Community College (CCC) system provides lower-division pre-baccalaureate and vocational education, grants certificates and associates degrees, and prepares students for transfer to the UC, CSU and private universities. It serves "any student capable of benefiting from instruction", and provides a wide variety of credit and non-credit coursework to an equally diverse set of students. California also benefits from

independent and private colleges which provide undergraduate and graduate level education.

As Figure 1.8 indicates, each part of the public higher education system has expanded since 1970. The actual pace of this increase resembled overall population growth through 1990, declined sharply through 1995, and rebounded equally sharply thereafter. Relative to the population aged 18-24, system growth tracked population growth through 1985, exceeded population growth from 1985-90 before a short decline, and resumed exceeding the growth of young adult population since then. Current projections from the California Department of Finance (DOF) and the California Postsecondary Education Commission (CPEC) anticipate a 35 percent increase in UC enrollments between 2000 and 2010, a 31 percent increase in enrollments at CSUs, and a 23 percent increase in enrollments in the CCCs. Both the DOF projections and our own indicate that the population aged 18-24 will grow about 23 percent in that same period. These results provide the basis for our "baseline projection" described later.

**Figure 1.8: Enrollment in Public Post-Secondary Education by Educational System, California, 1970 - 2013**




Source: DOF 2004 Public Postsecondary Enrollment Projections

The substantial gains in post-secondary enrollments rely upon equally substantial gains in K-12 education. In 1970, only 63% of the population age 25 and older had a high school diploma. By 2004, 81% of Californians held that credential. Despite these apparent substantial gains, California has steadily lost ground relative to others states. In 1970, the 63% proportion of the population 25 and older with a high school degree placed

California well above the 55% national average. By 1990, the national average matched that of California, and by 2004 the 85% national average exceeded the 81% rate in California. (In terms of rank, California fell from 23rd in 1989 to 45th in 2004 in the proportion of the population 25 and older with a high school degree.)

Given these mixed results, we have had to address the question: At what rate can California's public high schools produce well-educated graduates? How do graduation rates differ by ethnicity? What does this imply for future production of high school graduates? Despite state interests and federal requirements in tracking K-12 educational advancement, the answers to these questions are not easily answered.

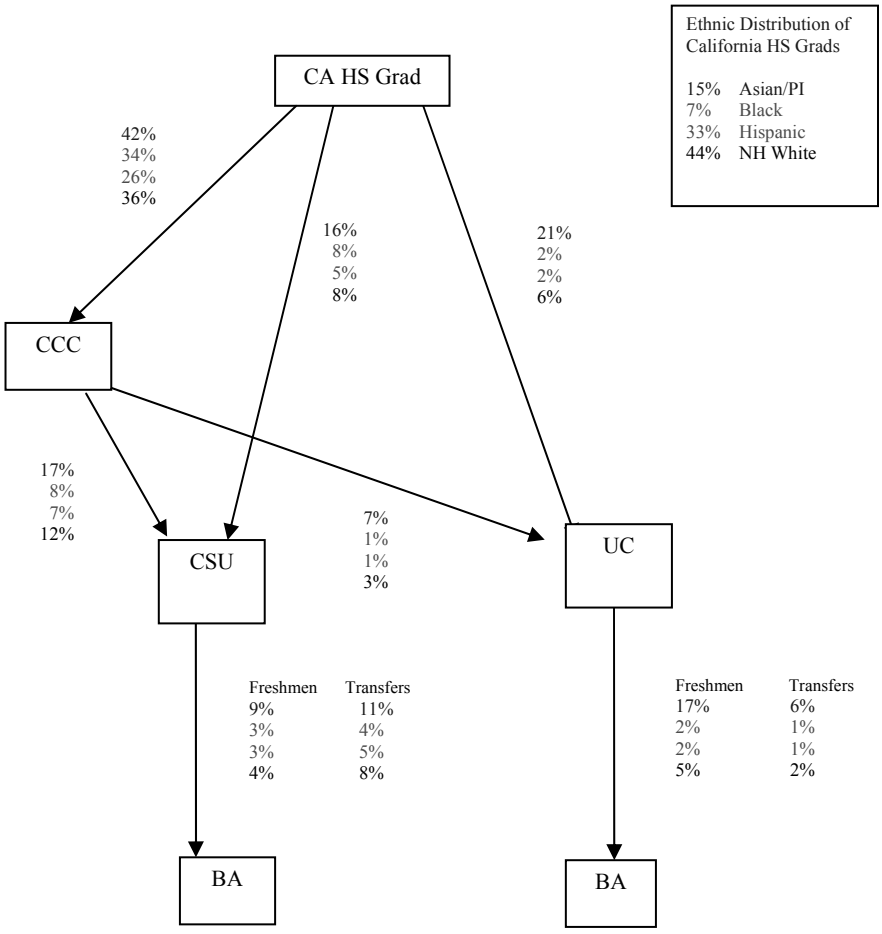
We come to three conclusions about these matters. First, rates of on-time graduation in California are much lower than official reports would suggest, and hover around levels that raise serious concerns about the state's ability to produce an educated workforce. Second, these concerns are particularly intense with respect to Hispanics and Blacks, while rates among Asians are fairly high. Third, though these graduation rates are fairly dismal, they do show considerable gains over the period we examine.

With information in-hand about trends in high school graduations and enrollments in public higher education in California, the next question is how different ethnic groups flow through the higher education system. Figure 1.9 provides an overview of flows through that system, based on data published by the California Postsecondary Education Commission (CPEC), the University of California Office of the President (UCOP) and reports on data from California State University (CSU) and the California Community College Chancellor's Office (CCCCO). The data from these sources are complex, differ in focus and coverage from one another, and are sometimes simply inconsistent. Yet, we believe that we have a relatively consistent picture of what is happening. For our purposes, we are interested in identifying the effects of a changing ethnic composition on eventual educational distributions, and subsequently on statewide outcomes such as income, poverty, employment, taxes, and political participation. This requires that we are able to express these rates relative to some population we identify in population projections. We do so with respect to the 18 year old population.

Given the large discrepancies in ethnic progression rates in public high schools, it should come as little surprise that similar ethnic-specific barriers manifest themselves in college. We expect nearly 80 percent of Asians to go to college, more than a quarter directly to UCs, and anticipate that 43 percent of Asians will eventually earn a BA at a public state university. In contrast, our estimates indicate that fewer than one third of Hispanic eighteen year-olds will go on to college (most of whom will enter a CCC), only 15 percent will eventually reach a public four-year institution, and less than one in ten will earn a BA there. Black eighteen year-olds do much better at entering college, nearly equaling the average rate, but suffer from the lowest transfer rates from the CCCs and highest attrition rates if they do eventually enter a UC or CSU. As a result, the likelihood that they will eventually earn a BA is virtually identical to that of Hispanics. Rates for non-Hispanic whites parallel the overall rates remarkably closely, falling between the extraordinary accomplishments of Asians and the less successful records for Blacks and

Hispanics. These projections of college-going provide us with a baseline for the scenarios described below.

**Figure 1.9 – College Progression in California**




*This chart represents a stylized progression of a cohort of potential students by ethnicity through the public system of higher education in California. The percenatges represent the fraction of eighteen-year-olds who enter one of the three systems, who transfer to a UC or CSU if they do not enter directly, and who earn a baccalaureate degree.*

*For example, we expect 42% of Asians to enter a CCC, 16% to enter a CSU, and 21% to enter a UC. After entering a CCC, 7% (or about one in six) will transfer to a UC and 17% (about two-in-five) will tanfer to a CSU. The final set of figure shows the percentage of all eighteen year old Asians who will enter a CSU as a freshman and earn a BA (9%), transfer to a CSU and earn a BA (11%), enter a UC as a freshman and earn a BA (17%), or transfer in and earn a BA (6%).*

Determining the Costs of Education in California – Increasing education offers obvious advantages in terms of employment, earnings, poverty, quality of life, civic participation and equality. Balanced against these advantages are costs as well. The direct costs of education are borne principally by students and their families, who pay fees, foot the expenses necessary to live and attend school, and face opportunity costs in the form of foregone earnings and lost time while attending college. Costs are also borne by the universities themselves through endowments and fundraising to support these educational programs. We make no attempt to estimates these costs, although they are real constraints to the decisions made by individuals to enroll and by universities to support those decisions. More centrally to these analyses, costs are also borne by the state to provide necessary infrastructure.

In this part of the report, we estimate how much it costs the state in order to provide an education to students. We create this estimate by applying a *cost per enrollment year* to a projection of the *years per enrollment* to establish a *cumulative cost per entrant*. We calculate the costs we use based on historic average costs per student in dollars from state General Funds, and do not include student fees, state contributions for financial aid, or funds for capital construction. Thoughtful alternate estimates of costs have been calculated and employed by other analysts, and we provide limited comparisons of those alternate estimates to our own. But we believe the historic variation in costs is such that a more simply defined and calculated measure appropriately captures system differences in costs without implying a precision we cannot claim.

Costs per year of enrollment are only half the story: to estimate the state investments in producing individuals who are high school graduates, have some college, or have a BA or more, we need to identify how long individuals are in school, where they attend, and how successful they are. Both UC and CSU provide summary figures tracking cohorts of entering freshmen and transfer students, identifying the fraction in each subsequent year who earn a BA or who remain enrolled without graduating. We use those figures to identify, by ethnicity and success in earning a degree, the number of years they are enrolled before leaving the system.

Choosing Specific Educational Interventions for Scenario Analysis – We consider four scenarios for changes in public higher education which range from highly constrained to more expansive. In the "fixed capacity" scenario, the state's capacity for students does not increase over time. In the "current conditions" scenario, current circumstances continue. In the "increased college-going" scenario, more people enter higher education and graduate from it than indicated by current trends. Finally, the "improved completion" rates scenario adds to the "increased college-going" scenario some greater efficiencies in getting students who enter public colleges to complete their programs. Using our demographic projections, we can be precise about what each scenario would entail. We can also determine how much each scenario would cost the state in increased funding for higher education.

We begin with the "current conditions" scenario in which we adjust the composition of the cohorts to fit the changing ethnic composition of college age adults

over the next 25 years. The future this describes is one in which both the educational achievements and the rewards those achievements earn are fixed at the same ethnic-specific rates we find today.

We then turn to a worst-case scenario, one in which the capacity of our system of higher education is fixed, and the growth in the college age population results in increases in unmet demand and declining rates of college enrollment. The "fixed capacity" scenario means that short-term costs to the state do not change, but instead the state bears the costs of foregone revenues, increased need for public support, and a population which is poorer and less engaged in the labor market and politics.

The third scenario we sketch out, "increased college-going", includes moderately increasing rates of high school graduation and college-going, commensurate with the finding of upward trends in high school graduation and college preparedness, coupled with fixed rates of progression and completion once students are enrolled. This scenario anticipates changes originating outside the system of higher education, to which the systems respond at rates equivalent to those found today. (Effectively, these increases translate to an increase in rates of public HS graduation of 2% for Asians, 6% for non-Hispanic Whites, 8% for Blacks, and 18% for Hispanics by 2015. These are increases in the rates, not gains in absolute percentages, for completing high school. College-going rates - college entry among HS grads - is set to increase by 2 absolute percentage points within each ethnic category. )

The fourth scenario, "improved completion", incorporates a more efficient system response to increased demands for higher education, and includes lower rates of attrition among enrollees coupled with higher rates of completion of four-year degrees. This scenario shows the possible impacts of improving outcomes among those who enroll with the intent of earning a bachelor's degree, but who currently face barriers which dissuade them. It uses the same levels of college-going as does the third scenario, but assumes that ethnicity-specific attrition rates are halved.

Applying Outcomes Analysis to Modified Educational Flows to Determine the Results of Scenarios – Because education is so highly tied to important outcomes such as per capita income, poverty, and tax revenues, we can use these scenarios to project the future economic, social, and fiscal well-being of the state.

Under a "current conditions" scenario in which eventual education distributions are completely determined by ethnicity and nativity, all changes in costs and outcomes reflect shifts in ethnic composition. Overall, as the shifts in California tilt towards cohorts who attend college less, the average educational expenditures required by the typical 18 year-old will decline by $750 for the 2020 cohort from that needed for the 2000 cohort. Despite these savings, the net cost to the state will far outweigh the savings. The declines in average income will cost the state nearly $2,000 in foregone taxes, the moderate increases in poverty will add an additional $100 in support payments and services, and incarceration costs will add more than $1,200 to the state's bill. Overall, the lifetime costs to the state are anticipated to increase by $3,200 per 18 year-old in 2020,

and net costs will increase by $2,500 (after deducting the savings from reduced educational support).

The losses and gains entailed under the "current conditions" scenario are bracketed above and below by the remaining three scenarios. While effects in that scenario are driven exclusively by shifts in the demographic composition of eighteen year-olds, the remaining scenarios also vary the educational distributions we expect. In the "fixed capacity" scenario, per 18 year-old, the state can anticipate shaving more than $1,600 off its support for education on average, primarily from the four-year colleges. However, it will pay heavily for these savings, totting up costs between $4,000 and $7,000 in lost tax receipts, increased costs for incarceration, and subsidies for the poor. The state's net lifetime losses average between $3,000 and $5,000, and cost the state more than two dollars over this cohorts' lifetime for every dollar saved in curtailed educational support.

If instead of limiting access, we allowed for the reasonable increases in high school completion and college-going rates, a very different picture emerges. The state will pay nearly $2,000 per person to achieve these benefits, but it will, in time, gain more than $5,000 in additional taxes and save nearly $4,000 in decreased supports for poverty-related programs. On net, the state will gain $7,000 per person over the life of this cohort, returning nearly four-for-one on its initial investment in their human capital.

The final scenario considers the potential impact of halving the rate at which students terminate their 4 year college careers prior to earning their baccalaureate. Currently, nearly one-third of students who enter a four year public university in California leave without a degree. These rates are particularly low for Black students, among whom only one-half graduate. Like the third scenario, this scenario is implemented gradually and achieves its greatest gains in later years. The gains would provide the state with an additional $8,000 per graduate in tax revenues which, in combination with the $4,000 in reduced expenditures for poverty and prisons, offsets the additional $3,000 in educational costs four times over.

Summary – In summary, we show that the level of investments that would be required to educate more students are repaid many times over, and that the burdens imposed by a failure to invest are large, not only to the residents of the state but also in terms of balances in the state coffers.

*The demographic composition of California's population is continuing to change. Because population composition - in terms of age, ethnicity, nativity, and education - is associated with outcomes for a broad range of social and economic indicators, any careful consideration of what California's future looks like should take that population composition into consideration. The California DOF produces official population projections for the state, but these projections do not differentiate the population by nativity or education, nor do they separate domestic and international migration. We develop projections which incorporate these factors, examine the inter-relationships among these additional factors and the mechanisms which drive population change, compare the results with the state's official estimates, and identify some key changes we anticipate in the state's future.*

## Chapter 2
## Demographic Underpinnings of California's Future

The introductory chapter identified some of the many ways in which California stands at a crossroads relative to the remainder of the US -- the lagging educational attainment of the adult population, the declining levels of per capita income, and the ever-wider income inequalities that divide Californians -- the trends are clear and discouraging. It also described some of the ways in which California foreshadows and differs from ongoing national trends, based on the demographic forces which are reshaping its ethnic composition. In this chapter, we attempt to describe some of those forces and the effects we can reasonably expect them to have.

We cannot know the future with certainty, but there are a number of tools which can help us create a map of its general features. Although we hope that many of those features are familiar and predictable, there will certainly be some surprises. Industrial shifts will reshape the economic landscape, changes in medical technology will extend many lives, and changing social and cultural values will alter many aspects of the way we live and pass along our ways of life to the next generations. Many changes will not surprise us, however, since they are based on trends which rest on fairly clear mechanisms. One very important tool for thinking about the future is the population projection. Population projections are tools which build on current patterns of fertility, migration and mortality to describe the demographic composition of future populations.

The "map" we produce in this chapter shows some of the broad features that we and others believe are likely to characterize the future population of California. The contours of this map come from the demographic composition of the population. We use well-established demographic methods to project future populations, albeit with some innovative distinctions. Other individuals and organizations produce demographic projections as well. Projections from two organizations, the California Department of Finance (DOF) and the U.S. Bureau of the Census, serve as authoritative standards for many planning purposes. Other important projections include those produced as part of the California Demographic Futures (CDF) Project at University of Southern California, which incorporates nativity and parentage into their projections of a state which is dramatically marked by the footprint of immigration. All of these projections agree that California is clearly on a trajectory of change, most noticeably in the changing ethnic composition of the state. Less obvious changes can also be expected. One possible change with the greatest implications for the state is in terms of levels of human capital – best indicated by levels of educational attainment achieved by Californians.

We recognize the high quality and substantial efforts which have gone into existing projections, but produce our own for two reasons. First, some of the elements we consider to be important features of the landscape -- nativity and education -- are not directly incorporated or produced in those official projections[10]. Second, the investigation of these additional features helps to clarify the relationships between each of these elements in ways which are absent from most projections. Finally, and perhaps more importantly, by including those elements directly into our projections, we can model the effects of policy changes which shape those elements and explore the directions those changes could take us.

We divide our discussion into two parts. In the first part, we identify the basic methods and inputs for our project and contrast those inputs with those used by the California Department of Finance and, as applicable, other producers. In the second part, we show the results of our preferred projection in terms of core characteristics of the population -- size, age structure, ethnicity, fertility, life expectancy, and education -- and compare those with DOF estimates where available. In later chapters, we will explore changes in some inputs that can be affected by policy-makers -- especially changes in education -- and discuss the potential effects of those changes on the well-being of California and its residents.

[10] The California Demographic Futures Project at USC incorporates one of these two elements - nativity - and further distinguishes between children of immigrants and natives among the native-born. Contrasts of our projections with respect to key features, such as population size, age structure, and ethnicity, are provided relative to the California Department of Finance (DOF) projections and existing Census Bureau (CB) projections, as well as to projections from the Demographic Futures Project at USC. In addition to these key features, we compare educational distributions and nativity for variations of our projections. Although updated state-level CB projections are expected in 2005, they have not yet been released; at this time, the April 2005 projections provide no detail by ethnicity.

## Methods

These projections use a *cohort-component* method to estimate the size and composition of California's population over the course of the next 40 years. The basic cohort component method divides the population into different *cohorts* -- individuals who share the same year of birth and sex, and potentially other characteristics -- and applies a schedule of demographic transitions to derive the size of equivalently defined cohorts at some point in the future. The schedules of demographic transitions reflect the specific ages at which each *component* of demographic change -- mortality, fertility, and migration – changes California's population.

In simplest form, this method estimates the population $P$ at time $t$ for cohort $i$ as:

$$P(i)_t = P(i)_{t-1} + B(i)_{t-1,t} - D(i)_{t-1,t} + M(i)_{t-1,t}$$

where for each cohort,

$P(i)_{t-1}$ = cohort population at time $t-1$;
$B(i)_{t-1,t}$ = additions to cohort via births, in the interval from time $t-1$ to time $t$;
$D(i)_{t-1,t}$ = deaths to cohort, in the interval from time $t-1$ to time $t$; and
$M(i)_{t-1,t}$ = net migration of cohort, in the interval from time $t-1$ to time $t$.

Since we have defined cohorts in terms of birth year and sex, the impact of the birth component $B(i)_{t-1,t}$ for existing cohorts is equal to zero: no-one can enter the cohort population after the year of birth by being born. That component exists only for new cohorts, and reflects how fertility changes affect the state both when they occur and from then on. We apply an age-specific fertility rate to the female population cohorts in the period $i-1$ to obtain future births ($B(i)_{t-1,t}$) for a number of difference demographic scenarios.

Although projections which define cohorts solely by sex and age are common, many projections reflect more elaborate models, often distinguishing populations by race/ethnicity, providing finer levels of geography, or modeling additional elements linked to population change or of particular interest to the analyst[11]. More elaborate models allow comparisons of projections in which these elements can be varied, and hence provide a better sense of factors which may drive demographic changes. Our projections are for the state of California, and are detailed by race/ethnicity, nativity, and current educational attainment. We detail projections by nativity because natives and non-natives differ markedly in fertility and educational attainment, and because we wish to separate net migration into its international and domestic components for further modeling. Current and completed educational attainment are incorporated both as outcomes of interest, and also because education is strongly tied to fertility, patterns of migration to California, and social outcomes of analytic interest.

[11] Of the five projections reviewed by Hans Johnson (1999), two provide race/ethnic detail, and three provide a finer geographic grain. One, the DOF projection, provides both. "The New Texas Challenge", in some ways to impetus for our work, also provides both race/ethnic detail and county-level detail. The California Demographic Futures projection provide addiotnal detail by ethnicity, nativity and recencuy of entry.

It is worth noting that the incorporation of additional elements into a projection does not necessarily produce a better estimate of the population size or all of its characteristics, although if the refinements are appropriately estimated and bear the same relationship over time to the components of population change, they should provide estimates of equal or better quality. A more important measure of the usefulness of additional elements is often what they tell us about the direction of change in other characteristics when those elements change.

In the follow sections, we identify the basic inputs to our projections and the way in which they were constructed. The manner in which we incorporate educational attainment relies on the attribution of individuals' final level of educational attainment, as well as the current educational level. For simplicity's sake, we will first discuss the basic projection, accepting as a given our ability to identify the current and future educational distribution of a cohort identified by race/ethnicity, nativity, single years of age and sex. Later sections will contrast alternative projections in terms of some core outcomes: population size, fertility, ethnic composition, educational attainment, age composition, and nativity.

## The Basic Projection

Our basic model has four inputs: the base year population, the fertility rates used to calculate new births, the mortality rate used to decrement the population, and migration into and out of California. To this basic model we add aspects of educational attainment. In particular, we:

1. Identify the size of the population by age, sex, race/ethnicity, nativity and period of entry, and current and future educational attainment in the base year (2000);

2. Estimate age-specific fertility rates by race/ethnicity, nativity and educational attainment;

3. Estimate annual survival rates, specific by race/ethnicity, age and sex, applicable to the population, and;

4. Estimate the domestic and international rates of immigration and emigration, specific by race/ethnicity, nativity and period of entry, age and education.

Projection of the size and composition of the population in subsequent years simply reflects the application of inputs 2, 3, and 4 to the base year population. The result of this process yields a projection of the population by race/ethnicity, nativity and period of entry, age and sex in the year following the baseline. (Although the method for generating educational attainment is not discussed in this section, each of the groups defined in the projection are also assigned educational distributions.) Populations in subsequent years can be projected by substituting the projected population for the base population iteratively.

The quality of the projections depends on how realistic we are when we make assumptions about what changes and what stays constant. If we assume something is constant, it cannot change much; if we specify a rate of change the real rate has to be close to our assumed rate. Improvements in estimates of the projected characteristic can come from:

A. More detailed distinctions in the cohorts. If we use two sets of cohort rates, one for men and another for women, but the rates really differ by, say, ethnicity, then we can get more accurate projections by splitting a basic "birth year-sex" cohort into a "birth year-sex-race" cohort.

B. More accurate estimates of any or all of the inputs to the projection. We cannot get the future right if we start by misrepresenting the present.

C. Correctly anticipating the future. For example, in the past, fertility norms of different groups converged and mortality rates have been falling for nearly all of California's history. Getting both of these likely changes in the model with just the right rate of change will make our projections more accurate.

Improvements achieved in these approaches impose a cost in other approaches. For example, adding race/ethnic distinctions to basic age-sex cohorts can more correctly model the relationship between a cohort and an outcome (as in approach A), but may make the estimation of fertility, mortality, or migration a noisier and more difficult process. In addition, the delineation of cohorts based on educational attainment moves the projection beyond one in which the three standard demographic components of change are sufficient to project cohort size.

For our purposes, we are incorporating three additional points of detail (beyond the most basic age and sex model) in the construction of our cohorts: first, adding distinctions based on race and Hispanic origin; second, preserving the native-born and foreign-born (and recency of entry) distinction, and; finally, incorporating levels of educational attainment as a separate cohort identifiers. The first of these three elaborations is fairly common, the second is more rare, and the third quite unusual.

Improvements which we are attempting through approach B include differentiating components of net migration into those attributable to domestic and international migration, using multiple sources for estimation of migration, utilizing multiple sources for fertility and mortality regimes and enhanced fitting of fertility regimes by nativity and education.

The following summary provides highlights of the primary components.

## Projection Inputs

### Projection Input 1: Base Year (2000) Distributions

***Description***: The base year reflects the year in which the size and composition of California's population is first specified, broken down into the categories we will use for projections. We use counts of the California population by single years of age, sex, ethnicity, nativity, and current and completed educational attainment. Sex, current educational attainment, nativity and period of entry were directly estimated from the Census Bureau's 5% Public Use Microdata Samples (PUMS); the remaining items required transformation as follows:

**Age**: The PUMS data on age coded everyone who was over 90 years old as exactly 90 (a practice known as "top coding" designed to preserve the confidentiality of the data), so we used summary data (SF2 counts) by race to distribute the top-coded age category within race to ages 91 through age 99.

**Race/Ethnicity**: For our purposes, we need mutually exclusive and exhaustive single race/ethnic categories. As collected in the decennial census, race and Hispanic origin are separate items, and -- for the first time in 2000 -- individuals may identify themselves by multiple ancestries. In order to create mutually exclusive and exhaustive categories, we apply a hierarchy to attribute a single ancestry[12]. In order, the priority is Hispanic (any race), non-Hispanic Black (alone or in combination), non-Hispanic Asian/Pacific Islander (alone or in combination with a category other than Black), non-Hispanic white (alone or in combination with Native American), and non-Hispanic Native American.

**Completed Educational Attainment*:*** Completed educational attainment for children is estimated as a function of ethnicity and parental education, is taken as reported currently for adults 26 and older, and interpolated within ethnicity/nativity categories for intervening ages. We discuss this attribution in greater detail in a later section.

The official projections for the state, produced by the California Department of Finance (DOF) include sex, single years of age, and race/ethnicity. They do not incorporate nativity or educational attainment, but do provide detail at the county level as well as for the state. Race/ethnic categories included Whites, Blacks, American Indians, Asians,

[12] The Census Bureau created a "modified race data summary file" file which distributes the "some other race" (SOR) category among the specified race and Hispanic groupings, but which leaves "more than one race" categories intact. We chose to collapse race/ethnicity to mutually exclusive and exhaustive categories for two reasons. First, we use our final base year file as a denominator to match to administrative natality data which do not report multiple races. Second, we use maternal race/ethnicity as a basis for assigning newborn's ethnicity, and it is clear that multi-race mothers are clearly not the only source for multi-race children. (Like us, the California Demographic Futures project also uses maternal race/ethnicity to assign newborns' ethnicity). The intent of the assignment of race/ethnicty is not to project future racial or ethnic *identity* but rather to maintain some historically consistent categories. As result, it necessary to reduce the social complexity of race and ethnicity to a few major categories that can be traced over time.

Hawaiian and Pacific Islanders, and Multi-race individuals, each also distinguished within race by Hispanic/non-Hispanic status[13].

## Projection Input 2: Age-Specific Fertility Rates

***Description***: The Age-Specific Fertility Rate (ASFR) reflects the rate of child-bearing, expressed in terms of births in the previous year per 1000 women of a given age. The age range is usually bounded on the low end at age 15 and at the high end at age 45 (inclusive), and may be provided either for single years of age or in 5-year age bands. Multiplying these rates by the number of women of that age in the population at a point in time yields the number of births we expect, based upon existing patterns of child-bearing.

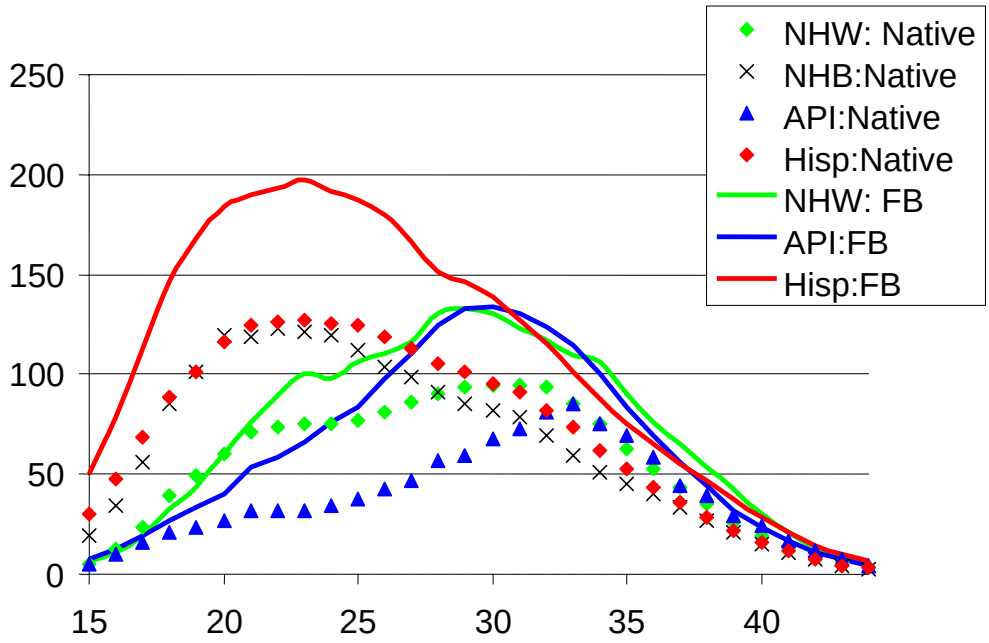
Most published fertility rates are estimated based on the age, race and Hispanic origin of the mother. Because California is home to such a large population of foreign-born residents, and because fertility patterns differ sharply by nativity, we differentiate fertility by nativity as well[14]. Similarly, the strong impacts of educational attainment on fertility, in combination with our focus on the effects of educational achievement in California, suggests that the differentiation of births by the educational attainment of the mother may be useful. We construct these rates using the base-year file constructed from the 2000 5% PUMS for denominators, and use the Natality Detail Files for California for 1999, 2000, and 2001 for numerators.

Figure 2.1 identifies the age-specific patterns of fertility by ancestry and nativity. Ancestry and nativity groups differ both in the overall level and timing of fertility. At the extremes, fertility levels are high and early for foreign-born Hispanics, low and late for native-born Asians. Hispanics - both native and foreign-born -- and blacks tend toward modes in their early 20's, while Asians and foreign-born non-Hispanic whites tend toward modes nearly a decade later. Native-born whites "split the difference" with a primary mode around 30 and a secondary peak in their early 20s.

[13] The source of the DOF's baseline year counts was the "Modified Race Data Summary File" produced by the Census Bureau's Population Estimates Program to allocate race to individual's reporting "some other race" in the 2000 Census. (Those counts are not distributed by single years of age, which are presumably allocated by the DOF). In addition, "special populations" (e.g. prisons, colleges, military installations) are removed from the baseline population, modeled separately, and added back in for each year.

[14] Hill and Johnson (2002) thoroughly document the existence of consistent differences in fertility rates between natives and immigrants within ethnic categories between 1982 and 1998. Myers, Pitkin, and Park (2001,2005) confirm these differences, and incorporate those differences in their demographic projections of race and nativity of Californians.

**Figure 2.1 Age-Specific Fertility Rates by Ethnicity and Nativity, 2000**




Sources: Authors' estimates from Natality Detail Files, 1999-2001, and 5% California PUMS

The impact of educational attainment on fertility is large. A comparison of ASFR's by current educational attainments shows both timing and level effects: Level effects are most apparent in distinguishing those up through a HS education, all with modes in their early 20s, while the incomplete college and the BA+ group shows differences in timing (and level to a lesser extent)[15].

It is possible to apply to the fertility rates specific to ancestry and current educational attainment directly in projections of fertility[16]. Doing so, however, will tend

[15] We cannot distinguish fertility among those with graduate or professional degrees, since the natality data identifies the education of the mother in years of completed schooling, and is topcoded at 17. Per the documentation for the 1999 Natality File: "The educational attainment of the mother is defined as "the number of years of school completed. Only those years completed in "regular" schools are counted, that is, a formal educational system of public schools or the equivalent in accredited private or parochial schools. Business or trade schools, such as beauty and barber schools, are not considered "regular" schools for the purposes of this item." The 2001 documentation adds: " Women who have completed only a partial year in high school or college are tabulated as having completed the highest preceding grade. For those certificates on which a specific degree is stated, years of school completed is coded to the level at which the degree is most commonly attained; for example, women reporting B.A., A.B., or B.S. degrees are considered to have completed 16 years of school."

[16] Mare (1997) reports that use of current rather than terminal education makes little difference except for "the youngest women (aged 15-19) who are at the highest levels of educational attainment. The vital statistics estimates for these women are lower than the own children estimates because the latter are based on eventual rather than current educational attainment." However, use of terminal rather than current

to underestimate the impacts of changes in educational attainment on fertility earlier in the life-course. (Consider, for example, the ASFR of a 17-year-old with less than a high-school education. The fertility of this group is a weighted average of the fertility of 17-year-olds who will not progress further in their education and the fertility of those who will. We have every reason to expect that those fertility rates will differ, since education and childbearing are, to some extent, competing life choices.) An alternative approach is to decompose the ASFR into the components attributable to women on the basis of their completed education, rather than their current educational attainment.

For any given age, we can express the ASFR as Births/Population of Women, and split both the Births (B) and population of women (W) by their educational destination (the educational attainment they will achieve after completing their education).

$$B_{tot} = B_{<HS} + B_{HS} + B_{SomeCollege} + B_{BA} + B_{Prof}, \text{ and}$$
$$W_{tot} = W_{<HS} + W_{HS} + W_{SomeCollege} + W_{BA} + W_{Prof}$$

Simple algebraic rearrangements allow us to express the ASFR for an educational destination group as the product of the ASFR for the population multiplied by the proportion of births for the population attributable to the destination group, and divided by the proportion of the population in that destination group. Thus,

$$ASFR_{<HS} = (B_{<HS} / W_{<HS}) = ASFR_{tot} (B_{<HS} / B_{tot}) / (W_{<HS} / W_{tot})$$

We have already estimated the ASFR directly by age and ethnicity, and we estimate completed educational distributions for groups based on ethnicity and parental education. To estimate the proportion of births at each age attributable to a mother with a particular educational destination, we created an extract of the PUMS of children residing with their mothers, and linked their mother's age, ethnicity, nativity and current educational attainment to those records. Children were classified according to mother's age at birth, and mother's educational destinations were estimated from women aged 25-35.[17]

We estimate ASFRs by single years of age by ethnicity, nativity, and presumed completed education for women 15-45. Because of sparse cells when including nativity and education, we collapsed the race/ethnic/nativity categories. Based on comparisons of fertility patterns, we collapsed non-Hispanic Blacks and American Indians together, and combined the native-born and foreign-born components of that group together. A

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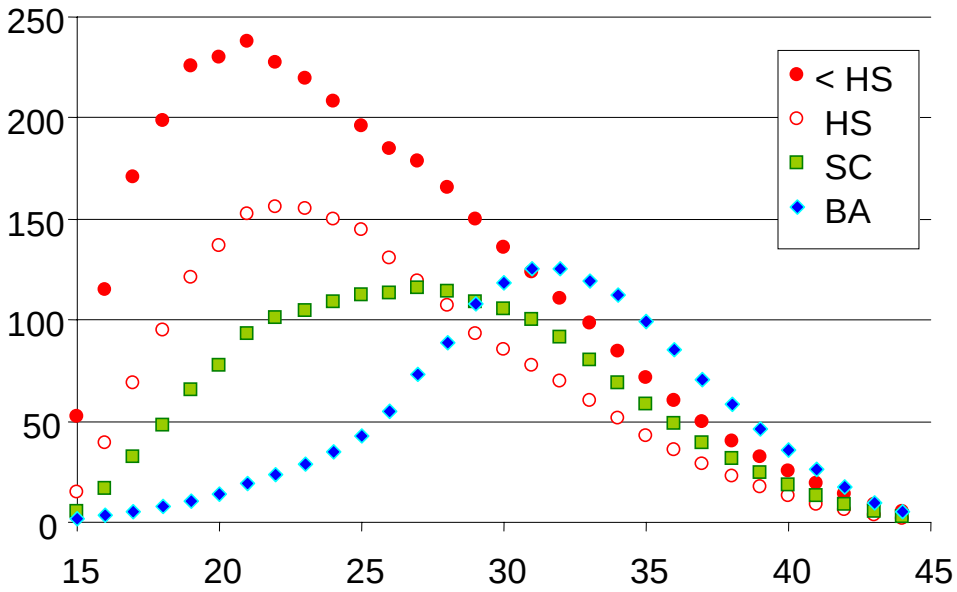
education will be most important when rates differ sharply by education and higher terminal levels of education are more common. These are likely to be the case for our projections.

[17] Hence, the distribution of births to women age 17 by the educational destination of the mother reflects the educational distribution of women in 2000 who gave birth as 17 year-olds between 1982 and 1992 and whose child lives with them in California in 2000, the distribution of births to women age 18 reflects those giving birth as 18-year-olds between 1983 and 1993, and so on. We attempt to redistribute educational destinations only to births occurring to women prior to age 25. After age 25, current educational attainment is presumed to match educational destination.

smoothed rate was then fit by nativity and ethnicity, and readjusted for women under age 25 based on presumed completed education.[18]

**Figure 2.2 Age-Specific Fertility Rate by Final Educational Attainment, 2000**




## Projection Input 3: Mortality

***Description:*** Fertility and migration, in combination with the age-composition of the population, form the basis of our projections of the rate that individuals enter the population. Mortality, in combination with emigration, determines the rate at which individuals leave. The lower the rate of mortality, all else equal, the higher will be rate of population growth. Since 1970, life expectancy has increased nationally from slightly less than 71 years to slightly more than 77 years, [19] while in California it has grown from 71.7 to 79.4 years. Life expectancy differs substantially by both gender and race.

We apply survival rates differentiated by single years of age, sex, and race/ethnicity, but not by education or nativity.[20] The basic survival rates are based on those used by the California DOF, provided to us by Mary Heim. Those rates were

[18] Counts of both births and women were smoothed in a 3 year centered moving average by age of the mother within race/ethnicity/nativity categories to provide a base ASFR. For each age, adjustment factors were calculated by dividing the proportion of children whose mother falls into that educational category by the proportion of women at risk by educational category, using the methods described above.

[19] http://www.childtrendsdatabank.org/tables/78_Table_1.htm

[20] Johnson (2004) reports substantial differences between US born and foreign born Californians 2000, with foreign-born life-expectancies exceeding those of natives by 4.4% for women and 5.7% for men. As well, age adjusted death rates drop substantially for those with 13 or more years of education (NCHS, 2001). We do not currently incorporate these distinctions into our projections, and expect those distinctions would most impact the size and composition of the aged population, on whom we do not focus.

derived using a three-year average of death data applied to the 2000 Census population. Those mortality norms are differentiated by slightly different race/ethnic categories, and we used the 2000 5% PUMS to create re-weighted averages of the DOF mortality appropriate to our ethnic categories. The DOF holds the survival rates constant through 2050 for most ethnicities.[21] Changing ethnic composition, net of any increases in other improvements in mortality, can be expected to result in slightly increasing overall life expectancy over the next half century.

It is reasonable to expect increases in life expectancy beyond those which simply result from a changing ethnic composition. The Census Bureau, for its middle mortality series[22], assumes an overall increase in life expectancy of about 10% for men and about 9% for women in the next 50 years. The actual level of increase is strongly related to existing life expectancy: black men, with a life expectancy of 68.4 years are expected to gain an additional 15% in life expectancy, while Asian women, with a life expectancy of 86.5 years, are anticipated to gain only an additional 4% in life expectancy. Using Census Bureau middle series figures, we estimate the proportional increase in life expectancy through 2025 and 2050 based on that relationship between current and future life expectancy, and apply it by ethnicity for Californians.[23] We do not estimate separate mortality schedules by education or nativity. Research in recent years indicates that higher-educated individuals live longer than others.[24] By not building this benefit of raising education into our projections we understate the total positive impact of expanding education on the state.

## Projection Input 4: Migration

***Description***: The net migration rates reflect the proportional increase or decrease in cohort sizes due to domestic (interstate) and international migration. Domestic migration tends to be the most unpredictable component of change[25] and we separately estimate these two components. There are a number of methods and sources through which domestic and international migration can be calculated, none without their drawbacks.

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[21] Survival rates are held constant for Non-Hispanics among Whites, Blacks, American Indians, Asians, and Hawaiian/Pacific Islanders, and for Hispanic Whites. They change linearly for Hispanics among Blacks, American Indians, Asians, and Hawaiian/Pacific Islanders, as well as for multi-racial individuals. In all, survival rates are held constant for well over 90% of the population.

[22] See Hollman et al. (2000) for a discussion of the assumptions and methodology for the 1999-2100 national projections. These projected overall life expectancies are based on the research of Lee and Tuljapurkar through 2065, with relative declines in mortality by age weighted in accordance with expert opinion of the Society of Actuaries. At this time, state-level projections derived from post-2000 census assumptions have not been released.

[23] While this approach may appear somewhat convoluted, it allows us to reconcile (admittedly moderate) existing differences between life expectancy in California and the US by ethnic group with anticipated increases in life expectancy. The gains in life expectancy were implented by proportionally adjusting the existing risk of mortality (separately for those under age 65 and those older) until the life expectancies matched the improved figures.

[24] A particularly useful article is Lynch's analysis of the how the effect of education on health increases both at higher ages and in more recent cohorts; see Lynch, Scott M., 2003. "Cohort and Life-Course Patterns in the Relationship Between Education and Health." *Demography* 40: 309-331.

[25] See, for example, Ching-Li Wang (2002)," Evaluation of Census Bureau's 1995-2025 State Population Projections".

First, it can be directly estimated using the Current Population Survey (CPS) or American Community Survey (ACS) samples, relying on their question on place of residence last year.[26] A second method is to etimate it from the 2000 decennial census, based upon its question on residence in 1995, and annualizing the net difference in flows.[27] A third method, used by the DOF for their projections, estimate rates from a comparison of 1990 census, 2000 census, and birth counts from the 1990's, using a survived cohort method and annualizing flows.[28]

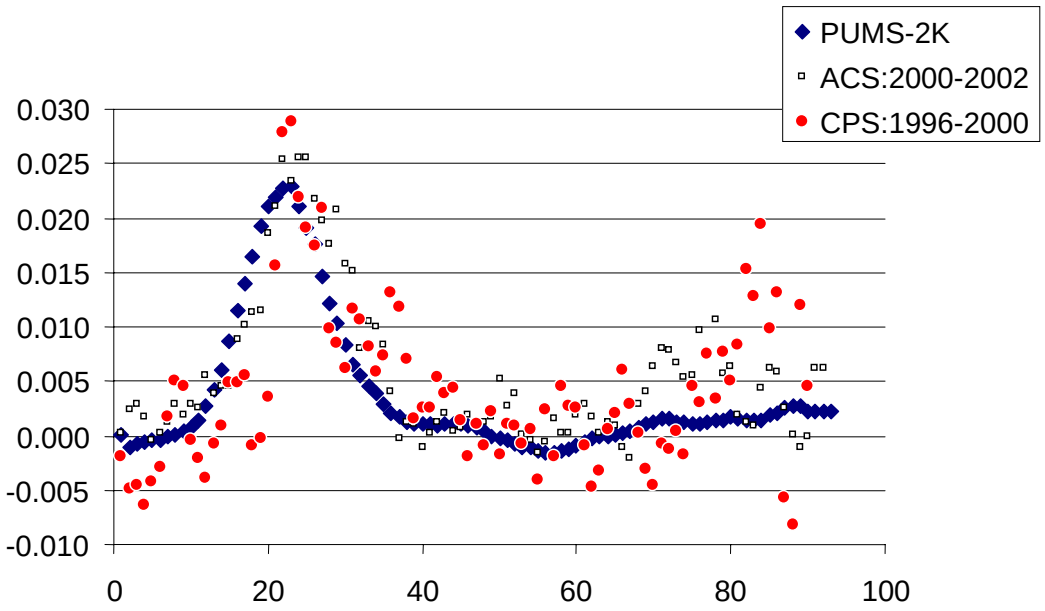
The first method is most straightforward, but the smaller sample sizes result in less statistically stable estimates. The second option relies on larger samples, but requires us to make assumptions about how to distribute migration across ages and years, and will underestimate those with multiple moves during the 5 year period. The last option suffers from the same drawbacks as the second, and relies on the assumption of equal coverage in the two censuses. Both the second and third approaches also make the attribution of education at the time of migration more problematic. Because the first two approaches rely on a retrospective question for a contemporary sample, the denominator will exclude international emigrants.

[26] Note that differences exist between these surveys in terms of residence rules and universe, as well as between these surveys and the census.

[27] This is the approach taken by the California Demographic Futures project.

[28] We discuss only the approaches we could utilize within the scope of our work. In fact, the Census Bureau and DOF make use of administrative records, like Internal Revenue Service data on change of address, or drivers license changes, to estimate domestic migration. Similarly, levels of legal migration are reflected in intended place of residence for immigrants adjusting to permanent resident, and undocumented flows can be estimated using implied differences between populations measured in the censuses adjusted for mortality.

**Figure 2.4. Net Migration Rates by Age, California**




In Figure 2.4, we plot the total net migration rate based on each of these three data sources. That figure shows a high degree of consistency in the story each data set tells about the shape and level of net migration by age, despite differences in the reference periods and universes among the PUMS, American Community Survey, and Current Population Surveys. The limitations of these samples in measuring international emigration, in combination with our interest in separating domestic and international migration, calls for their use most strongly in tracking *domestic* migration. Figures 2.5, 2.6 and 2.7 contrast annual estimates (or annualized estimates in the case of the PUMS data) by ethnic category. Again, while the ACS estimates are more dispersed due to smaller samples, they report a similar pattern. As a result, we rely on the annualized estimates from the PUMS for input rates of domestic migration. Figure 2.8 identifies the same familiar domestic migration rates as the earlier figures, but this time differentiates by current educational attainment.[29] That figure illustrates the extent to which migration flows to and from California are educationally structured: virtually all positive flows by age are among those with a BA or an advanced degree, while outflows are concentrated among those with less education, particularly among those with less than a HS education.

To determine appropriate and reasonable levels for international migration, we estimate the age and sex composition of immigrant inflows by ethnicity based upon those

[29] Educational attainment is possibly the most problematic aspect of using an annualized rate based on residence 5 years prior. For our purposes, this weakness is mitigated by our application of the rates by education to "destination" education rather than current education. Hence, the net rates for 19 year-olds with BA's largely reflect those who responded to the census after age 22 and may have received that credential after moving. Since we increment our projections of the basis of terminal educational attainment, we will increment the population who will earn that degree even if they do not current hold it.

composition of immigrants in the 2000 5% PUMS. For immigrants in each of our ethnicity categories, we calculated their age at entry, and examined age and sex distributions for single year-of-entry cohorts from 1980 onwards. The age composition of immigrants at entry is remarkably uniform within ethnicity, although some differences attributable to differential mortality or emigration are apparent over longer periods. We used the distributions of from 1994-1998 as the basis our composition estimates. We then applied those age and sex distributions, apportioned among ethnic groups in proportion to the ethnic composition of post-1990 entrants, to a level of immigration set at 310,000 annually.[30]

International migration is also strongly differentiated by education, although California is the recipient of both the least educated and most educated in these flows. Figure 9 identifies international immigration rates by education, although those rates do not reflect emigration. Emigration of the foreign born is estimated calculated based on Monique Oosse's 1998 replication of Ahmed and Robinson's emigration estimates, provided to us as annual emigration rates by sex, age-groups, and country of origin[31]. Those rates were modified to reflect years since arrival in an application of the approach used by Hoefer for Office of Immigration Statistics (OIS) estimates of emigration.[32]

The DOF utilizes the third of the three methods we discussed to estimate migrations rates[33]. Although the DOF does not distinguish between domestic and international migration in their projections, the California Demographic Futures project produces forecasts which distinguish between natives, immigrants, and the children of immigrants, as well as providing detail for immigrants by the recency of their entry. Those projections estimate the immigration to California as a fixed share (24%) of the

[30] This figure is 24% of the international immigration used in the middle series US projections for 2000; because the middle series predicts declining absolute levels of immigration through 2020, it would represent 25% of the US middle series in 2005, 29% of the 2010 in flows, 28% of the 2015 inflows, and 27% of the 2020 inflows. Research by Myers, Pitkin, and Park (2005) indicates that California's share of immigration in the 1990's was 24%. The 2000 figure is virtually identical to the 312,000 figure used by the California Demographic Futures (CDF) project for 2002, although CDF estimates of immigration in subsequent years increases to 341,000. We believe the 310,000 figure is a conservative, but reasonable, level.

[31] We do not separately model emigration of legal and undocumented immigrants. In the methodology used by the USCIS (Hoefer, 2004, unpublished OIS document) for their estimates of unauthorized immigrants, the 10-year emigration rate of unauthorized immigrants is set at a level 25% higher than that of legally resident immigrants, and distributed on the assumption that emigration rates for both decline by 5% for each year since entry. We may elaborate our estimates of emigration at a later point.

[32] Within the origin and age-groups, total emigration rates were held fixed at the level derived from Oosse's tables, but within each group emigration was modeled as declining 5% for each year since entry. The resulting rates differ by age, ethnicity, and years since entry.

[33] The DOF documentation indicates: "Migration proportions were developed for the decade of the 1990s by a survived population method. The 1990 population was aged forward in time to 2000 by adding recorded births to form new cohorts and subtracting deaths from existing cohorts. The survived 1990 population was compared to the 2000 population and differences were assumed to be migration. The ten-year migration was annualized and divided by the total to derive a proportion. Then a three-year moving average was used to smooth the migration proportions"

Census Bureau national estimates of immigration,[34] and emigration of the foreign-born based on Ahmed and Robinson's (1994) estimates of emigration between 1980 and 1990.[35] Net domestic migration is estimated by age, race, and nativity based on responses on place of residence in 1995 from the 2000 census.

It is possible to introduce additional distinctions into models of migration, particularly for domestic migration. We model that flow as a net flow -- i.e. we do not separately model flows outward from California and flows inward to California. The separation of these streams can affect the net rates if the stock of potential in-migrants to California changes over time. For example, if rates of in-migration to California from Asians was markedly higher than for other groups, and the proportion of Asians elsewhere in the U.S. increased markedly more than in California, the net rate would be underestated. Given the volatility of domestic migration and the necessity of extending our projection model to the U.S. to use this approach, we choose to rely on the estimation of a net rate. For an alternative, the California Demographic Futures Project does separately model the domestic flows into and out of California.

[34] As discussed in Hollman, Mulder and Kallan (2000), immigration to the US is estimated based on the existing composition of immigrant flows adjusted according to the anticipated growth among the working age populations among current sending countries.

[35] Ahmed and Robinson use a survived cohort method similar to that used by the DOF in its estimates of net migration. They derive rates from cohorts arriving prior to 1980, and estimate the emigration of an entry cohort defined by age, period of entry, and country of origin based on counts from the 1980 and 1990 census and expected mortality from standard life tables. Although attempts were made by the Census Bureau to replicate these estimates for the period 1990-2000 (Mulder, Guzman, and Brittingham, 2002), "due to time constraints and possible weaknesses in the current methodology (especially the assumption of equal census coverage in using a residual approach) and/or data sources, we were unable to produce 1990-2000 foreign-born emigration estimates". The Census Bureau's middle series estimate of emigration, used for their national projections, is set at 12.1 per 1000 foreign-born persons.

**Figure 2.5 Net Domestic Migration Rates by Age, Non-Hispanic Whites, California**

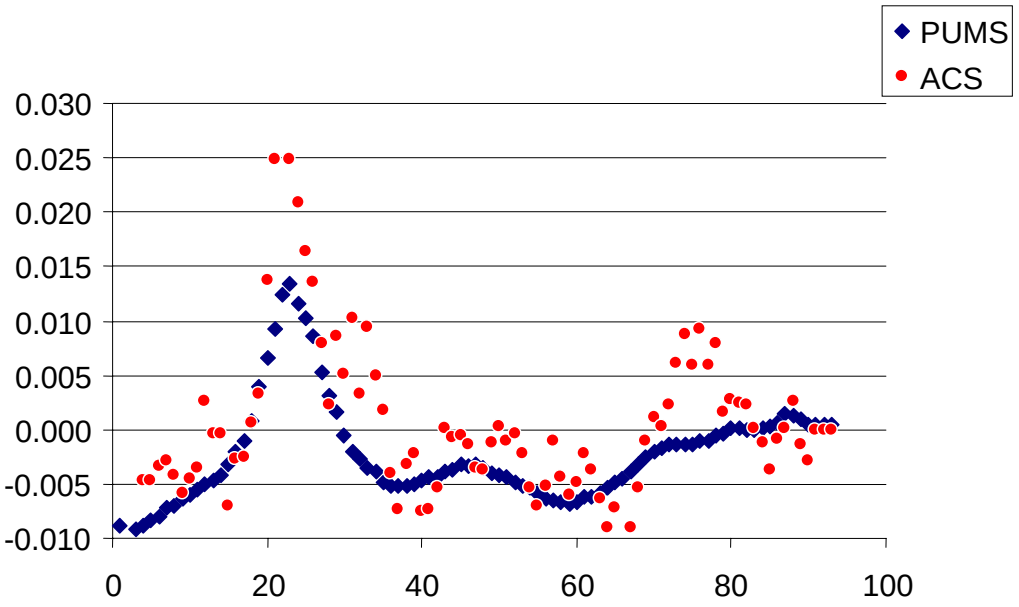
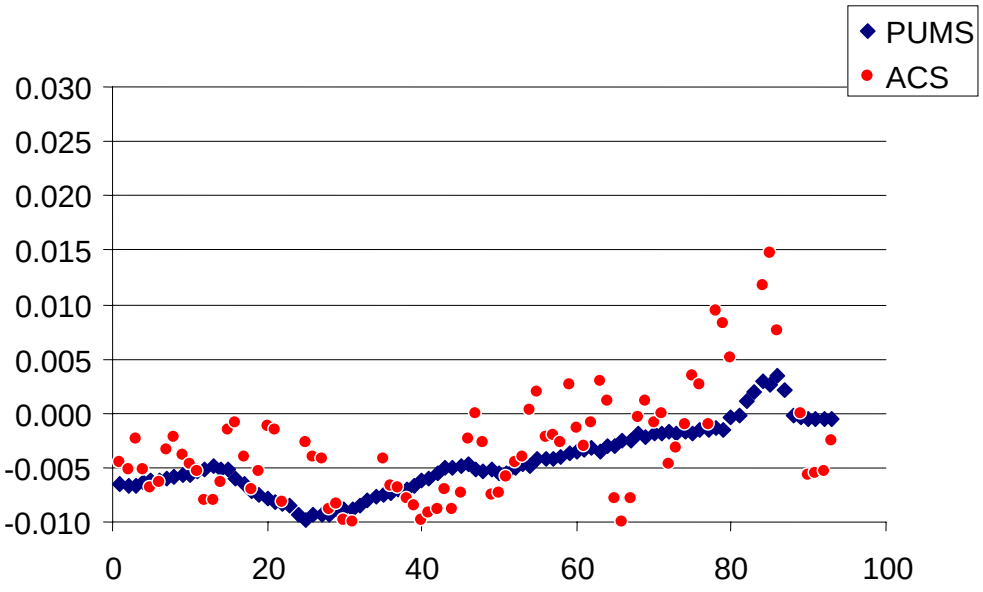



**Figure 2.6 Net Domestic Migration Rates by Age, Hispanics, California**




Our estimate of net international immigration in 2000 is 239,000; with immigration of 310,000, less out-migration of 71,000. We estimate net domestic

migration at negative 128,000, for a combined gain of 111,000. Historical DOF figures for the 1990's from Report E-6 provide quite similar estimates: the DOF[36] reports an average annual net international migration of 214,000 between 1990 and 2000, and an average annual loss to domestic migration during the period of 124,000. Their one-year period estimate of net migration in 2000 (Report E-2) was much higher, with a net gain of 236,000 due to net international migration, and a gain of 146,000 from domestic sources. Projections from the CDF project place net international migration at 227,000 in 2002 and 254,000 in 2005, with net domestic migration showing a 74,000 gain in 2002, falling to a 105,000 loss in 2005. This difference between the average annual estimates and the period estimate highlights the temporal variability in domestic migration. For its projections, the DOF reports an average annual net gain to migration of 186,000 over the entire course of their projection period.[37]

These broad annualized similarities mask a great deal of variability for domestic migration. During the 1990's, net annual immigration ranged between 174,000 and 261,000; during the same period, domestic migration varied between net outflows of 362,000 and net inflows of 146,000.[38] Evaluations of Census Bureau state-level population projections through 2025 report "errors in domestic migration continue to be the highest among the projected components of change".[39] Furthermore, based on pooled CPS data, Johnson (2000) reports large differences in the ethnic composition of net domestic flows between the first and last halves of the 1990's, with earlier flows dominated by non-Hispanic whites, and later flows much more inclusive of Latinos and Asians. We expect that domestic migration estimates rooted in different periods may result in different projections.

Some important points to note: our net international migration estimates agree closely with both annualized estimates from the 1990's and point estimates for 2000 from the DOF: we estimate 239,000, versus an annual DOF average of 214,000, and a DOF 2000 point estimate of 236,000. They also agree in range with estimates from the CDF project, which show anticipated gains between 227,000 and 254,000 for 2002 and 2005. In contrast, domestic migration is more variable. However, the annualized loss estimated by the DOF and our estimates are fairly close: 128,000 for us and 124,000 for the DOF 1990-1999 period.

[36] State of California, Department of Finance, Revised County Population Estimates and Components of Change by County, July 1, 1990-2000. Sacramento, California, February 2005.
[37] Mary Heim at the DOF also kindly provided "migration proportions" applicable by race, Hispanic origin, and sex. These proportions permit the redistribution of net migrants within an ethnic category by age and sex. We lacked the base distribution of annual net migration by ethnicity, however, and did not attempt to replicate this part of the DOF projection process.
[38] These ranges are from DOF estimates; other analysts estimate higher net outmigration, but similar degrees of variability.
[39] Wang (2002).

**Figure 2.7 Net Domestic Migration Rates by Age, Non-Hispanic Asians, California**

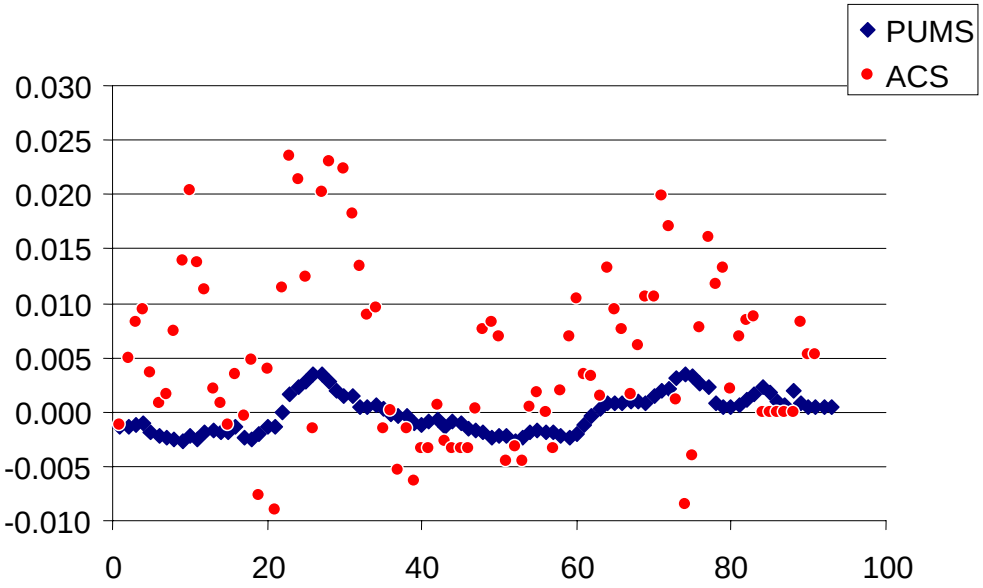



**Figure 2.8 Net Domestic Migration Rates by Age and Education, California**

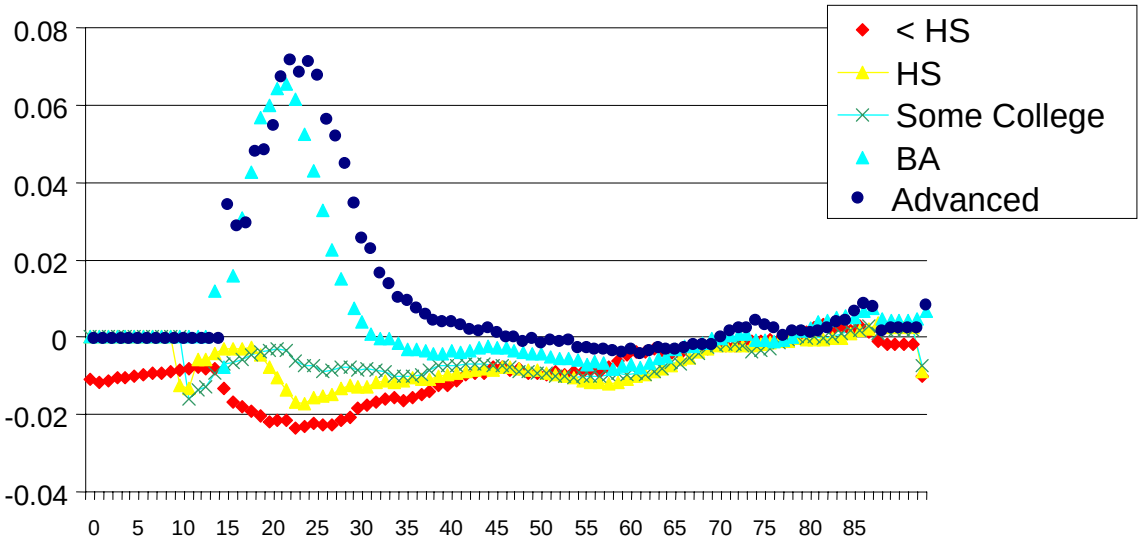
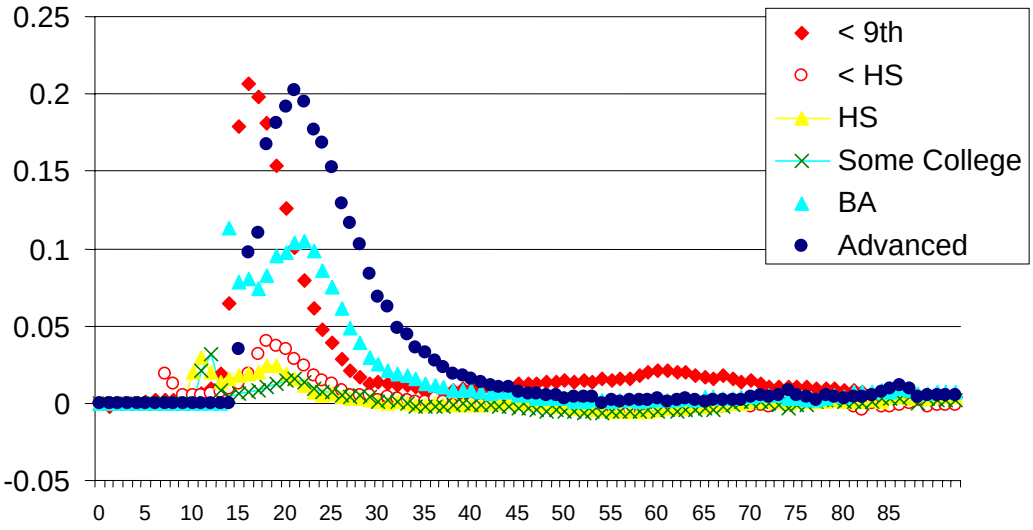


**Figure 2.9 International Immigration Rates by Age and Education, California**




**Projection Input 5:** Educational Distributions and Transitions

***Description***: As the previous sections have shown, education affects fertility, domestic migration, and international migration. It is also a critical factor in labor markets, the ability of individuals to support themselves and others without reliance on transfer income, and statewide attractiveness to competitive industries. To add education to our models requires that we know, not only the current educational attainment of individuals, but also that we have a means for projecting the educational attainment of future generations. We do this with tools known as educational transition matrices.

The demand for higher education depends on the education of the parents. Research confirms the common-sense assumption that college graduates' children are more likely than other peoples' children to pursue higher education. We used educational transition matrices to quantify these differences. An educational transition matrix reports the probability of attaining each of five educational levels (no diploma, high school graduate, some college, four-year degree, advanced degree) for each category of parent's education (the same five categories). To fill in the educational transition matrices we used data on recent cohorts of American adults from the U.S. General Social Survey, a long-running data collection effort funded by the National Science Foundation and fielded by the National Opinion Research Center at the University of Chicago.

An educational transition matrix has a row and a column for each level of education (we use four). The rows refers to the first generation and the columns to the second. The cells contain conditional probabilities, for example, the probability of earning a BA for people whose mothers had high school diplomas, that we call "transition rates." Formally we say that the educational transition matrix **M** contains transition rates $m_{ij}$ that denote the probability of attaining educational level *j* for persons whose mothers have level *i*. The transition rates ($m_{ij}$) sum to one across the rows, i.e., $\Sigma_j m_{ij} = 1$.

For this work we did not want to assume that all categories of people have the same transition rates even if their mothers all had the same education. In particular, we wanted to let transition rates vary by sex, year of birth, and race/ethnicity. The data we have are quite sparse for some combinations of cohort and race/ethnicity, so we used a statistical model proposed by DiPrete (1990) to smooth out fluctuations that are best attributed to sampling variation[40]. The model perfectly reproduces the observed counts by (1) sex, cohort, and ancestry, (2) sex, cohort, and mother's education, (3) sex, cohort, and respondent's education, (4) ancestry and mother's education, (5) ancestry and respondent's education, and (6) mother's education and respondent's education. In so doing, the model allows for differences among groups in educational outcomes but applies one matrix of parameters that gauge the association between mother's and offspring's education to all groups. Because the $m_{ij}$ for any group mix together those parameters that gauge the association between mother's and offspring's education and the group's own educational distribution, we do get unique $m_{ij}$ for each combination of sex, cohort, and ancestry. Statistical tests fail to reject this model.

The GSS is a national sample, not a California sample. As desirable as California data might be from a descriptive standpoint, there is no evidence in the literature that the transition rates we look at differ by state. While college graduation is higher in California than in many other states, the gap between students whose parents differ is probably not very different across states. We tested for time trends in the GSS cohorts and found them not to be statistically significant. Nor are differences between US born and foreign born people significant[41]. Our model includes a main effect for gender but it turns out not to be statistically significant.

The educational transition rate matrix **M** generates an educational distribution for each combination of sex, cohort, ancestry, and mother's education. This is fairly simply to integrate for newborns in the projection in the manner described in the fertility section. For the baseline population, we link children under age 18 in the PUMS with their mothers (or, if the mother is not present in the household, their father or the head of the household) and estimate likely

[40] The particular algorithm we used is explained by Thomas A. DiPrete, 1990. "Adding Covariates to Loglinear Models" American Sociological Review, Oct.: 757-773.

[41] We restrict analysis to people who were living in the US when they were high-school age because including educational transitions that occurred outside the USA would have introduced substantial biases.

educational destinations. Since simple proportional assignment will result in a fraction of children with higher current educations that their estimated destination education, we adjust within age and ethnicity to fit marginal current and destination educations while forcing structural zero's for logically impossible combinations. Individuals age 26 and older are presumed to have reached their completed education. For intervening ages, we interpolate educational distributions and fit marginal educational distributions as we do for children.

Finally, we determine the rate at which we will advance individuals through their educational careers during the period in which their completed education exceeds their current education. We estimate the pace of advancement from pooled samples from the October Supplement to the CPS. That supplement gathers information on educational enrollment and educational attainment in the current and prior October for a large sample of school-age children and young adults.

Although the acquisition of formal education, particularly that directed at pre-baccalaureate and baccalaureate credentials, tends to be heavily concentrated in the ages before age 25, a significant fraction of adults[42] attend college or earn degrees later in life. This does not affect the parent-offspring education matrix, but educational outcomes for offspring may occur at later ages than the projections suggests. In addition, terminal educational attainment for those aged 25 - 30 in 2000 is likely to be understated (as well as that for those in their thirties and forties, but to a lesser extent).

These analyses do imply substantial upward educational change for the children of today's parents. Although nearly 30% of California births in 2000 were to mothers with less than 12 years of education, we expect that by 2025, nearly 90% of those children will have completed high school or its equivalent[43]. Among the children of foreign-born Hispanics, gains are quite dramatic: while nearly two-thirds of such children are born to mothers lacking a high school degree, all but 17% are expected to eventually earn a degree of their own. (These estimates are quite close to the figures shown in Table 3.5 in Reed et al. (2005) showing educational progress across immigrant generations for California Latinos). Gains will also be experienced at more advanced levels of education: while 21% of births in 2000 were to mothers with a B.A. or more, slightly more than 28% of all children born in 2000 are expected to earn a B.A.

[42] Per the combined October CPS from 1998-2001, about 15% persons earning a BA in the previous year were aged 25 or older when they received that degree. All but a fraction of persons earning a HS diploma were aged 25 and younger, while advanced degrees were most commonly received after age 25.

[43] Overall educational gains will be be smaller, since migration is expected to continue to add many adults and near adults with lower levels of educational attainment.

| WHITE | Progeny's Education | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Mother's Education | Incomplete secondary | Complete secondary | Some college | Bachelors degree | Advanced degree | Estimated Eventual Educational Distribution: Women 15-44 | Total Fertility Rate: Women 15-44 | Mean Age of Childbearing: Women 15-44 |
| Absent | 0.2508 | 0.4656 | 0.1858 | 0.0781 | 0.0198 | | | |
| Incomplete secondary | 0.2130 | 0.4982 | 0.1806 | 0.0814 | 0.0267 | 4% | 2.80 | 24.0 |
| Complete secondary | 0.0618 | 0.4654 | 0.2311 | 0.1974 | 0.0442 | 30% | 1.57 | 26.4 |
| Some college | 0.0297 | 0.2907 | 0.2706 | 0.3403 | 0.0687 | 28% | 1.79 | 27.3 |
| Bachelors degree | 0.0096 | 0.1872 | 0.2684 | 0.4078 | 0.1270 | 27% | 1.58 | 31.7 |
| Advanced degree | 0.0037 | 0.1387 | 0.2038 | 0.4578 | 0.1960 | 10% | 1.56 | 32.0 |

| BLACK | Progeny's Education | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Mother's Education | Incomplete secondary | Complete secondary | Some college | Bachelors degree | Advanced degree | Estimated Eventual Educational Distribution: Women 15-44 | Total Fertility Rate: Women 15-44 | Mean Age of Childbearing: Women 15-44 |
| Absent | 0.3118 | 0.4738 | 0.1723 | 0.0356 | 0.0066 | | | |
| Incomplete secondary | 0.2688 | 0.5145 | 0.1700 | 0.0377 | 0.0090 | 7% | 3.91 | 23.4 |
| Complete secondary | 0.0884 | 0.5447 | 0.2466 | 0.1035 | 0.0169 | 40% | 1.80 | 25.5 |
| Some college | 0.0485 | 0.3884 | 0.3296 | 0.2037 | 0.0299 | 33% | 1.91 | 25.9 |
| Bachelors degree | 0.0176 | 0.2804 | 0.3665 | 0.2736 | 0.0619 | 15% | 1.48 | 29.9 |
| Advanced degree | 0.0076 | 0.2320 | 0.3107 | 0.3429 | 0.1067 | 5% | 1.39 | 30.5 |

| LATINO | Progeny's Education | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Mother's Education | Incomplete secondary | Complete secondary | Some college | Bachelors degree | Advanced degree | Estimated Eventual Educational Distribution: Women 15-44 | Total Fertility Rate: Women 15-44 | Mean Age of Childbearing: Women 15-44 |
| Absent | 0.2850 | 0.4737 | 0.1796 | 0.0509 | 0.0108 | | | |
| Incomplete secondary | 0.2442 | 0.5113 | 0.1761 | 0.0536 | 0.0148 | 33% | 4.09 | 25.2 |
| Complete secondary | 0.0764 | 0.5146 | 0.2428 | 0.1400 | 0.0263 | 38% | 2.27 | 25.8 |
| Some college | 0.0397 | 0.3476 | 0.3075 | 0.2611 | 0.0441 | 18% | 2.42 | 26.6 |
| Bachelors degree | 0.0137 | 0.2391 | 0.3258 | 0.3341 | 0.0872 | 8% | 2.09 | 29.4 |
| Advanced degree | 0.0056 | 0.1886 | 0.2633 | 0.3992 | 0.1433 | 3% | 2.17 | 29.3 |

| ASIAN | Progeny's Education | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Mother's Education | Incomplete secondary | Complete secondary | Some college | Bachelors degree | Advanced degree | Estimated Eventual Educational Distribution: Women 15-44 | Total Fertility Rate: Women 15-44 | Mean Age of Childbearing: Women 15-44 |
| Absent | 0.1940 | 0.4284 | 0.1853 | 0.1441 | 0.0482 | | | |
| Incomplete secondary | 0.1618 | 0.4500 | 0.1768 | 0.1476 | 0.0639 | 8% | 2.49 | 26.9 |
| Complete secondary | 0.0406 | 0.3634 | 0.1956 | 0.3092 | 0.0913 | 22% | 1.74 | 28.3 |
| Some college | 0.0169 | 0.1973 | 0.1991 | 0.4634 | 0.1232 | 22% | 1.75 | 29.2 |
| Bachelors degree | 0.0049 | 0.1142 | 0.1774 | 0.4988 | 0.2047 | 34% | 1.61 | 30.9 |
| Advanced degree | 0.0017 | 0.0771 | 0.1228 | 0.5103 | 0.2881 | 13% | 1.59 | 31.1 |

## Selected Findings from Projections

Earlier sections described the basis for each of the inputs we used in our projections. We also described the extent to which those inputs resembled or differed from those used in other projections (although, since we incorporate new elements, that was not always fully possible). In general, those comparisons suggested a high degree of agreement for elements which could be readily compared. In a separate methodological report, we have described the extent to which outputs -- the population size and characteristics as projected through 2050 -- agreed with the official projections from the DOF. That report showed a high level of agreement with official projections for characteristic present in both sets of projections[44].

In this section, we briefly discuss some elements of our projections which have implications for educational policy, future educational distributions and well-being in California. We begin by discussing trends in the population size and the dependency ratio. The dependency ratio splits the population into three segments: a segment that is too young to support themselves (the child dependents), a segment which is available to support themselves and others through paid employment, and a segment which has retired from the labor force and must be supported through savings or transfers (the aged dependents). Effectively, the dependency ratio is intended to provide a rough approximation of how many non-working persons need to be supported by each worker. Although alternate versions of the dependency ratio exist, we calculate the ratio as the number of persons younger than 15 or older than 64 for every "working age" person age 15-64. The dependency ratio itself is only influenced by the age structure of a population, but the actual ability of the working age population to support dependents relies not only on the number of workers but also on the productivity and earnings of workers.

We follow that discussion with a brief description of trends in ethnic composition, both for the population as a whole and for selected age groups. Changes in the size and ethnic composition of the working age population will have implications for potential earnings and the ability to support dependents. Changes in the size and composition of the youngest segment of the population will have implications for demand for services

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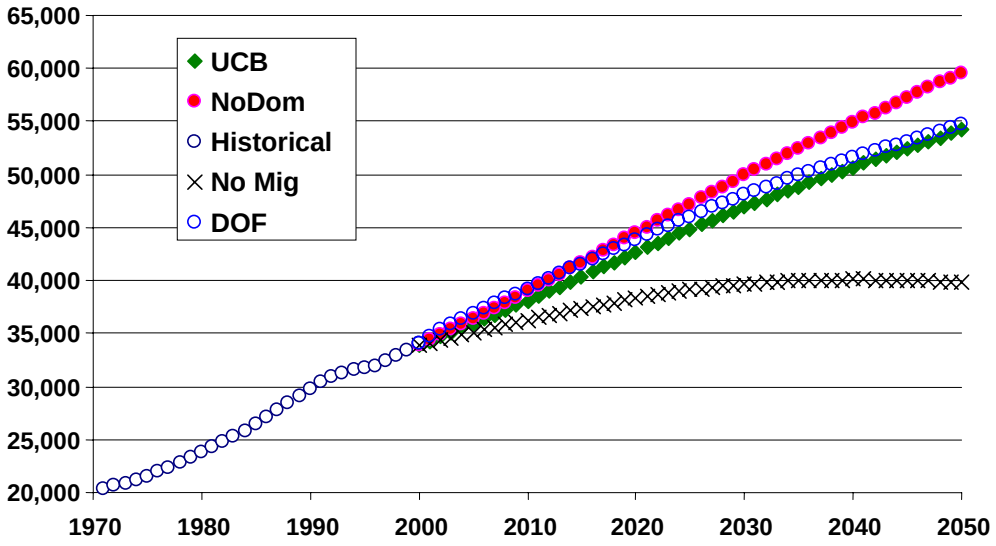
[44] The most notable differences between our projection and that of the DOF lies in the speed at which the Hispanic population becomes the largest single ethnic group: in DOF projections, they reach 40% of the population by 2013, and 50% of the population by 2039. In our projections, they reach 40% of the population in 2019, and still fall a half-percent short of majority status in 2050. The slower growth in the Hispanic population is balanced in our projections by a slower decline in the non-Hispanic white population: in our projections, the decline is driven by a growing overall population matched with a relatively stable number of non-Hispanic whites. The DOF projects absolute declines in the white population which average 66,000 annually through 2050.

While these differences are worth noting and identifying, we do not mean to overstate their importance: the difference in our respective estimates of the percent Hispanic and percent non-Hispanic white in 2025 are smaller than those between the Census Bureau alternative and the DOF estimates for their pre-census projections. Most of the differences appear to be attributable to alternative estimates of migration, although our projections of declining fertility also have a smaller role. (See the discussion of differences in migration methods and estimates for more detail.)

and levels of preparedness for work. Finally we focus on the segment of the population which is at the age in which post-secondary education is usually acquired. The educational decisions made by that group of 18-24 year-olds will affect their place in the labor market, the ability to earn, save, support others and pay taxes throughout their lives. Based on the educational transitions matrices discussed in this chapter, we finish by tracking the anticipated "baseline" levels of educational attainment for working age Californians over the next five decades. In later chapters, we will examine the gains to and costs of educating California's youth, and how those differ under a set of reasonable alternatives.

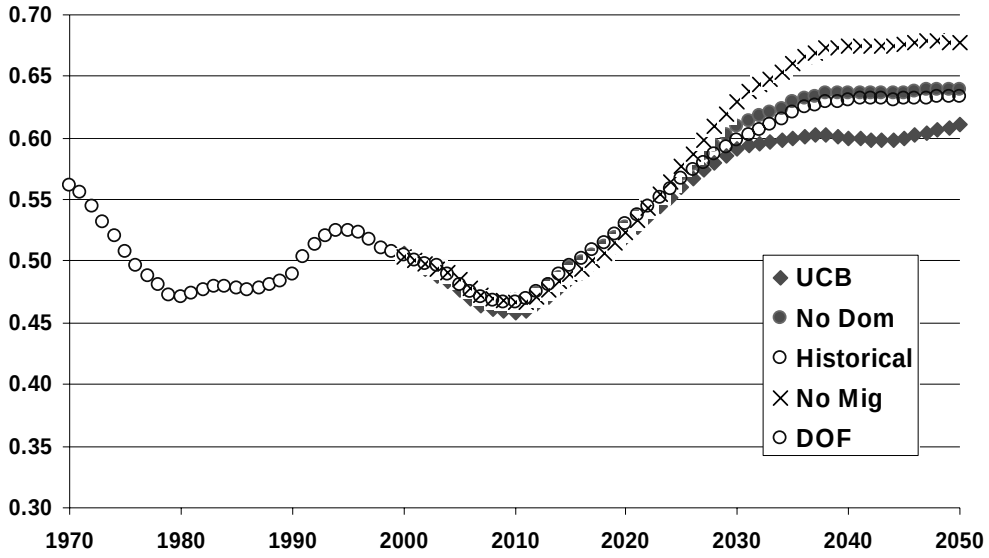
**Figure 2.10 Historic and Projected Population of California, 1970-2050**




Population shown in 1,000's. For this figure, as well as those which follow, we show historical counts for 1970-1999 based on the DOF[45] estimates. The figures labelled "DOF" refer to the official Department of Finance projections, while the figure labelled "UCB" refers to our own baseline projections. Two additional variants are plotted: the first, labelled "No Mig" uses our projection methodology, but allows for no migration in or out of the state, while the variant labelled "No Dom" allows for international migration, but sets domestic migration to zero.

[45] State of California, Department of Finance, *Race/Ethnic Population with Age and Sex Detail, 1990–1999,* Sacramento, CA, May 2004, and *Race/Ethnic Population with Age and Sex Detail, 1970–1989.* Sacramento, CA, December 1998.

**Figure 2.11. Projected and Historic Dependency Ratios, 1970-2050**




The total dependency ratio use here is defined as the population either aged 0-14 or 65+, divided by the population aged 15-64. It can be divided into two components: the child dependency ratio (those aged 0-14 divided by the population age 15-64) and the aged dependency ratio (those aged 65+ divided by the population age 15-64). These ratios are intended as approximations of non-productive (non-working) fractions of the population relative to those who are working age, and the specific age cut-offs used differ from one analyst to the next.

Figure 2.11 shows patterns in the dependency ratio since 1970 in California, combined with projections through 2050. Since 1970, the dependency ratio has fluctuated between .45 and .55, with a pattern of decline from 1995 projected to continue through 2010, followed by increases until 2030, and leveling off after that at levels around .60.[46] Variability before 2000 was largely the result of changing proportions of children under age 15 in the population, while growth in the dependency ratio after 2010 will be driven by increases in the elderly population. Variations in domestic migration have only minor effects on the projected dependency ration, but international migration acts to lower the dependency ratio by about 10% in the post-2030 period (relative to what it would be in the absence of immigration).

[46] Our projections differ slightly from those of the DOF after 2030, although the difference is fairly small (a difference of 5% by 2045). That difference is driven by somewhat higher growth in the population under age 15 by the DOF which is, in turn, linked to their higher estimates of fertility in later years.

**Figure 2.12. Projected and Historic Child Dependency Ratios, 1970-2050**

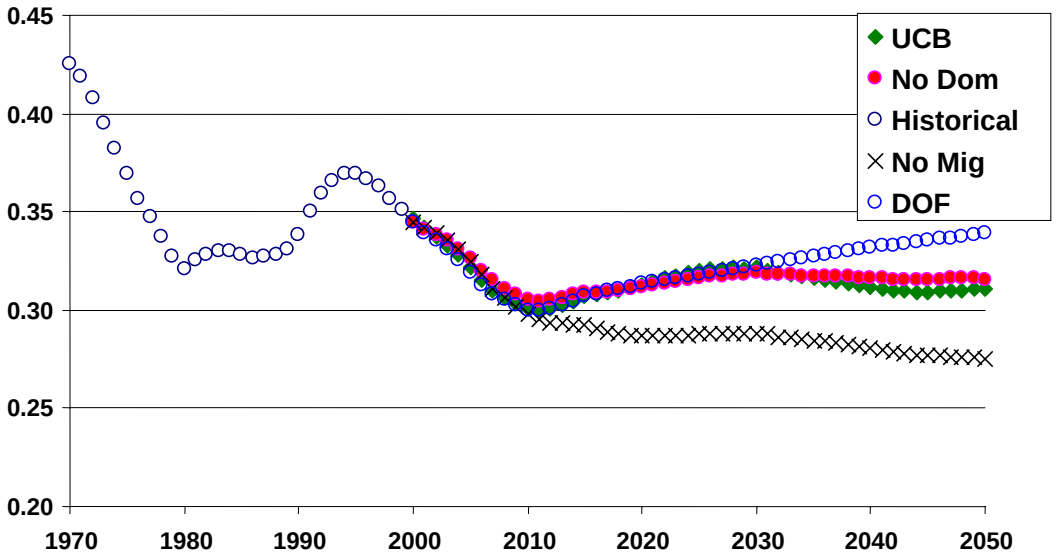
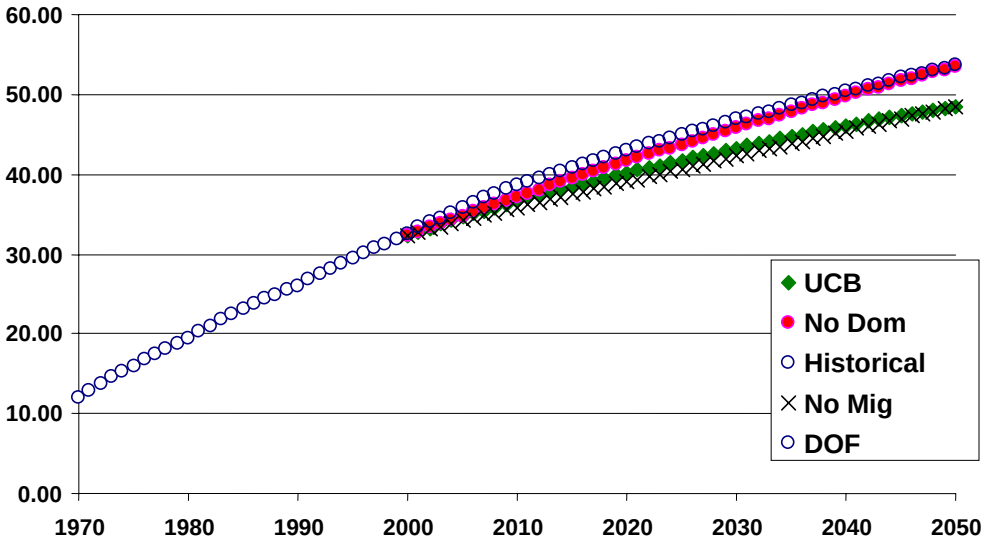


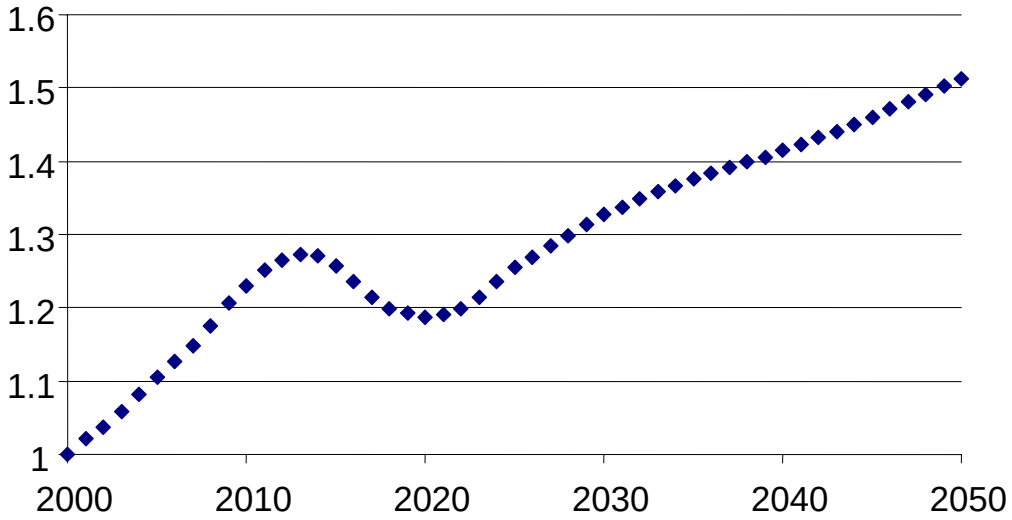

**Figure 2.13 Percent of Californians who are Hispanic, 1970-2050**




Gains in population size among all age groups are strongly affected by the growth of the Hispanic population. The overall population is expected to grow nearly 30% between 2000 and 2020 and increase by over 50% between 2000 and 2040. The Hispanic population will increase more rapidly, growing by more than two-thirds by 2020 and by over 125% by 2040, outpacing growth rates for Asians and non-Hispanic Blacks, and

substantially larger than the small changes in the non-Hispanic white population. Among 25-64 year-old age group, the core working age population, growth will be only marginally slower, and will be even more heavily influenced by increases among Hispanics. For this group, most of the investments they will make in their formal education will be complete by age 25, and the returns they can earn in the labor market will reflect the decisions they've made about the level of education they could achieve. Because this group also largely supports the dependent child and aged populations, the decisions they have made and will make affect all age groups.

**Figure 2.14 Proportional Growth of the College-age Population, 2000-2050**

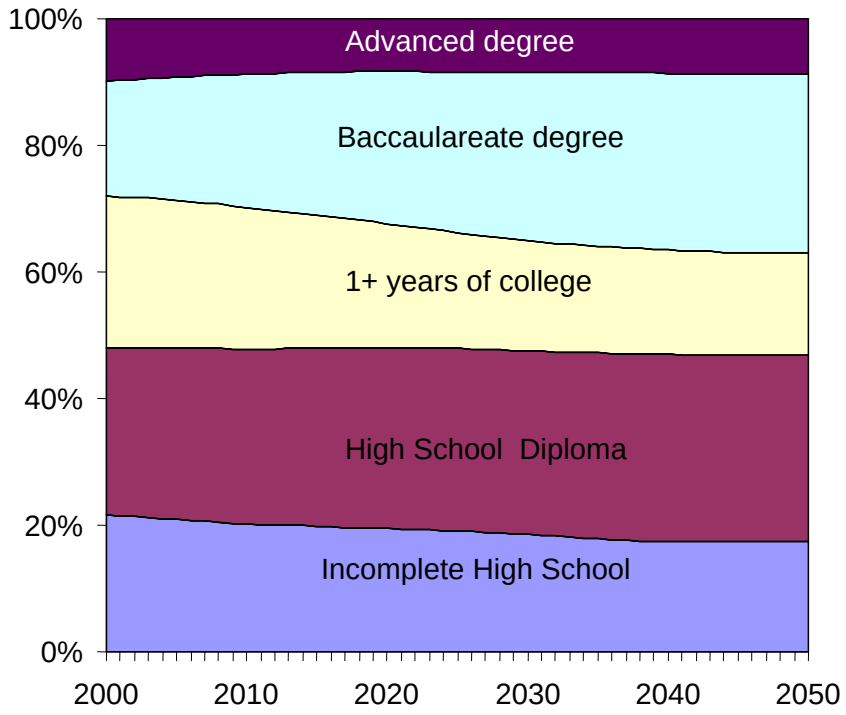



An important and quickly growing part of the population is comprised of young adults entering the years in which post-secondary education is usually acquired, the ages between 18 and 24. Between 2000 and 2013, this population will add more than 900,000 members to its ranks and grow by 27%, continuing a pattern of increase which began in 1995. Increases in the numbers of young Hispanics will account for between half and two-thirds of the growth, depending on assumptions about international migration patterns. Increases in Asians/Pacific Islanders will account for about 9% of the growth, and increases in non-Hispanic Blacks account for 13-17% of the growth. This "Tidal Wave II" boomlet presents both a challenge and an opportunity. If they can acquire educational credentials at rates higher than achieved in the past, the enduring benefits that result will continue to pay of for themselves and the state throughout their working careers. If the educational opportunities available are constrained, however, it is likely that the resulting losses will also become embedded as these individuals pass beyond the principal ages at which credentials are earned.

Our baseline estimate, reflecting the educational distributions we expect based on existing associations between parents' and children's' educational attainments and patterns of migration by education, suggest gains educational distributions for Californians. As shown in Figure 2.17, the proportion of the population age 25-64 who

have not completed high school is anticipated to drop by 2.3 percentage points by 2020 (about a 10% decline), while the proportion of the population with a B.A. or more is projected to increase 4.5 percentage points (an increase of 15%). The growth in the population with a BA or more is slightly lower than the 19% growth in PPIC's "dynamic" population forecast, but the decline in the population with less than a high school degree is larger than the 2% decline in PPIC's "dynamic" forecast. (See either Neumark, 2005 or Hanak and Baldassare, 2005). The gains are considerably larger than would be suggested by the "static" PPIC forecasts, however.

**Figure 2.15 Baseline Projections of Educational Attainment of Adults age 25-64**



**Findings**

*Comparisons of core characteristics of our projections with those of the California DOF show a high degree of consistency for characteristics that appear in both projections.*

- *The size and growth of California's population in DOF and our own projections is quite close, showing our total population growing to around 43 million by 2020 and approaching 55 million by 2050.*

- *The age structure, as reflected in total, child and elderly dependency ratios, are extremely similar through 2030 in each of the projections. The total dependency ratio is expected to decline slightly through 2010 before commencing an upward trend. The short-term downward dip results from a decline in the child dependency ratio, followed by upward trending in both the elderly and child dependency ratios. Our projections suggest we will reach a plateau in both ratios after 2030, while the DOF projections indicate a continued climb in the child dependency ratio accompanied by a flat elderly dependency ratio.*

- *Growth in the size of the "college age" group is expected to be substantial. By 2014, this group will increase by 27% in both sets of projections. The DOF projects that during this period, the number of Hispanics of college going age will increase by 42%, while the number of non-Hispanic whites will increase by only 2%. Our projections agree that growth in this age group is be dominated by Hispanic growth, although by a smaller margin than DOF projections.*

- *Ethnic groups are not defined in exactly the same fashion, as the DOF includes a multiracial category, but both projections suggest a steady and substantial growth in the proportion of the state which is Hispanic, mirrored by a decline in the fraction of non-Hispanic Whites. The rate of change is slightly higher in the DOF projections, but the level of agreement between projections is higher than that between current projections and the pre-2000 projections of the Census Bureau. The differences largely result from differing estimates of future migration.*

*The examination of the relationship between education and other elements of our demographic projection model show:*

- *Strong associations between education and fertility.* Education strongly affects both the timing and level of fertility. California women with less than a high school education tend toward much younger child-bearing, peaking in their early twenties and continuing to exceed that of women with higher educational attainment until their thirties. As a result, they

will bear an average of 3.6 children during their lives. As education increases, fertility steadily declines and is delayed: among women with four years of college, fertility peaks in the early thirties and, on average, these women will bear 1.6 children during their lifetime.

- *Strong associations between the education of parents and their offspring*. Childen whose mothers earned a high school degree are more than three times as likely as children whose mother dropped out to finish high school themselves, and the child of a mother with a B.A. is more than five times more likely to finish high school than the child of a mother with only a high school degree. These familial advantages are also evident in completion of higher levels of education: the proportion of children who complete their own B.A. is twice as high for mothers with a BA than for mothers with only a high school diploma.

- *Strong associations between education and migration.* California benefits from substantial inflows of adults (both domestic and international migrants) with post-secondary educations, who arrive either as post-secondary students or when their own educations are complete. These inflows are notable among both domestic flows and international flows. The more poorly educated are also over-represented in international migration flows: the foreign-born make up only a third of the population age 25-64, but comprise over two-thirds of the working age population who lack a high school degree.

These associations argue for a careful consideration of education as an integral component of models which project future populations. Inclusion of the elements of nativity and education in our projections suggest:

- *Historical patterns of upward mobility in terms of education will increase the educational attainment of today's children relative to their parents.* Although nearly 30% of California births in 2000 were to mothers with less than 12 years of education, we expect that by 2025, nearly 90% of those children will have completed high school or its equivalent. Among the children of foreign-born Hispanics, gains are quite dramatic: while nearly two-thirds of such children are born to mothers lacking a high school degree, all but 17% are expected to eventually earn a degree of their own. (Note: This is quite close to the figures shown in Table 3.5 in Reed et al. (2005) showing educational progress across immigrant generations for California Latinos). Gains will also be experienced at more advanced levels of education: while 21% of births in 2000 were to mothers with a B.A. or more, slightly more than 28% of all children born in 2000 are expected to earn a B.A.

- *Although the proportion of the population which is foreign-born will continue to increase for at least the next two decades, the foreign-born population will increasingly consist of immigrants who have been present for a longer period of time*. Because native-immigrant differentials tend to diminish the longer immigrants have been present in the U.S., overall differences between natives and immigrants may be expected to narrow.

**Qualifications/Caveats**

*Population projections are based on contemporary rates for the components of fertility, mortality and migration. If those rates change, projections will not accurately depict future growth. The more that projected and actual rates differ, the more future populations will diverge from the model. Near term projections are likely to be better than long-term projections, since rates tend to change slowly and a great deal of inertia from current populations is present in nearer term projections. We produced projections which track California's population through 2050, largely because that provided the maximum period for differences to emerge between our projections and those of the DOF. However, we believe those projections are strongest in the near- and mid-term future, the period through 2030.*

*More complex projections are not necessarily more accurate than simple projections. Adding additional elements may also introduce error, particularly if the associations between the added elements are volatile or poorly measured. The elements we add to the mix used by the DOF - nativity and education - display strong associations with fertility and migration in data we can observe from 1980 and 1990, as well as in the 2000 census and natality data on which we base our projections.*

*Migration - especially domestic migration - is a volatile component which is sensitive to the method used to measure it and the period for which it is measured. Evaluations of the accuracy of projections by the Census Bureau conclude that mis-estimation of domestic migration is responsible for the largest proportion of mismatch between projected and actual populations. In California, the domestic migration patterns of the 1990s were, in the eyes of many analysts, very atypical. The early 1990's were characterized by high and increasing levels of emigration, especially among non-Hispanic whites. Net domestic flows remained negative throughout the decade, although the size of the net flows*

*declined, and the ethnic composition of the flows became less concentrated. The DOF calculations of net migration are based on the entire decade between 1990 and 2000 while our calculations are rooted in the period from 1995 through 2000. Which period of reference is preferable (or, indeed, whether either period serves as a strong basis for projection) is open to debate. However, one of the strengths of the explorations of this chapter is to highlight that variability and its potential impact on estimates of California's future population.*

*Although the acquisition of formal education, particularly that directed at pre-baccalaureate and baccalaureate credentials, tends to be heavily concentrated in the ages before age 25, a significant fraction of adults attend college or earn degrees later in life. This does not affect the parent-offspring education matrix, but educational outcomes for offspring may occur at later ages than the projections suggests. In addition, terminal educational attainment for those aged 25 - 30 in 2000 is likely to be understated (as well as that for those in their thirties and forties, but to a lesser extent).*

***Conclusions***

*Consideration of education and nativity can strengthen population projections by shedding light on mechanisms/factors associated with the basic building blocks of projection models. The inclusion of these elements in projections of California's population produces basic results for population size and age which are quite consistent with official projections by the DOF. The projections also suggest an upward trend in educational attainment for Californians which could exert additional demands on secondary and post-secondary education systems. Balanced against these intergenerational increases are potential declines in educational achievement as traditionally disadvantaged ethnic groups increase their share of the population. The direction in which this balance may fall --and the costs and consequences of the resulting gains and losses in educational achievement-- are the subject of the remaining chapters.*

*Educational attainment is an increasingly important determinant of the well-being and life chances of individuals. As the last chapter showed, it is also strongly tied to parental education, ethnicity and nativity, all of which are actively shaping California's demographic landscape and future. Past and anticipated changes in the demographic composition of California can be reasonably expected to affect educational distributions as well, and hence lead to changes in educationally linked outcomes. As a result, it makes sense to pay attention to the kinds of benefits associated with education and how those benefits differ by ethnicity and nativity.*

## Chapter 3:
## Benefits of Increasing Educational Attainment

California is changing, and the projections of the last chapter delineated the characteristics and trends we will see in the California population if existing vital rates continue in their current patterns. The traits that we used to differentiate those vital rates -- age, sex, ethnicity, nativity, and education -- also structure many other important life experiences. The kinds of jobs we can find, the money we earn for our efforts in the labor market, the housing conditions and lifestyle we can purchase with those earnings, the savings we accumulate for retirement, and the likelihood that we will live in poverty or rely on transfer payment for basic needs are only some of the many outcomes which emerge from the interplay of these basic characteristics.

In this chapter, we will focus on one characteristic -- education -- and consider the consequence of shifts in the educational distribution on outcomes other than the simple demographic characteristics of the last chapter.[47] In particular, this chapter asks

[47] Of course the outcomes we look at are also affected by the other basic characteristics, like age, sex, ethnicity and nativity. However, the ability of government to influence those outcomes by trying to intervene in the distribution of those basic characteristics is (rightly) limited in democratic states, and of dubious value. Of course, policies set by state and local governments can and do affect the age, sex, or ethnic composition of the population. Preferential tax status, such as the measures put into place by California's Proposition 13, may make continued residence more possible or preferable to aged residents, legislation on hate crimes or official languages may make a state more or less attractive to non-white migration, and social supports for child-bearing or child-rearing may influence the decisions of individuals to have children or move to an area if they already have children. As well, state and local policies can try to change the relationship between demographic characteristics and outcomes (e.g. changes in minimum wage laws may change the relationship between education and earnings, and social support programs have significantly changed the relationship between poverty and age). In general, however, the relationship between the demographic characteristics we model and the outcomes we examine is well-entrenched and resilient.

and answers the question: What is the relationship between education and measures of the social and economic well-being of Californians?

Regardless of what (or whether) additional steps are undertaken in our educational system to improve outcomes for California, changing demographics and the state's responses to them will reshape the educational distribution in California. In the next chapter, we will turn our focus on how educational attainment and movement through the educational pipeline are structured by age and ethnicity, and look at trends in these movements over time in California. In that chapter, we trace the overall growth in the systems of higher education since 1970, place it in the context of population growth, and identify trends in ethnic composition of enrollees. We step back from the gross trends in the second section of Chapter 4, and examine transitions through high school, into college, and through the acquisition of a baccalaureate degree. Finally, we investigate costs to the state for providing educational infrastructure, and consider the total investments the state makes from general funds for entrants and completers in California's four year public universities.

The final chapter will build upon each of these elements to explore four possible educational trajectories for the state, and the costs and benefits entailed under differing scenarios of educational investment. That chapter, however, raises serious concerns over our ability to maintain our competitive edge in the national and global economy, our standard of living and our ability to support our population and infrastructure if we continue down our current path. Although existing levels of education are improving for all groups, non-Hispanic whites and Asians attain substantially higher levels of education than relatively disadvantaged Blacks and Hispanics. These educational disparities translate to economic and social disparities whose impact will increase in pace with shifting state demography. Furthermore, because the educationally disadvantaged groups are growing faster than the more educated groups, educational disparities may, in turn, lead to declines in state revenues at the same time they drive up demands for state services.

**Benefits of Education: Typologies, Measures and Sources**

This section describes how we study the relationship between educational attainment and well-being. We start by describing the measures we use and the sources from which they are derived. We next identify a simple summary method for describing what kinds of educational transitions make a difference for specific outcomes based on relationships and distributions in 2000, and identify how some of the specific measures differ by education and ethnicity.

To organize our discussion of these consequences of the interaction between educational and demographic change, we differentiate three classes of effects: personal benefits, collective benefits, and -- considered from the perspective of the state -- changes in revenues and expenditures[48]. In terms of personal benefits, we consider items that we

[48] There are a number of distinctions that are drawn with respect to educational benefits in academic literature. The principal distinction is drawn between "private returns" and "social returns": the former

expect individuals to benefit from directly: a good job, good wages, ownership of one's home and automobile, freedom from overcrowding in housing and poverty, and increased security in retirement. Non-financial personal benefits would also include the enjoyment derived from satisfying curiosity or self-fulfillment and better health. In terms of collective benefits, we could place such items as an educated population, high levels of citizenship and civic participation, lower levels of inequality, high levels of facility with a common language, increased proportions of the population registered and willing to vote, or the establishment of common values. These latter benefits are considered to be "externalities" -- consequences which are not experienced or taken into consideration by the individual student making choices about continuing his or her education. Finally, in the state's eyes a central concern is its ability to fund its operations through tax revenues and, to the extent possible, minimize the costs of the programs it operates. We provide some limited estimates of some of the elements of those revenues and expenditures.

Not all benefits are quantifiable from the data sources we rely on for this report. For most of these potential benefits, the data we use to estimate impacts is the 2000 5% Public Use Microdata Sample (PUMS) for California. This source is the largest and best *single* source of information with data on both the majority of outcomes we are interested in and the characteristics we incorporate in demographic analyses.[49] In some cases (e.g. voter registration or voting), pooled samples of the CPS were used to estimate values for measures unavailable from the PUMS.

Many of the more quantifiable benefits of education can be tied to the labor market. The logic most frequently used to explain the relation these benefits have to education is expressed in terms of human capital. As individuals pursue their education, they make investments in skills, knowledge and practices which become part of the "package" they sell in the labor market. If these skills are in demand by employers, more highly educated workers are rewarded with employment and higher wages, while their

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considers the costs and gains only to the individual student, while the latter reflects costs and benefits to society at large. Psacharopoulos and Patrinos ("Human Capital and Rates of Return" in the International Handbook on the Economics of Education (2005) draw even more distinctions, separating private returns, narrow social returns (which are private returns which consider costs incurred by those other than the student), contributions to growth, and non-market benefits and externalities. Walter McMahon ("The Social and External Benefits of Education", International Handbook on the Economics of Education, Edward Elgar Publishing, Northhampton, MA, 2005) identifies a number of paths through which contribution to per capita growth may occur, including R&D and innovation effects, income growth effects, and declines in fertility. Non-market benefits include health impacts, gains in the strength of civic institutions, lowered crime, and reductions in inequality. Enrico Morretti ("The Social Return to Higher Education: Evidence from Longitudinal and Repeated Cross-sectional Data", NBER Working Paper Series, WP 9108, August 2002) includes the positive spillover earnings gains to workers in areas which experience increases in education. See also W. Craig Riddell, "The Social Benefits of Education: New Evidence on an Old Question". Paper for the conference "Taking Public Universities Seriously", November 2004.

[49] Other sources, such as the Survey of Income and Program Participation (SIPP) or the Current Population Survey (CPS), can frequently provide selected measures of superior quality as a result of interviews by trained personnel and more detailed questions and quality checks, but those sources have much smaller samples and, in the case of the SIPP, non-representative state-level samples. Similarly, surveys which focus on social attitudes, like the General Social Survey (GSS), are a preferred source for analysis of items which can be more difficult to quantify or which include a richer set of controls. Such surveys usually have much smaller samples which are not specific to California.

employers gain from increased productivity and quality of work. Increased earnings subsequently translate, in combination with household structure and needs, to lower levels of poverty and fewer demands on means-tested public services. An individual's increased income can either be directly exchanged for goods – such as uncrowded living space or vehicle ownership – or accumulated as savings for retirement or additional investments in other more durable goods, such as homes or stocks. Although it is possible for measures to represent multiple types of benefits, we include the following measures as personal benefits:

| | |
|---|---|
| Labor Force Participation | Dichotomy |
| Unemployment | Dichotomy (if in Labor Force) |
| Hours worked | (in Last Year) |
| Occupation | Seven broad categories |
| Earnings | In Last Year |
| Total Income | In Last Year |
| Poverty: 100% | Dichotomy |
| Home Ownership | Dichotomy |
| Home Value | (if Home Owner) |
| Auto Ownership | Dichotomy |
| Crowding | Dichotomy (> 1.5 person/room) |

In addition to these personal benefits, we can explore a more limited set of collective benefits. These are which benefits we gain from indirectly, via changes in the environment in which we live and work, or which inhere in relationships between many individuals or groups. We may consider, for example, a citizenry which is more engaged with politics to be a collective good, because we believe that democracy works best when voter interest and eligibility is high. We may also consider a society in which income inequality is low to be a collective good to the extent that we think that equity among groups is a good thing, or find high levels of facility with a common language to be beneficial in maintaining common goals, identity, or civic transparency. A short list of items related to collective benefits is identified below, although each of the benefits associated with net fiscal benefits to the state is also collective in nature.

| | |
|---|---|
| Citizenship | Dichotomy |
| Voter Registration | Dichotomy |
| Voter Turnout | Dichotomy |
| Educational Attainment | Categories |
| Facility with English | Dichotomy |

Finally, one very important good to consider is the net fiscal benefit to the state. Although individuals make choices about whether or not to invest in their education, these choices are constrained and shaped by the state's own investment in infrastructure and support. The state does have a stake in both of the types of benefits described above – at least we hope that states have an interest in increased well-being among residents and improvements in collectively experienced goods – but it also has a more narrowly defined interest in maintaining a positive cash balance. Education affects this interest in two ways. First, by increasing the average income of the state's residents, the state can either increase its tax revenue while maintaining a constant tax rate or it can maintain a constant level of income while reducing tax rates. The second impact of education on the

state's cash balance is through reduced spending. Increased education has measurable effects on the need for means-tested transfer programs, such as the California Work Opportunities and Responsibility to Kids Program (CalWORKs), Supplementary Security Income (SSI) for elderly and disabled people or poverty-related supports like Medi-Cal, the program for health care and long-term care for low income residents in California. Educational attainment also influences rates of incarceration, in which the more poorly educated are heavily over-represented. (Of course, it also imposes a direct cost for education support, which we discuss in more detail in the next chapter). Measures reflecting costs and revenues for the state include:

| | |
|---|---|
| Welfare Receipt | Dichotomy |
| SSI Receipt | Dichotomy |
| Poverty | As proxy for demand for Transfer Programs |
| Incarceration | As proxy for costs of incarceration |

For each of these measures, values were estimated using logistic or ordinary least squares (OLS) regression separately for seven ethnicity/nativity categories. The following variables were included as covariates in the estimation process: age (linear and quadratic terms), sex, educational attainment, interactions between age and sex, age and education, and sex and education. Reduced form estimates were calculated and compared with raw measures for the baseline projection over time as a verification check.

There are critical assumptions which underlie the estimation of outcomes and the subsequent linking of those outcomes to our projections. These assumptions are that the relationship between our outcomes and the demographic characteristics for which they are summarized will remain the same in the future and that behavioral effects, equilibrium relationships, or the omission of unobserved variables (e.g. ability) do not misstate the strength of the relationship between education and outcomes. We cannot always directly evaluate these assumptions with available data, and choosing a method of addressing such problems inevitably requires additional complicating assumptions which analysts disagree about and which cannot be incorporated with our later work.[50] We instead discuss possible upward or downward biases that other analysts have identified, and suggest the extent to which resulting estimates could reasonably vary from our own. We remain committed to using the more straightforward and transparent approach, which gets to the core issue - *What choices do we have and what differences can we make?* - while getting the basic magnitudes correct.

[50] We do discuss one special instance of a changing relationship between our demographic characteristics and outcomes in the following section. In that section, we show that the association between education and earned income, which we treat as fixed, has been trending upward in California over the last two decades. As a result, the gains we predict from educational gains are likely to be *understated*. We could conceivably adjust the earnings gains by extrapolating a linear or curvilinear trend, but the assumption required is that the pattern of *growth* is fixed rather than the existing association, and that it can be predicted with accuracy. Any improvements in the quality of the projection would be debatable, and the cost would be a loss of clarity and simplicity.

**Where Education Matters: Methods and Outcomes**

In the last section, we discussed some of the outcomes where education is likely to matter. In this section, we provide one method of summarizing how much outcomes differ by educational level, and how much changing outcomes for those specific transitions could affect overall outcomes for the population. These are a necessary precursor to answering such questions as: What would happen if educational attainment for Latinos resembled that of Asians? What would happen to overall levels of earnings, employment, poverty, or asset accumulation if college going rates increased? What if the proportions of Blacks who drop out of college decreased? To estimate these effects, we look at the relationship between those outcomes and education in 2000. Although part of the relationship between outcomes and education may reflect unmeasured factors tied to both outcomes and education, these estimates are a strong indicator of the size and direction of changes we could expect from shifts in educational distributions.[51] Furthermore, the relative impact of education appears to be increasing over time.

Educational attainment affects us at all stages in a life cycle. For children, most of these effects - poverty, crowding, disposable income - depend more upon their parents' education than their own. However, the educational opportunities afforded to children and the choices they make about their education become more important as those children transition into adulthood. To capture the effects of one's own education rather than parental characteristics, we focus on outcomes for adults, particularly those aged 25 and over. We use these adults to construct a synthetic cohort[52] which allow us to estimate the differences in outcomes which emerge by education over the course of an

[51] The most important critique of interpreting existing educational differentials in outcomes like earnings as an unbiased measure of the consequences of educational gains is that it ignores the effects of unobserved characteristics which are responsible for some of the variation in both earnings and education. The association we measure between education and outcomes does not control for many factors – things like ability, motivation, parental support, or an array of other possible characteristics -- which are related to both education and income. Moreover, since continuation of education is matter of choice as well as opportunity, we might expect that those who have continued their education are those who expect to benefit the most. Grubb and Lazerson (2004) suggest that "simple differentials among education groups…are slightly lower when other variables are considered, but between 70 and 90 percent of differences persist". Hence, it is possible that groups with low average levels of education also have lower levels of motivation or ability, and would benefit less from gains in education – in fact would be likely to benefit only about 70-90% as much. However, Grubb and Lazerson go on to note that "recently economists have concluded that the "ability bias" in estimating the effects of education may be offset by the bias caused by measuring educational attainment incorrectly".

In fact, other analysts suggest that the bias may run in the opposite direction. Card (2001) provides reviews of 11 recent analyses which use instrumental variable methods to separate the influence of educational gains from those associated with ability. Those analyses consistently suggest that true returns to schooling are higher - typically by about 20% - than would be estimated using typical OLS techniques. This would suggest that increasing the educational attainment of groups facing greater educational disadvantages could provide greater gains than we estimate here.

[52] The concept of a synthetic cohort is a common one used in demographic analysis. A synthetic cohort applies the rates of a given time period over the entire projected lifetime of a group of people, as they age through life. Though it makes the assumption that rates will not change throughout time in the future, synthetic cohort analyses provide a useful way to assess the implications of the continuation of current conditions.

individual's life. A synthetic cohort approach uses a cross-sectional sample and takes a 'snapshot' of conditions for a group at each year of age, and combines those snapshots to create a movie of that groups' expected life course. It has the advantage that it has a readily summarizable form and interpretation, and standardizes for age differences between groups. We define groups on the basis of educational attainment, ethnicity and nativity, and report outcomes within ethnic/nativity groups relative to a 'base' educational category.

Specifically, we derive these synthetic estimates by estimating the mean value of the outcome for each year of age, and summing those values separately for men and women in each of our ethnic categories. The cumulative synthetic outcome ***S*** for each stratum defined by an educational category ***E***, ethnicity $\boldsymbol{R}^{53}$, and gender ***G*** reflects the average value of the outcome ***O*** at each year of age ***A*** summed across all ages from 25 to 64.

$$S_{ERG} = \sum_{A=25-64} mean(O_{AERG})$$

That synthetic outcome represents what the average Californian of that ethnicity, gender and education could expect to experience over their adult years if the relationship between that outcome and age remains consistent over time. If, for example, we are considering the impact of education on employment, we estimate the likelihood that an individual will be employed at each age, and sum across the relevant ages. The sum will reflect the number of years (out of the forty possible years between ages 25 and 64) that we expect that individual to be employed. If the outcome of interest is instead income, we sum the age-specific mean income for a stratum, and the result reflects the total income (in constant dollars) that an individual in that stratum could expect to receive between the age of 25 and 64.

Personal income is a key indicator of the potential for well-being. It reflects our ability to purchase goods for consumption, it is strongly tied to happiness, health and mortality, provides savings for our retirement, and opens up many possibilities for choices and lifestyles that are unavailable without it.[54] The following table uses this indicator, in the form of earned income, to illustrate the sharp differences that emerge from educational attainment.

Weighted to correspond to the ethnic composition of 25 year-olds in 2000, Table 3.1 indicates that earning a high school diploma also means earning 74% more over a lifetime on average; taking the next step and entering college pays an additional 33%; with a baccalaureate degree comes an expected increment of 54% beyond that, and

[53] For notational simplicity, we include distinctions based on nativity and years since entry under ethnicity.
[54] See *Social Inequality*, edited by Kathryn Neckerman (2004), for a review of the literatures that support our claims in this sentence.

**Table 3.1 Proportional increases in lifetime earnings by educational attainment in California, 2000**

| *Total Population* | **Proportional increase in Lifetime Earnings** | | | | |
|---|---|---|---|---|---|
| | ***if educational attainment increased to:*** | | | | |
| ***From current education of:*** | **Less than HS** | **HS Diploma** | **Some College** | **BA** | **Advanced Degree** |
| **Less than HS** | 1.00 | 1.74 | 2.31 | 3.56 | 4.89 |
| **HS Diploma** | | 1.00 | 1.33 | 2.05 | 2.82 |
| **Some College** | | | 1.00 | 1.54 | 2.12 |
| **BA** | | | | 1.00 | 1.38 |
| **Advanced Degree** | | | | | 1.00 |

earning an advanced degree rewards one with an average of 38% more.[55] Cumulatively, the transitions from an incomplete secondary education to an advanced degree yield nearly a fivefold increase in earnings, corresponding to an increase in income (in 1999 dollars) from slightly over half a million dollars to more than 2 ½ million dollars.

The impact of educational on lifetime earnings varies by ethnicity/nativity. Focusing on that first row, Table 3.2 contrasts lifetime earnings by education relative to non-Hispanic whites a high school degree. Comparison of the values in adjacent columns shows the effect of increased education *within* an ancestry group, while comparison of values in adjacent rows shows the extent to which educational payoffs for the foreign-born and non-whites trails that of native non-Hispanic whites.

**Table 3.2 Relative lifetime earnings by educational attainment, ethnicity, and nativity in California, 2000**

| | **Relative Lifetime Earnings** | | | | |
|---|---|---|---|---|---|
| | ***if educational attainment increased to:*** | | | | |
| ***Earnings relative to NH White with a HS Diploma*** | **Less than HS** | **HS Diploma** | **Some College** | **BA** | **Advanced Degree** |
| **NH White: Native** | 0.65 | **1.00** | 1.29 | 2.02 | 2.66 |
| **NH Black: All** | 0.42 | 0.72 | 0.99 | 1.54 | 2.09 |
| **Asian/PI : Native** | 0.60 | 0.95 | 1.25 | 1.79 | 2.59 |
| **Hispanic: Native** | 0.51 | 0.86 | 1.15 | 1.68 | 2.13 |
| **NH White: Immig** | 0.64 | 0.92 | 1.19 | 1.83 | 2.55 |
| **Asian/PI : Immig** | 0.46 | 0.71 | 0.98 | 1.40 | 2.35 |
| **Hispanic: Immig** | 0.48 | 0.71 | 0.94 | 1.27 | 1.51 |

[55] Information on all of the rows after the first is redundant, and can be derived from the ratios of adjacent columns. Thus, the first row summarizes all of the information in the table. For example, the transition from "HS diploma" to an "Advanced Degree" (2.82) is simply the ratio of the transition from "less than HS" to "Advanced Degree" (4.89) divided by the transition from "less than HS" to "HS Diploma" (1.74).

Both of these comparisons are important. The first comparison shows the huge difference in outcomes that can be expected for education, regardless of ethnicity. Failing to advance educationally imposes huge penalties within all of these groups. The comparisons relative to non-Hispanic whites reveals an equally important consideration: increasing educational attainment among educationally disadvantaged minorities to equal that of non-Hispanic whites may only partially compensate for changing demographic composition. Some of these differences in relative lifetime earnings no doubt reflect unmeasured factors like English proficiency or the country in which credentials were earned, but they also reflect barriers to converting human capital to income due to discrimination.

We have stressed that synthetic cohort estimates emphasize the effects of currently prevailing associations between education and outcomes. As such, they may overstate or understate the very real effects that education will have on people's lives as they experience them in "real-time" over the next half-century. It could be argued, for instance, that as more and more adults go to college and earn baccalaureates and advanced degrees, payoffs will decline as the supply increases. All available evidence suggests, however, that future demands for educational credentials in the workplace are outstripping the supply[56], and trends from the last three decades imply *increasing,* not declining, differentiation by education[57].

This trend can be illustrated through a comparison of synthetic cohort estimates of work-life earnings[58] based on patterns prevailing in California in 1980, 1990 and 2000, which shows steady and substantial growth in the payoffs to education. Table 3.3 shows that in the twenty year period since 1980, earnings for those without a high school diploma fell relative to that of high school completers, declining from 81% of the earnings for high school completers to 68% in 2000. During the same period, earnings relative to high school graduates for adults with a BA grew from 164% to 213%. Declines in earnings of those who failed to complete high school are partially tied to shifts in the ethnic composition of non-completers, but declines are notable within each ethnic group, as well. Relative gains among those with a baccalaureate degree are large and consistent for all ethnic groups.

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[56] See Neumark (2005) *California's Economic Future and Infrastructure Challenges*. The summaries provided in Table 8 suggest potentially large shortfalls in skilled labor. He also notes that demand for skilled labor is likely to grow strongly in the remainder of the US, and "there are likely to be similar demand pressures elsewhere, and therefore that the state's economy is most likely going have to rely, in large part, on boosting educational levels among the California-born and California-educated population." Available at http://ppic.org/content/pubs/OP_605DNOP.pdf . Also see Hanak, Ellen and Mark Baldassare. 2005. *California 2025: Taking on the Future*. San Francisco: Public Policy Institute of California. Available at: http://www.ppic.org/main/publication.asp?i=489.

[57] See Betts (2000) for an earlier examination of diverging trends in earnings by education for Californians between 1969 and 1997.

[58] Worklife earnings differ from the lifetime earnings discussed previously in that they focus only on employed persons, and eliminate the impact of education on the likelihood that one will actually have a job. We also use slightly different educational categorizations, due to inconsistencies in the way that educational attainment was asked and coded in the three censuses.

**Table 3.3 Work-life Earnings Relative to HS Graduate of Same Ethnicity, 1980, 1990 and 2000**

| Work-life Earnings Relative to a HS Graduate of Same Ethnicity (Synthetic Cohort of Employed Persons) | | | | |
|---|---|---|---|---|
| | | Less than HS | Some College | BA or More |
| **All Ethnicities** | 1980 | 0.81 | 1.17 | 1.64 |
| | 1990 | 0.78 | 1.23 | 1.88 |
| | 2000 | 0.68 | 1.26 | 2.13 |
| **Non-Hispanic White** | 1980 | 0.90 | 1.16 | 1.63 |
| | 1990 | 0.91 | 1.19 | 1.83 |
| | 2000 | 0.79 | 1.20 | 2.03 |
| **Non-Hispanic Black** | 1980 | 0.86 | 1.14 | 1.60 |
| | 1990 | 0.78 | 1.21 | 1.80 |
| | 2000 | 0.82 | 1.19 | 1.90 |
| **Asian/Pacific Islander** | 1980 | 0.77 | 1.17 | 1.59 |
| | 1990 | 0.72 | 1.29 | 1.86 |
| | 2000 | 0.75 | 1.31 | 2.18 |
| **Hispanic** | 1980 | 0.77 | 1.17 | 1.52 |
| | 1990 | 0.72 | 1.26 | 1.79 |
| | 2000 | 0.73 | 1.27 | 1.90 |

Author's Calculations from: 1980, 1990, and 2000 PUMS for California.
Figures represent earnings relative to those of an individual with a high school degree.
(The census question on educational attainment changed between the 1980 and 1990 census, and complete comparability is not possible. In particular, holders of some vocational certificates from trade school may be classified as high school only in 1980, but having some college in later years. The ratios of "Less than HS" to "BA or more" will be unaffected by those changes in the question, and increase steadily from 2.02 in 1980 to 2.40 in 1990, and to 3.13 in 2000. All 1990 to 2000 comparisons are completely unaffected.)

The extent to which these returns to differing levels of education will continue to diverge is open to question. If demand in the labor market is the key factor, we can expect differences to remain constant or increase, with recent work by Neumark (2005) indicating that demand in California for more highly skilled workers will remain strong through 2020. Demand for workers with less than a high school degree is expected to decline, as is demand for workers with only a high school degree. Estimated declines in demand vary between models which hold industry-specific education rates fixed (the "static" model) and those which incorporate a trend (the "dynamic" model), but the declines range between by 3.6% and 19.9% for those with high school degrees, and decline between 2.2% and 37.8% for workers with a high school degree. Demand will remain steady or increase slightly for those with some college and AA degrees, and will increase sharply for those with B.A.s (between 2.0% and 31.9%) and those with advanced degrees (between 5.1% and 31.6%). However, we believe a simple linear extrapolation of increasing divergence is unwarranted, and there is some evidence that

returns to education may be stabilizing since 2000. As a result, we do not project increasing gains over time for our later cost/benefits projections. This is a conservative approach, and it is quite possible that the resulting estimated benefits will be understated.

Using the same synthetic lifetime measures, the following tables identify impacts on a much broader range of outcomes, expressed for each educational category relative to outcomes for those with a high school education. Outcomes are presented for the total population, and we combine and weight the ethnicity-specific results in proportion to their share of the 25 year-old population in 2000. The resulting figures can be interpreted as the average effects of education that can be anticipated for twenty-five year-olds who were present in California in 2000.

Table 3.4 Synthetic Benefits Associated with Education

| ***Outcomes relative to HS Graduate*** | **Less than HS** | **HS Graduate** | **Some College** | **BA** | **Advanced Degree** |
|---|---|---|---|---|---|
| Years in Labor Force | 0.80 | 1.00 | 1.12 | 1.19 | 1.25 |
| Years Employed | 0.75 | 1.00 | 1.14 | 1.23 | 1.30 |
| **Occupation** | | | | | |
| Professional | 0.39 | 1.00 | 2.11 | 4.32 | 6.98 |
| Managerial | 0.32 | 1.00 | 1.51 | 2.56 | 1.89 |
| Self-Employed | 0.67 | 1.00 | 1.56 | 3.08 | 2.72 |
| Routine White Collar | 0.48 | 1.00 | 1.04 | 0.66 | 0.27 |
| Skilled Manual | 1.14 | 1.00 | 0.61 | 0.23 | 0.10 |
| Less Skilled Manual | 1.89 | 1.00 | 0.60 | 0.23 | 0.09 |
| Earnings | 0.57 | 1.00 | 1.33 | 2.05 | 2.81 |
| Income | 0.59 | 1.00 | 1.32 | 2.02 | 2.78 |
| Poverty : < 100% | 2.13 | 1.00 | 0.64 | 0.38 | 0.38 |
| Poverty : < 200% | 2.00 | 1.00 | 0.66 | 0.38 | 0.34 |
| Auto Ownership | 0.93 | 1.00 | 1.03 | 1.04 | 1.05 |
| Home Ownership | 0.76 | 1.00 | 1.08 | 1.14 | 1.14 |
| Value of Owned Home | 0.78 | 1.00 | 1.18 | 1.60 | 1.87 |
| Crowding : > 1.5 Persons/room | 3.45 | 1.00 | 0.59 | 0.41 | 0.34 |
| Welfare Use | 1.85 | 1.00 | 0.61 | 0.22 | 0.19 |
| SSI Use | 1.85 | 1.00 | 0.61 | 0.26 | 0.19 |
| Incarceration | 1.14 | 1.00 | 0.50 | 0.13 | 0.09 |
| Citizenship* | 0.63 | 1.00 | 1.16 | 1.20 | 1.11 |
| English Fluency* | 0.52 | 1.00 | 1.07 | 1.07 | 1.08 |

* Figures for Citizenship and English Fluency are restricted to foreign-born population

Table 3.4 clearly shows the positive impacts of education on a broad spectrum of outcomes, ranging from labor force attachment, earnings, income, and asset ownership to crowding, poverty, welfare use and incarceration. Beginning with simple labor force attachment, we know that among working age adults about 70% are in the labor force (employed or looking for work). Labor force participation is lower (at about 57%) for those without a high school diploma, and increases steadily with education, such that 86% of those with an advanced degree are in the labor force. The benefits of education are even stronger if we look at, not just being in the labor force, but actually holding a job. Only 47% of the working age population with less than a high school degree is employed, while the fraction of those with an advanced degree who are employed is virtually identical to the fraction in the labor force - 86%.

By creating a synthetic cohort, we can assess the impact of education on the number of hours worked over the course of a lifetime. These ratios are similar to the figures for the simple employment dichotomy, but reflect an increase from the equivalent of 21 full time years worked between the ages of 25 and 64 for those with less than an HS degree, to 35 years for those with and advanced degree.

Education affects the *kind* of work one does, as well as the ease one has in finding work and the number of hours and years one works. Professional careers are heavily skewed toward those with advanced degrees, managerial work is dominated by those with a baccalaureate degree, and both those with BAs and advanced degrees are over-represented among the self-employed. In contrast, a high school diploma or some college are the most common levels of education found among routine white collar workers, and those with less than a high school degree are most dominant in less-skilled manual jobs and, to a lesser degree, in skilled manual occupations.

Although part of the payoff from education emerges simply from the greater likelihood that someone can find work, a more substantial boost comes from the difference in earning power among the employed. Those with less than an high school degree will earn just over a half-million dollars ($538,000) over the course of their working life. Simply earning a high school degree is likely to yield an increase to $934,000, while those with a BA will earn almost 2 million dollars ($1,915,000) in the same period, and those with an advanced degree will earn 2.6 million dollars. Earning a high school diploma results in an average of $10,000 more each year, going onto college gains an additional $8,000 per year, finishing college with a BA yields yet another $17,000 per year, and going on to earn an advanced degree nets an additional gain of $18,000, for a total annual gain of 54,000 (taxable) dollars over that of an individual who does not complete high school.

The relative benefits for total income are similar to those of earned income, but reflect increases from $770,000 to $3.6 million as education increases from less than high school to an advanced degree. The net average annual gain is slightly larger if one looks at total versus earned income, at $57,000 rather than $54,000, and is more likely to reflect additional income from investments rather than the fall-off in transfer payments.

An indication of the impact of education on transfer payments is shown on the following tables reflecting self-reported receipt of welfare and SSI income. The likelihood that someone will use these benefits nearly doubles if they haven't earned a high school diploma and, as education increases beyond high school, the likelihood of public assistance income continues to decrease sharply. Welfare use among those with a baccalaureate degree is a quarter of those with a high school diploma, and an eighth of the rate among those who failed to complete high school.

Taken together, earnings and other income relative to family needs translate into large differences in poverty by education. Among adults, 22% of those with less than a HS degree live in poverty; only one in ten adults with a high school degree is in poverty, and less than one in twenty of those with a BA or more is in poverty.

These advantages translate to ownership of assets, as well. For most Californians, their home is their largest single asset and also represents the bulk of their total savings for retirement. While the relative differences in home ownership are more similar in size to those seen in terms of employment or lifetime hours worked than to the huge differences in earnings or poverty, they are nonetheless substantial. Less than half of working age adults without a high school degree own their homes, versus two-thirds of those with some college, and three-quarters of those with an advanced degree. Even more dramatic are the differences in the value of the homes afforded by those with varying levels of education: homes owned by Californians with high school degrees in 2000 averaged $220,000 in value, while those owned by those lacking a diploma had a value 23% lower, and those owned by those with a BA had a value 60% higher. Although the explosion in Californian home values since 2000 has driven up values for all owners, the association of home values with education remains.

**Summary**

This section has chronicled the substantial impacts of education on an array of benefits to individuals and the public. By and large, these benefits emerge from an improved position in the labor force, which affects the amount that individuals work, the kind of work they do, and the amount of money they earn from work. These gains permit the accumulation of durable assets, like homes, and savings for retirement, while reducing poverty rates, use of cash assistance, and levels of household crowding. Increasing levels of education are also associated with reduced rates of incarceration[59] and, among the foreign-born, greater fluency in English and rates of naturalization. In addition to these benefits, increasing levels of education attainment also provide fiscal benefits to the state, which will be discussed in detail in chapter 5. In the next chapter,

[59] See Lochner and Morretti (2004) for total crime-related social benefits related to increases in high school completion, including benefits in lowered costs of incarceration and savings in costs to victims and property damage. They estimate total annual savings of $1,700 to $2,100 annually for each male shifted from non-graduate to graduate (e.g. cumulative saving over 40 years would range from $68,000 to $84,000).

we will describe the demographic and higher education trends in California, track trends and ethnic differences in educational attainment, and provide some estimates of the costs of providing public education in California.

**Findings**

It is no surprise that educational credentials benefit those who hold them: a voluminous literature documents the extent to which social and economic well-being – including financial well-being, labor market advantages, health, civic participation, home ownership and satisfaction with life – all vary with educational attainment. Education confers both personal benefits, where the holder of the credential is the recipient of the benefit, and social benefits, where some of the gains are experienced by those who do not hold the credential, but instead benefit from sharing the same place of residence, labor market or political and social sphere as those who have advanced their educations. Focusing specifically on California, we find personal benefits measured over a lifetime relative to those for a high school graduate include:

- *Increased participation in the labor force*. Over his or her working life, a Californian without a high school diploma will spend 20% less time in the labor force, and 25% fewer years employed than a high school graduate. In contrast, a B.A. holder will spend 19% more time in the labor force and 23% more time employed than a high school graduate.

- *More favorable occupational status.* Occupations vary in their prestige, fringe benefits, hours and work conditions. While occupational composition is dependent on a complex mix of industrial structure, workforce age, and availability of skilled labor, our analyses suggest that over the course of a worklife those with less than a high school degree spend almost twice as much time employed as unskilled labor as a high school graduate. They also spend 14% more time as skilled laborers, but are only half as likely to be employed in routine white collar occupations, and are roughly a third as likely to be employed in managerial or professional occupations as a high school graduate. In contrast, a bachelor's degree increases the likelihood of professional employment fourfold, more than doubles employment in managerial occupations, and quarters the likelihood of employment in skilled and manual labor relative to a high school graduate.

- *Higher earnings and income.* Non-graduates from high school suffer a 40% penalty over their lifetime for failing to complete high school, while earning a B.A. doubles the income that can be expected relative to a Californian who stops after earning a high school diploma.

- *Decreased likelihood of poverty and receipt of welfare*. Taken together, the gains in earnings and other income relative to family needs translate into large differences in poverty by education. Among adults, 22% of those with less than a HS degree live in poverty; only one in ten adults with a HS degree is in poverty, and less than one in twenty of those with a BA or more is in poverty.

- *Increased likelihood of home ownership and home value.* Labor market advantages also provide the possibility to accumulate savings and invest those savings in home ownership. Those without a high school degree are 25% more likely to live in a rental property, while those with a B.A. are about 15% more likely to live in an owned home than a Californian who has only completed high school. The advantage in the value of an owned home is greater, with holders of a bachelor's degree holding properties which average 60% higher values.

- *Decreased likelihood of incarceration*. While those with less than a high school degree are about 15% more likely to be incarcerated than high school graduates between the ages of 25 and 64, the likelihood of incarceration is cut in half for those with some college, and is 85% lower for B.A. holders.

In addition to the personal benefits, gains in average levels of educational attainment confer social benefits to those around them. We focus on a fairly narrow set of those social benefits which derive from changes in demands for tax revenues from the state and the supply of fellow taxpayers to satisfy those demands. In particular, we focus on the extent to which available taxes increase due to shifts in the educational attainment of the population as a whole, and we focus on decreases in the demands for state spending on poverty- and incarceration-related programs.

**Qualifications/Caveats**

Like the demographic projections of the last chapter, the association between outcomes and education for each year of age is estimated from a single point in time (the year 2000). Changes in the actual effects of education over time could eventually result in higher benefits to education (if outcomes by education become more differentiated) or lower benefits to education (if education matters less in the future than it does today). Our own analyses of trends in personal income since 1980 confirm the published work of numerous analysts who find earnings and income to be increasingly

differentiated by education. The upward trends with respect to those with a BA or more are largest, while trends in losses among those lacking a high school diploma are also notable; changes in the relative gains to those with some college are less evident. Recent work by Neumark (2005) suggests that the demand for and value of higher education in California should increase over the course the next 20 years. *If these trends and estimates are reliable guides, true benefits could substantially exceed the benefits we estimate.*

The associations we measure between education and outcomes do not control for many factors – things like ability, motivation, parental support, or an array of other possible characteristics -- which are related to both education and income. Moreover, since continuation of education is a matter of choice as well as opportunity, we might expect that those who have continued their education are those who expect to benefit the most. Grubb and Lazerson (2004) suggest that "simple differentials among education groups…are slightly lower when other variables are considered, but between 70 and 90 percent of differences persist", but note that "recently economists have concluded that the "ability bias" in estimating the effects of education may be offset by the bias caused by measuring educational attainment incorrectly". Other analysts suggest that, not only are effects of education on income not overstated, the true effects are probably larger than simple differentials would indicate. Card's (2001) evaluation of 11 studies using instrumental variable (IV) controls for unobserved variables finds returns to schooling average 20% higher than returns estimated using typical OLS techniques. *In short, a range from 20% below to 20% above the benefits we identify form a reasonable upper and lower bound for possible effects of unobserved variables.*

By and large, we exclude from consideration social gains derived from paths other than direct earnings, poverty spending, and incarceration. Those benefits include spillover wage benefits to workers sharing labor markets with college graduates (Moretti, 2002), multiplier effects as a result of job creation, decreased exposure to crime and property loss, gains in health, potential gains in social equity, or society-wide gains reflecting increased innovation. We do so not because the gains from these paths are unimportant or insignificant, but rather because we wish to focus on the fiscal stake the state has in providing broad educational access and infrastructure.

We confine ourselves to looking at outcomes across broadly measured levels of educational attainment. The coursework undertaken, the grades earned

and the knowledge which students take away from their studies will vary from one major to another, as well as between students and institutions. So, too, will the outcomes experienced by those students. As a result, changes in educational distributions resulting from the addition of more poorly performing students, or degrees granted in less renumerative fields or in less competitive institutions may not have the same *average* effect on outcomes.

Because the mechanisms which link age, education, and the benefits we consider differ for different outcomes, the synthetic estimates we use may be better able to capture some outcomes than others. For example, measures of crowding in housing may reflect preferences for extended families as well as income or resources, and shifts in educational attainment may increase income without changing housing preferences. Nor do we expect that future occupational structures will be determined solely by educational distributions, or that the exact relationship between the existing occupational categories we use and education will remain fixed. In the absence of models which specify those future occupational structures or housing preferences, we believe these estimates are reasonable approaches to identifying the ways and extent to which education matters.

## Conclusions

Education matters. The effects of education are far-ranging and substantial, and yield benefits to the individuals who advance their educations at virtually every step along the way. Because pursuit of education is, to a great extent, a matter of personal choice, it is neither surprising nor controversial to learn that individuals who have made the choice to continue their education reap benefits from that choice. The method we have chosen to measure benefits shows that the advantages which accrue vary from one outcome to another, but are apparent for each. Analyses by other academics suggest that we have neither substantially over-estimated nor under-estimated the gains in earnings attributable to education as a result of omitted variables. Trends in the returns to education over time suggest that we have held to a conservative estimation of benefits (i.e. an under-estimation) if historical trends continue.

If all benefits of education were received solely by the individual, all individuals were perfectly knowledgeable and had perfect foresight about the full costs and benefits of education, and the costs and consequences of education were not marred and distorted by effects of discrimination, then economic theory would suggest that we leave educational access and opportunity to the private market. However, in addition to the private gains to education, taxpayers and the state have important stakes in the educational choices of others, both as an issue of equity and fiscal responsibility. How much these issues matter depends upon a number of factors, including the costs to the state to support education, the gains to the state which accrue from the education of its residents, the extent to which progress through the educational pipeline differs between groups, and patterns of demographic change in the state. In the following chapters we turn to those issues.

Earlier chapters established the strong ties between educational attainment and the kinds of demographic changes California is undergoing, as well as quantifying some of the many social and economic consequences associated with differing levels of educational attainment. Those findings underline the need to pay close attention to the educational progress - the pipeline -- of students in California. Examination of the educational pipeline is central to answering a number of questions: How successful are students in California at pursuing higher education? Where are they most likely to stop in the process? How do members of different ethnic groups vary in their educational success, and at what points in the pipeline do they deviate from one another? What cost implications do these rates of progression hold for the state?

## Chapter 4:
## California's Educational Pipeline and State Educational Costs

Education clearly makes California more prosperous and vibrant, and historically California has had the best higher education system in the country. Yet California currently faces a significant challenge. Between 2000 and 2015, the cohort of Californian children known as "Tidal Wave II" will pass through their high school and college-age years. This cohort will not only be larger than earlier cohorts, it will differ in terms of ethnic composition, containing larger proportions of children from ethnic groups with traditionally lower levels of academic achievement. In this section, we will look at the "educational pipeline" -- the flow of students from one level of educational attainment to subsequent levels -- to try to identify some of the consequences of these demographic trends.

By tying educational transitions to demographic shifts, we can estimate the impact of population changes on educational attainment and enrollments in California. Our concern is not only with the implications of where the application of current demographic rates is collectively taking us, but also with how changes in levels of public education can take us places we would rather be. These concerns with meeting public demands for education with an infrastructure suited to differing pools of student needs and abilities underlie the existing Master Plan for higher education in California.

**Public Postsecondary Education under the Master Plan**

The Master Plan, initially established in 1960, created a three-tiered system of post-secondary education in California. The University of California (UC) system serves as the state's primary research institution, provides doctoral-level education and degrees, and draws upon the top one-eighth of high school graduates for its incoming freshmen body. The California State University (CSU) system focuses on undergraduate and professional education, granting baccalaureate, masters and professional-level degrees, and drawing from the top one-third of high school graduates. The California Community College (CCC) system provides lower-division pre-baccalaureate and vocational education, grants certificates and associates degrees, and prepares students for transfer to the UC, CSU, and private universities. The CCC system serves "any student capable of benefiting from instruction", and provides a wide variety of credit and non-credit coursework to an equally diverse set of students. The Master Plan also included the state's independent and private colleges, which continue to serve the state through provision of bachelors and graduate degrees. The state in turn supports financial aid for qualified low-income California residents enrolled in these colleges. Due to a number of factors, most notably a focus on substantial costs of enrollment rather than the more limited costs for financial aid, the analysis in this study focuses on the public segments.

As Figure 4.1 indicates, all three parts of the public higher education system has expanded since 1970. Figure 4.2 places this growth in the context of growth in the college age population and total population in California during the period. The actual pace of this increase in enrollments resembled overall population growth through 1990, declined sharply through 1995, and rebounded equally sharply thereafter. Relative to the population aged 18-24, system growth tracked population growth through 1985, exceeded population growth from 1985-90 before a short decline, and resumed exceeding the growth of young adult population since then. These gains in enrollment relative to the young population signal the increasing expansion of interest in and the importance of a college education.[60]

Current projections from the California Department of Finance (DOF) and the California Postsecondary Education Commission (CPEC) anticipate a 35% increase in UC enrollments between 2000 and 2010, a 31% increase in enrollments at CSUs, and a 23% increase in enrollments in the CCCs. Both the DOF projections and our own indicate that the population aged 18-24 will grow about 23% in that same period.

[60] There is quite a bit of variability around the central upward trend line, especially for the Community Colleges. These variations track the unemployment rate reasonably closely, suggesting that as the labor market hardens, college becomes more attractive as potential students seek to upgrade their skills and potential losses of immediate earnings (opportunity costs) decline. Interestingly, the growth in enrollments continued unabated in the latter half of the 1990's, when the unemployment rate was steadily declining. This might signal that the desire for improved skills and credentials has overshadowed the role of opportunity costs in recent years.

Figure 4.1 Enrollment in Public Post-Secondary Education by Educational System, California, 1970 - 2013

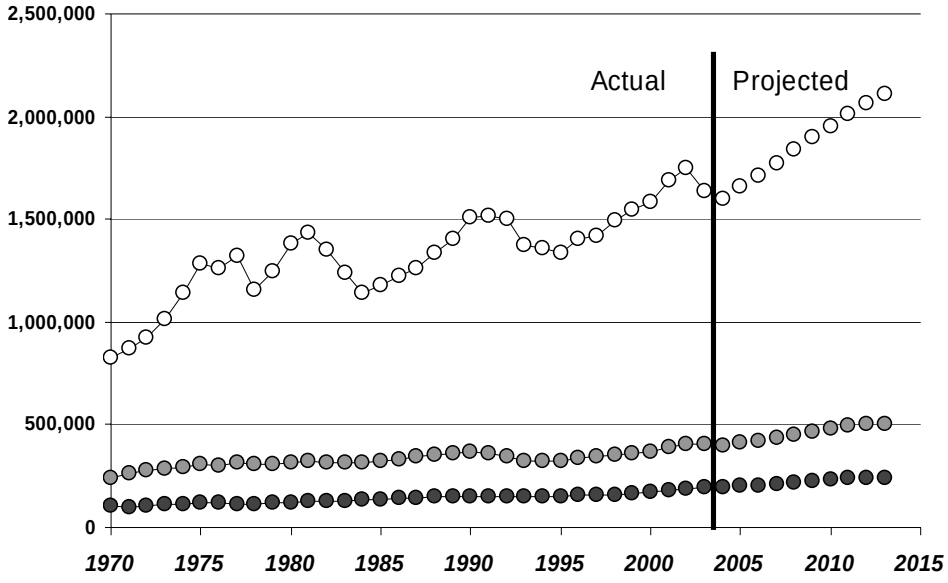
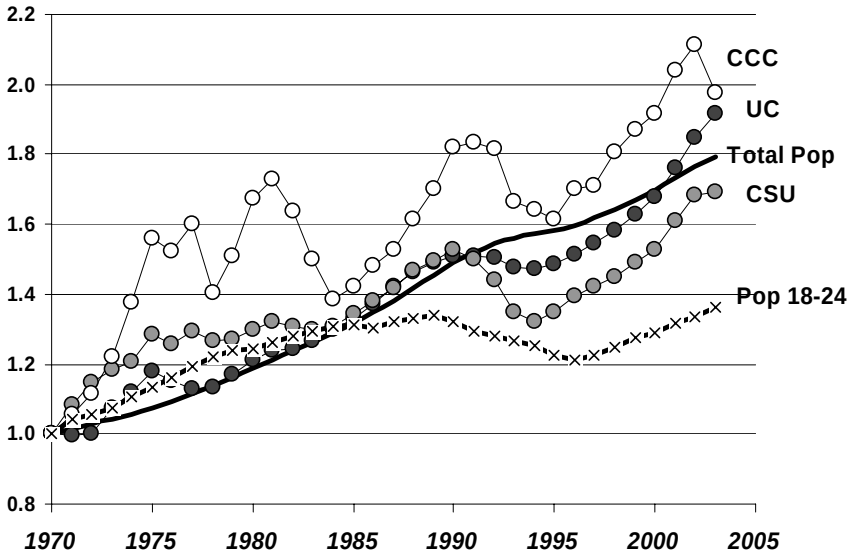


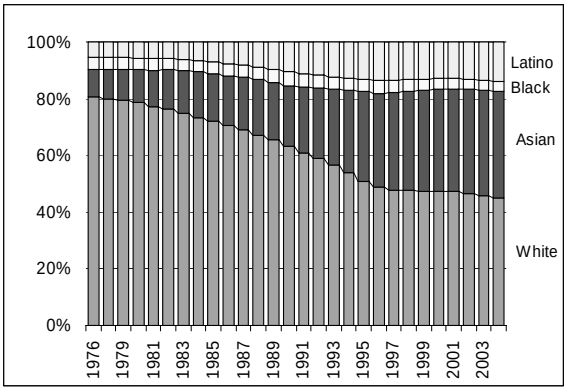

Figure 4.2 Growth in Educational Enrollments and Population Relative to 1970, California, 1970 - 2003



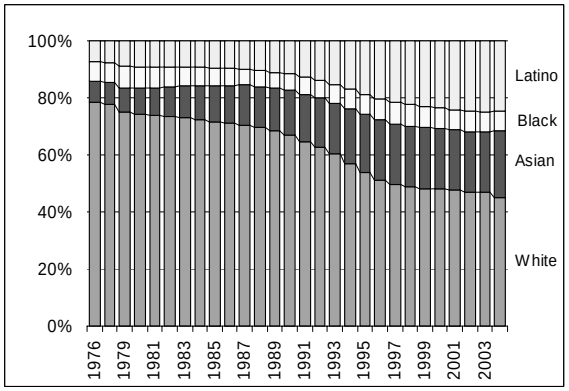
All of the systems have experienced substantial growth in the enrollment of Asians and Latinos in the last 30 years, but the rate of growth differs between systems. UC has seen large growth in Asian enrollments, but relatively moderate increases of Latino students, while CCCs have experienced much larger rates of growth for Latinos and moderate increases for Asians. The CSU's have tracked intermediate and similar levels of growth among both Asians and Latinos. These differences by ethnicity in educational pathways are persistent, and they have implications for the differential impacts of demographic change on higher education in California. The nature of those implications is best elaborated by looking at trends and ethnic differences in the educational pipeline in both the secondary and postsecondary systems.

Figure 4.3 Trends in Ethnic Composition of Enrollees, 1976-2003

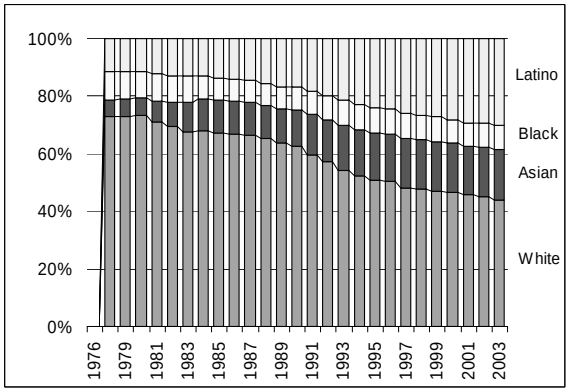
A. In UC System




B. In CSU System




C. In CCC System



**The Educational Pipeline: Progress in Public High Schools**

The substantial gains in post-secondary enrollments have relied upon equally substantial gains in K-12 education. In 1970, only 63% of the population age 25 and older had a high school diploma. By 2004, 81% of Californians held that credential. Those gains have been achieved despite considerable barriers raised by declining levels of funding (which on a per pupil basis fell from about $400 above the national average in 1970 to $600 below the national average in 2000), and a considerably more diverse and challenging student population (due to language deficiencies and low socio-economic status among other factors.)

Despite these gains, California has steadily lost ground relative to others states. In 1970, the 63% of the population 25 and older with a high school degree placed California well above the 55% national average . By 1990, the national average matched that of California, and by 2004 the 85% national average exceeded the 81% rate in California[61]. (In terms of rank, California fell from 23rd in 1989 to 45th in 2004 in the proportion of the population 25 and older with a high school degree.)

Given these mixed results, we have to question: At what rate can California's public high schools produce well-educated graduates? How do graduation rates differ by ethnicity? What does this imply for future production of high school graduates? Despite the state interest and federal requirements in tracking K-12 educational advancement, the answers to these questions are not easily answered.

Officially, California reports a graduation rate of 86.9% for its public high schools. Unfortunately, that relatively high rate reflects a methodology which underestimates the number of dropouts, inflating the apparent level of success[62]. Much recent attention has been focused on the extent to which "official" graduation rates systematically overstate success, and alternative methodologies suggested for measuring academic progression. One, the Cumulative Promotion Index (CPI), has the particular advantage that it can be calculated for relatively small areas, uses administrative data which is already collected and disseminated and can be estimated using a shorter time frame (two years) than students actually take to complete high school, but it too has weaknesses. Most notably, it is biased by changes in net migration and retention in grade.[63] A third alternative is to use data from the decennial census, limiting the sample to adults who were and are present in California as 14, 15 or 16 year olds, and to determine the proportion who identify themselves as having entered high school without

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[61] In terms of levels of higher education among adults 25-64, California shows the same pattern of substantial absolute gains

[62] Johanna Wald and Dan Losen, 2005. "Confronting the Graduation Rate Crisis in California." Civil Rights Project Research Report, Harvard University.

[63] The CPI is based on a synthetic cohort created from grade-specific enrollment rates in adjacent years x and x+1. It is defined as:

$$CPI(years(x,x+1)) = \left[\frac{E(10,x+1}{E(9,x)}\right] * \left[\frac{E(11,x+1}{E(10,x)}\right] * \left[\frac{E(12,x+1}{E(11,x)}\right] * \left[\frac{Grad(x)}{E(12,x)}\right]$$

completing it as of five years later. Those young adults were presumably present in California as high school students, and have had the opportunity to graduate by their current age as 19, 20 and 21 year-olds. (A similar approach could use data from the annual Current Population Surveys, although they use a five year migration window only twice per decade, and have much smaller sample sizes.)

**Table 4.1 Secondary Educational Progression, 2000-2002**

| | | Proportion Advancing | | | | |
|---|---|---|---|---|---|---|
| | | to 10th | to 11th | to 12th | Graduate | Completion Rate |
| **CDE** | **NH White** | .99 | .99 | .98 | .97 | .93 |
| | **NH Black** | .95 | .95 | .95 | .94 | .81 |
| | **NH API** | .99 | .99 | .99 | .98 | .94 |
| | **Hispanic** | .97 | .97 | .96 | .95 | .86 |
| | ***Total*** | *.98* | *.98* | *.97* | *.96* | *.89* |
| **CPI**[64] | **NH White** | .97 | .95 | .93 | .91 | .79 |
| | **NH Black** | .91 | .90 | .90 | .83 | .60 |
| | **NH API** | 1.00 | .99 | .96 | .93 | .88 |
| | **Hispanic** | .91 | .89 | .87 | .86 | .60 |
| | ***Total*** | *.94* | *.93* | *.91* | *.89* | *.71* |
| **Census** | **NH White** | .99 | .98 | .95 | .95 | .88 |
| | **NH Black** | .99 | .97 | .90 | .89 | .75 |
| | **NH API** | .99 | .99 | .98 | .96 | .91 |
| | **Hispanic** | .96 | .94 | .90 | .88 | .65 |
| | ***Total*** | *.98* | *.96* | *.92* | *.92* | *.79* |

The California Department of Education (CDE) rates reflect non-dropouts in each grade and the four-year derived rate based on the pre-NCES formula. CPI rates based on authors' calculations from statewide enrollments and graduations from the California Basic Educational Data System (CBEDS). Census rates are calculated as described in text.

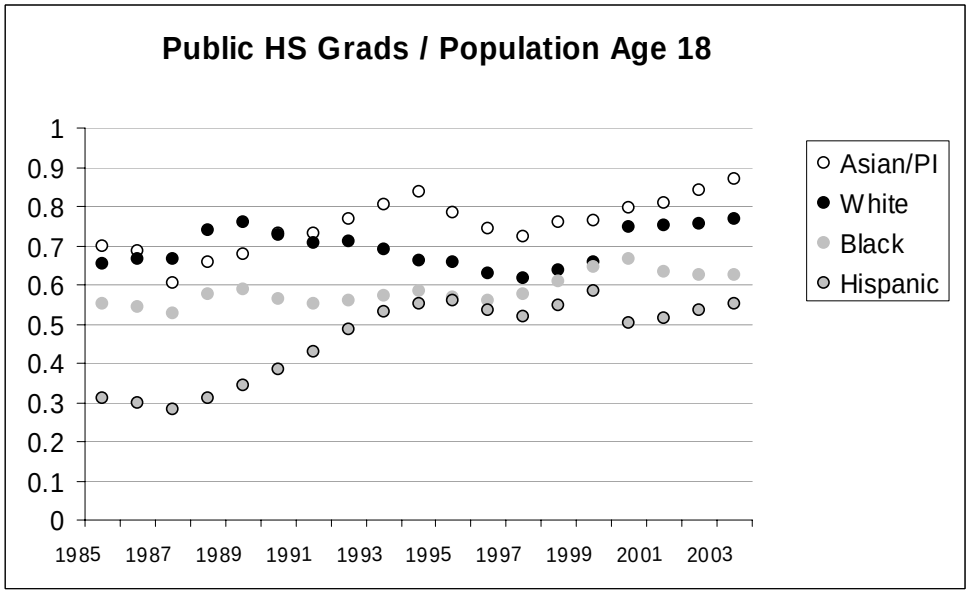
Table 4.1 contrasts the graduation rates by ethnicity and in total using the three methods described in the previous paragraph. Several facts clearly emerge from these calculations. First, rates of on-time graduation in California are much lower than official reports would suggest, and hover around levels that raise serious concerns about our abilities to produce an educated workforce. Second, these concerns are particularly intense with respect to Hispanics and Blacks, while graduation rates among Asians are

[64] Counts by grade-specific enrollments by ethnicity were determined from school level figures from Section B of the School Information Form (SIF) available from California's Basic Educational Data System (CBEDS), and aggregated to the state level. Recently, the Harvard Civil Rights Project (HCRP) used this approach to estimate ethnicity-specific graduation rates in California. Although our total estimates are identical, their ethnicity-specific estimates differ slightly from our own. These differences arise because the HCRP builds statewide rates from the district-level up, top-codes individual grade promotion rates at the district level, and limits their universe to large stable districts. We topcode only at the state level and make no restriction on our enrollment universe.

fairly high. All three methods suggest increases in graduation rates during the prior decade, with the CPI and the official graduation rate suggesting large gains, particularly among Hispanics, while the census based methods shows more moderate increases with no improvement for Hispanics.

Evaluating trends over a longer period requires a shift to a mix of population estimates (for the denominator), and the number of diplomas awarded to public high school graduates (for numerators). Figure 4.4 show trends in the ratio of diplomas to 18 year-olds by ethnicity since 1985. These figures show similar positive trends in Californian's graduation rates, with particularly strong growth since the late 1980's. Overall, the ratio of public high school graduates to 18 year-olds has climbed from 52% in 1985 to 65% in 2003[65]. These longer trends underscore the points we extracted from the CPI-based calculations: worrisome rates of graduation, large ethnic variation in success, and a marked upward trend in rates over time. Overall, these ratios point to the substantial growth in college readiness in the last two decades, with particularly dramatic increases for Hispanics. (Ratios have increased about 15-20% for most groups, but 80% for Hispanics).

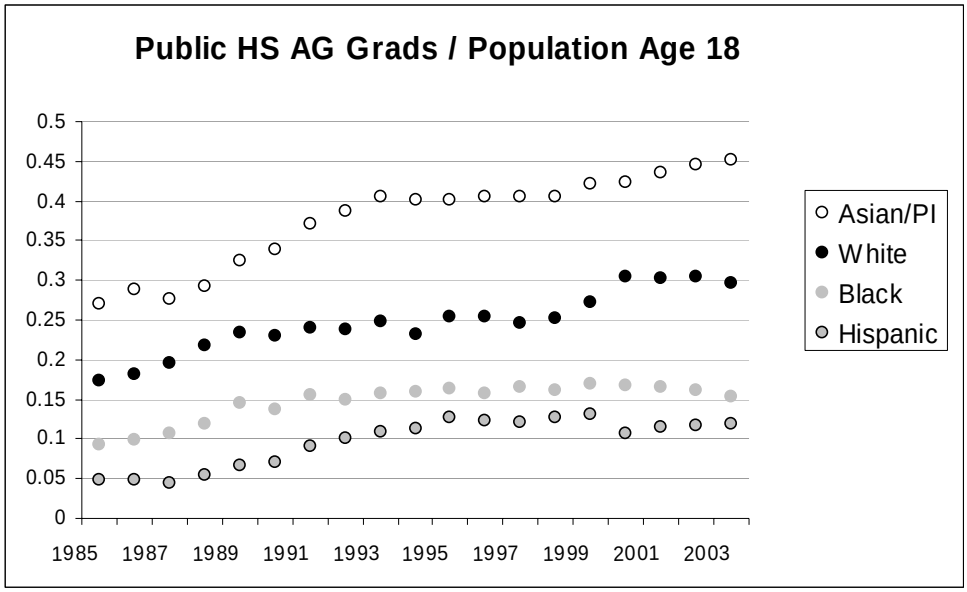
Figure 4.4 Public High School Graduates per 18 year-old California resident, by ethnicity, 1985-2004




[65] Figures based on California Department of Finance detailed population estimates and counts of public high school graduates from the California Basic Educational Data System (CBEDS). The numerator for this statistic exclude graduations from private schools (which comprise about 10% of graduations in California) and includes all 18-year-olds in the denominator (and thus include many young adults who never entered high school in California, particularly among groups with high rates of immigration). Finally, the population estimates we use (provided by the Department of Finance), like all survey based-estimates, can be subject to mis-estimation. There appears to be some seaming evident in the DOF figures at the juncture of 1999 and 2000, when there is a sharp single-year increase in the estimates of Hispanics and declines in the estimates of non-Hispanic Whites.

In recent years, however, much attention has focused on the extent to which graduating students find themselves academically unprepared for college[66]. While not a perfect representation of college preparedness, the ratio of public high school students who graduated having completed the set of coursework required for admission to UCs and CSUs (the A-G requirements) to the 18 year-old population shows the same patterns of wide ethnic differentiation and strong growth in the levels of college preparedness among the population of college age.

Figure 4.5 Public High School A-G Graduates per 18 year-old California resident, by ethnicity, 1985-2004




The extent to which students can reasonably expect to enter college, pursue their education and reap the rewards that additional credentials bring is dependent on their adequate basic preparation. We began our investigation of California public high schools by questioning how well and for whom California succeeds at this task. Data from the last twenty years provides a mixed answer. Overall, California clearly faces strong obstacles to providing a successful high school education to its students, and it is less successful in providing that education to Blacks and Hispanics. These difficulties are apparent in simply generating high school graduates, and are exacerbated with respect to preparing students who are ready to enter a four year college (i.e. those who have completed the "A-G" subject requirements). At the same time, large gains have been made in preparing students since the mid-1980's, and those gains have been particularly notable for the Hispanic students who are comprising a steadily larger fraction of our population. We turn now to the post-secondary level, and repeat the same questions for our system of higher education.

[66] See, for example, the LAO brief of April 20, 2005 on "Are Entering Freshmen Prepared For College-Level Work?".

## The Educational Pipeline: Progress in Public Postsecondary Schools

The Master Plan for higher education in California created a tiered post-secondary system. The following chart provides an overview of flows through that system, based on data published by the California Postsecondary Education Commission (CPEC), the University of California Office of the President (UCOP) and reports on data from California State University (CSU) and the California Community College Chancellor's Office (CCCCO). The data from these sources are complex, differ in focus and coverage from one another, and are sometimes simply inconsistent. Within the limits of the available data, the following discussions are intended to provide the most complete picture we can of the flows into and through the three systems, and their success in moving students through to a successful completion of their education.

To speak of educational success implies a goal. For the UC and CSU system, that goal is fairly simple to define: the system is successful to the extent that it is able to enroll students, either directly as freshmen or indirectly via transfer from the community colleges, and can enable them to earn a baccalaureate degree. We do not attempt to model or estimate transitions into professional or graduate schools.[67] For the CCCs, we focus on their role in preparing students to enter a four year institution and eventually earn a baccalaureate. *This is only a small fraction of the mission of the CCC system, which provides remedial education, ESL instruction, vocational training, academic Associate's degrees, and a broad gamut of coursework which directly improves its' student's skills and lives, even if it does not result in a credential.* This choice of goals is the result of our intent to link the benefits of education, which we can measure in our data only in term of credentials, with the success rates we calculate below. It is not intended to suggest that these additional roles the CCCs fill do not play an important part in the state's system of higher education. We provide a fairly abbreviated description of success rates for the CCCs in this chapter, but address the complex data available and the rates of the success in other work.

The population we start with - public high school graduates - is approximately 15% non-Hispanic Asians, 7% non-Hispanic Blacks, 33% Hispanics, 1% Native Americans and 44% non-Hispanic whites. (Figures for American Indians omitted for readability). All the remaining percentages in the chart are calculated with reference to the number of public high school graduates of that ethnicity. Although it is tempting to interpret the remaining rates as the overall progression of California high school graduates, it is important to recognize that California has a robust system of private education in addition to its public education system and that students pass between the public and private systems. Nonetheless, 90% of high school graduates do emerge from the public school system, and over 90% of college-going students from California attend college in-state[68]. Similarly large fractions of post-secondary enrollments (85%) are in

[67] Data on movement into graduate school is simply not available in any systematic and representative form.

[68] Figure from the National Center for Education Statistics, Digest of Education Statistics (2003), table 207. In Fall 2000, out of 161,235 Californians who graduated from high school in the previous year and enrolled in degree-granting institutions, 91% (146,279) pursued their higher education in-state. Only 9% (14,956) of

public institutions[69]. As a result, despite some caveats, these rates of entry, progression, and graduation provide a strong sense of the extent to which public education successfully prepares the youth of California for the workplace and their future.

For our purposes, we are interested in identifying the effects of a changing age and ethnic composition on eventual educational distributions, and subsequently on statewide outcomes such as income, poverty, employment, taxes, and political participation. This requires that we be able to express these rates relative to some population we identify in population projections. Tables 4.2 and 4.3 express the expected distribution relative to the 18 year old population. Based on preceding analyses, we expect public high school graduates to average about two-thirds that of the 18 year-old population, and expect about slightly less than half of eighteen year-olds to go to college in the next year[70]. The bulk of those college-goers (about a third of 18 year-olds) will attend a CCC and 13% will enter a UC or CSU. Although data to appropriately estimate transfer rates are scarce, we anticipate that about 14% of eighteen year-olds will eventually transfer to a UC or CSU after initially entering a CCC[71]. Finally, we expect that slightly more than one in five eighteen year-old Californians will eventually earn a baccalaureate degree at a CSU or UC.[72]

Given the large discrepancies in ethnic progression rates we identified in public high schools, it should come as little surprise that similar ethnic-specific barriers manifest themselves in college. We expect nearly 80% of Asians to go to college, more than a

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high school graduates enrolled out-of-state. California received about 13,000 students from other states. Among the fifteen most populated states in the country, California and North Carolina tied for first (91%) in terms of college attendees pursuing their education in their home state.

[69] The bulk of these enrollments are in the CCC system. If we consider only four-year institutions, about 70% of college enrollments are in public institutions.

[70] To estimate college going rates, we divided the counts of Fall semester first-time freshmen age 19 and younger at UC and CSU, and divide them by the 18 year-old population. For the CCCs, we estimate the same rate, but adjust it to include first-time enrollments in the following Spring semester, as well. The rate of adjustment is based on the ratio of first-time students age 19 and younger in the Spring semester to the same counts in the Fall. That ratio draws on CCC datamart counts, and is averaged over a 3 year period. For our calculations, we estimate rates for the last 3 years, and average the resulting rates.

[71] This transfer includes both entrants who enter with the intent to transfer and those who do not. Per Patrick Perry, "transfer rates for students who show transfer intent is around 40% statewide". For the purposes of tracing transitions into the CCC and through the CCC into the four years systems, the 14% figure is the figure consistent with our inflow estimates.

Fall term transfer counts considerably underreport the number of transfers annually between the Community College system and the four-year institutions. The full year transfer counts we use are only available for the last two years. Unlike the direct enrollment rates, we divide the full years transfers by the number of eighteen-year olds from 3 years prior. More problematic is that, while we can largely regard direct enrollments in the UCs and CSUs as drawn from recent high school graduates, the CCCs draw on a much broader age spectrum for their student body. Nonetheless, age distribution of the transfer ready are quite skewed toward the younger ages, and we don't believe that transfer rates are biased greatly by defining them relative to the lagged eighteen year-old population. (Other analyses have suggested that slightly over half of transfers are to students age 21 and younger, and about 80% are of students aged 24 and younger.)

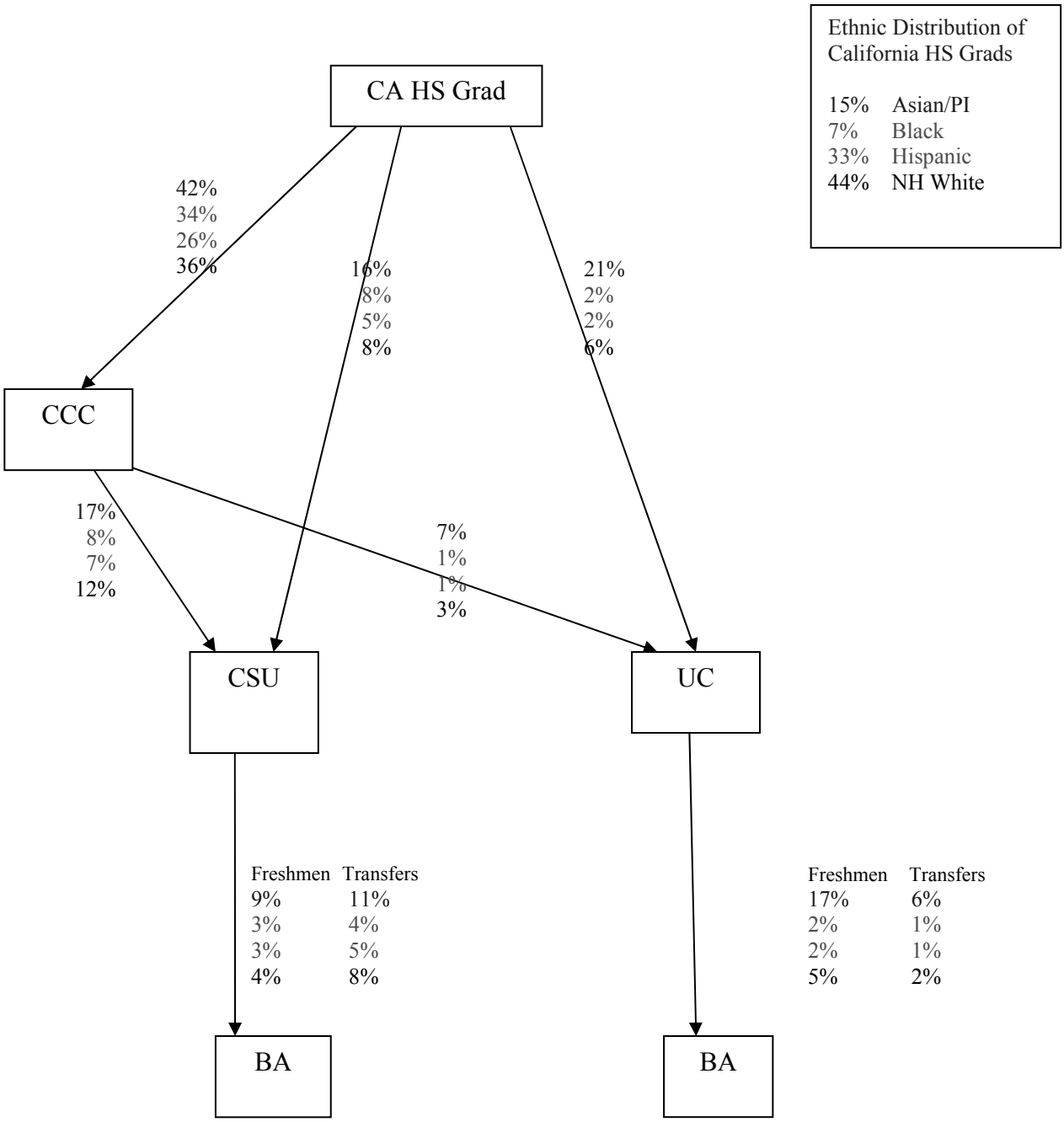
[72] Cohort-based graduation rates and retention rates are provided for a period of six years after entry for CSU. At that point, nearly 1 in 10 (and 1 in 7 for Hispanics) have neither earned a BA or dropped out. We assume that 75% of continuing students at that point will continue on to earn a BA.

quarter directly to UCs, and anticipate that 43% of Asians will eventually earn a BA at a public state university. In contrast, our estimates indicate that fewer than one third of Hispanic eighteen year-olds will go on to college (most of whom will enter a CCC), only 15% will eventually reach a public four-year institution, and less than one in ten will earn a BA there. Black eighteen year-olds do much better at entering college, nearly equaling the average rate, but suffer from low transfer rates from the CCCs and high attrition rates if they do eventually enter a UC or CSU. As a result, the likelihood that they will eventually earn a BA is virtually identical to that of Hispanics. Rates for non-Hispanic whites parallel the overall rates remarkably closely, falling between the extraordinary accomplishments of Asians and the less successful records for Blacks and Hispanics.

**The Educational Pipeline: Conclusions**

This section has attempted to describe trends in educational advancement and the challenges we collectively face in extending access to those rewards to more of our population. These issues are particularly pertinent to California at this point, as it simultaneously faces a spike in the 18-24 year old population and a shift toward ethnicities which have traditionally experienced less educational success. The ways it confronts these issues will determine whether it continues its educational decline relative to other states, or can build on its diverse population to create a skilled and well remunerated workforce.

Confronting our educational needs requires investment, and in the next section we turn to describing the costs the state incurs in providing a public education to its residents. We then place these costs into the context of the benefits we derive from education and calculate the returns earned through the provision of educational infrastructure. Those estimates, presented in term of four scenarios, draw upon the projections of the last chapter, the synthetic returns to education by ethnicity, and the educational cost estimates to identify some of the choices we can make and the consequences those choices may bring.




*This chart represents a stylized progression of a cohort of potential students by ethnicity through the public system of higher education in California. The percenatges represent the fraction of eighteen-year-olds who enter one of the three systems, who transfer to a UC or CSU if they do not enter directly, and who earn a baccalaureate degree.*

*For example, we expect 42% of Asians to enter a CCC, 16% to enter a CSU, and 21% to enter a UC. After entering a CCC, 7% (or about one in six) will transfer to a UC and 17% (about two-in-five) will tanfer to a CSU. The final set of figure shows the percentage of all eighteen year old Asians who will enter a CSU as a freshman and earn a BA (9%), transfer to a CSU and earn a BA (11%), enter a UC as a freshman and earn a BA (17%), or transfer in and earn a BA (6%).*

## Table 4.2 Progression through the Public Educational Pipeline by Ethnicity

| Educational Progression relative to 18 year population | Asian/PI | Black | Hispanic | NH White | Total |
|---|---|---|---|---|---|
| PHS Graduates | 87.00% | 63.50% | 55.30% | 77.50% | 65.60% |
| Go to College (CCC, CSU or UC) | **78.65%** | **44.51%** | **33.07%** | **49.14%** | **45.26%** |
| To CCC | 42.1% | 34.4% | 25.7% | 35.5% | 32.1% |
| Go directly to a CSU or UC | **36.54%** | **10.16%** | **7.41%** | **13.64%** | **13.19%** |
| To UC | 20.88% | 2.48% | 2.27% | 5.81% | 5.64% |
| To CSU | 15.66% | 7.68% | 5.14% | 7.83% | 7.54% |
| Go to CCC then transfer to a CSU or UC | **24.36%** | **8.64%** | **7.91%** | **14.57%** | **14.17%** |
| To UC | 7.40% | 1.02% | 1.16% | 3.10% | 2.76% |
| To CSU | 16.97% | 7.62% | 6.75% | 11.47% | 11.41% |
| Eventually go onto a CSU or UC | **60.90%** | **18.80%** | **15.32%** | **28.21%** | **27.36%** |
| To UC | 28.28% | 3.49% | 3.43% | 8.91% | 8.40% |
| To CSU | 32.63% | 15.30% | 11.89% | 19.30% | 18.96% |
| Graduate with a BA | **42.53%** | **9.34%** | **9.58%** | **19.61%** | **20.45%** |
| From UC | 22.55% | 2.23% | 2.46% | 6.85% | 6.61% |
| *Directly* | *16.70%* | *1.56%* | *1.59%* | *4.65%* | 4.46% |
| *As Transfer* | *5.84%* | *0.67%* | *0.87%* | *2.20%* | *2.15%* |
| From CSU | 19.98% | 7.11% | 7.12% | 12.76% | 13.84% |
| *Directly* | *8.61%* | *2.69%* | *2.47%* | *4.38%* | *3.92%* |
| *As Transfer* | *11.37%* | *4.42%* | *4.66%* | *8.37%* | *9.92%* |

## Table 4.3 Conditional Progression through the Public Educational Pipeline

| Transitions Rates Through Educational Pipeline | Asian/PI | Black | Hispanic | NH White | Total |
|---|---|---|---|---|---|
| Transfer to a CSU or UC **if initially entered CCC** | **57.85%** | **25.14%** | **30.82%** | **41.05%** | **44.17%** |
| To UC | 17.6% | 3.0% | 4.5% | 8.7% | 8.6% |
| To CSU | 40.3% | 22.2% | 26.3% | 32.3% | 35.6% |
| Graduate with a BA **if entered a UC/CSU** | **69.8%** | **49.7%** | **62.6%** | **67.7%** | **67.7%** |
| From UC | 79.7% | 63.9% | 71.7% | 71.3% | 78.7% |
| *Directly* | *80.0%* | *63.0%* | *70.0%* | *80.0%* | *79.0%* |
| *As Transfer* | *79.0%* | *66.0%* | *75.0%* | *55.0%* | *78.0%* |
| From CSU | 61.2% | 46.5% | 59.9% | 66.1% | 62.8% |
| *Directly* | *55.0%* | *35.0%* | *48.0%* | *56.0%* | *52.0%* |
| *As Transfer* | *67.0%* | *58.0%* | *69.0%* | *73.0%* | *70.0%* |

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## Estimation of State Costs and Benefits in California

Increasing education offers obvious advantages in terms of employment, earnings, poverty, quality of life, civic participation and equality. Balanced against these advantages are costs as well. The direct costs of education are borne principally by students and their families, who pay fees, foot the expenses necessary to live and attend school, and face opportunity costs in the form of foregone earnings and lost time while attending college. Costs are also borne by the universities themselves through endowments and fundraising to support these educational programs. We make no attempt to estimate these costs, although they are real constraints on the decisions made by individuals to enroll and by universities to support those decisions. More centrally to our analyses, costs are also borne by the state to provide necessary infrastructure.

In this chapter, we start by creating estimates of how much it costs the state in order to provide post-secondary education to students. We create this estimate by applying a *cost per enrollment year* to a projection of the *years per enrollment* to establish a *cumulative cost per entrant*. In the second section of the chapter, we place these costs per enrollment in context with the synthetic outcomes estimated in the last chapter. Because both costs and benefits are calculated on an ethnicity-specific basis, we can apply these estimates to existing and projected populations of young adults, and see how both costs and benefits would vary under different assumptions about educational progression. We select four stylized educational regimes -- one with fixed capacity, a second with fixed educational progression rates, a third with moderate increases in college-going, and a final one using increased college-going rates in conjunction with declining attrition -- in order to contrast the effects of choices made in educational investments[73].

## Estimation of Costs

In order to calculate the state's burden in educating future generations, we estimate future costs by applying system-specific costs per enrollment to predicted levels of enrollment in each system. There are a number of choices in estimating costs. In budgeting for enrollment growth, the state currently allocates expenditures for increases using marginal cost estimates. Marginal costs are immediately lower than average costs because they exclude or discount items which are not sensitive to the size of the student population (such as existing common facilities or infrastructure). In contrast, average costs apportion the entirety of state funds equally among students. Marginal cost estimates may be more appropriate when growth in enrollments is relatively low or when the expected cost structure of educating new students is similar to that of existing students, but may not provide a better estimate of true long-run costs of increased

[73] We describe these scenarios more fully, and the assumptions they reflect, in a later section. In other work, we match the projections we generate in Chapter 2 by age, ethnicity, nativity, and period of entry to the outcomes of Chapter 3 to model the effects of educational changes on a year-by-year basis. That approach allows additional flexibility, and permits the incorporation of some elements that are not amenable to synthetic cohort approaches. That work is ongoing and is not a part of this current report.

enrollments. When the educational demands of new students differ from those of existing students, in the presence of changes of technology, when new enrollments cannot fully share existing discounted resources, or when growth is large enough that discounted items in marginal cost estimates must be expanded, average costs may be more appropriate[74].

We calculate the costs we use for subsequent modeling based on historic average costs per student in dollars from state General Funds, and do not include student fees, state contributions for financial aid, or funds for capital construction. Thoughtful alternate estimates of costs have been calculated and employed by other analysts. To place our own estimates in context, we provide limited comparisons of those alternate estimates to our own. However, we believe the historic variation in costs is such that a more simply defined and calculated measure appropriately captures system differences in costs without implying a precision we cannot claim.

**Estimation of Cost per year of Enrollment**

Average costs are initially calculated in terms of dollars from State General Funds per full-time equivalent student (FTE) in each of the three systems.[75] Figure 4.1 shows the historic state funds (adjusted to 2004 dollars) per FTE in each of the three systems.[76] Figure 4.2 identifies the same expenditures per FTE, but divided by the median expenditure per FTE in each system during the period to highlight the common temporal patterns in expenditures. In each system, the variability in expenditures per FTE appears to be largely driven by changes in the state budget, rather than by changes in FTEs. In financially constrained times, funding per equivalent student is low, while in flush periods the per-FTE funding climbs. Figure 4.2 also shows how the precipitous fall in funding since the advent of the state's most recent budget crisis has pushed UC's funding to historic lows.

[74] If new enrollments are consistently funded at marginal rates, and the average cost structure for existing enrollments remains fixed, use of a marginal cost approach to project expenditures will result in a steady decline in average costs as enrollments increase. If this is the best way to "cost out" long term enrollment growth, historic average costs should drop significantly over time. As we show later, despite substantial growth in each of the state's higher education systems over the last three decades, little or no secular trend is apparent.

[75] An undergraduate FTE is 15 semester or quarter units or, on an annual basis, 30 semester or 45 quarter units. A graduate FTE in the semester system is student enrollment in 24 semester units or 36 graduate credit units per academic year. (from: http://www.cpec.ca.gov/completereports/2003reports/03-08/appendixb.pdf)

[76] State funds for the last three years are from the LAO budget databank (http://www.lao.ca.gov/sections/econ_fiscal/Historical_Expenditures_Pivot.xls); FTE's from LAO publications. Earlier years are drawn from CPEC.

Figure 4.7 State General Funds per Full-time Enrollment by System

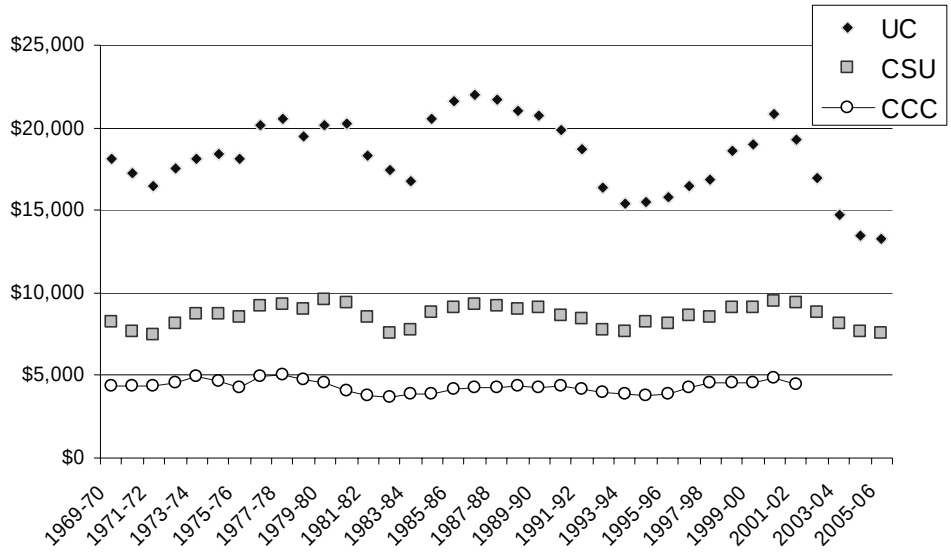
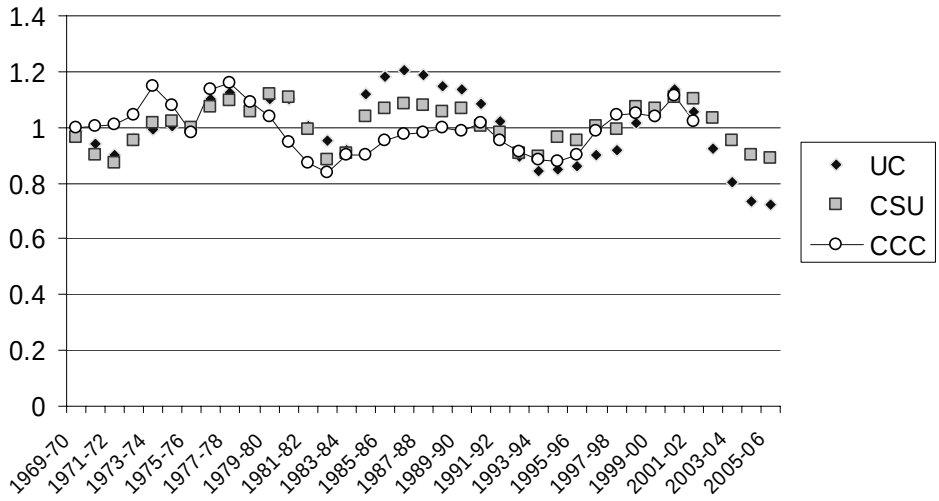



Figure 4.8 State Funds/FTE relative to System Median




The substantial temporal variability and absence of a time trend evidenced by these series suggests the use of a central value -- either a mean or median -- over the entire period to represent the cost. The median cost per FTE (in 2004 dollars) since 1970 is $4,340 in the CCCs, $8,585 in the CSUs and $18,350 in the UCs. During this period, costs per FTE climbed more than 10% above the median 23% of the time in the UCs, 8% of the time in CSUs, and 12% of the time in CCCs. It fell below 90% of that median in 18% of years in the UC, 8% of years in CSUs, and 18% of year in CCCs. The mean

values over the period are $4,321 at CCCs, $8,559 at CSUs, and $18,545 at UCs, quite close to the medians.

How much do these *average* funds per FTE differ from *marginal* costs? For FY 2005-06, the Governor's budget suggested $7,528 as the marginal cost per FTE at UCs $6,270 per FTE at CSUs, and $4,150 per FTE at CCCs. The California Legislative Analyst's Office (LAO) recommended slightly lower marginal costs of $7,180 for additional UC students and $5,999 for additional CSU students. Average costs for that year stood at $13,300 for UC and $7,800 for CSU. These were about 75% higher than the Governor's figure for UC and 25% higher for CSU. Although we lack estimates of FTEs at the CCCs for this period, the governor's recommended cost per FTE at the CCCs was only marginally lower than the average historic figure we previously calculated.[77]

We can assess some of the implications of using marginal costs rather than average costs to estimate the impact of changing enrollments by applying those marginal costs to historic growth. We pick the 30 year period between 1970-71 and 2002-03 as a period which falls into the middle of the cyclic variation in average costs to avoid skewing the impact in a particular direction. During that period, FTE enrollments grew by 94% in the UCs, 57% in the CSUs, and 80% in the CCCs. If that additional growth had been funded at the Governor's recommended marginal costs, the average funding for a UC FTE in 2002-03 would have been more than a quarter lower than its actual level ($12,365 vs. $16,922) and only two-thirds of the median level of funding at UC. At CSU, the funding would have been 17% lower ($7,350 vs. $8,847) than actual levels. It is unlikely that institutional quality or access could have been maintained with these levels of state support. We believe it unwise to budget for enrollment growth for traditionally disadvantaged students while assuming a lower cost structure[78].

Although these costs are expressed relative to FTE students, enrollment data we use to estimate college going rates, attrition, and completion of baccalaureate degrees are defined in terms of head counts and years of enrollment. We adjust the costs to a per-year-of-enrollment basis using the median headcount to FTE-ratio since 1975-76, the first year for which we can calculate this ratio. The UC ratio of .93 results in an adjusted average cost of $17,000; the .76 ratio for CSUs results in an adjusted average cost of $6,500, and the .65 ratio for the CCCs results in an adjusted average cost of $2,800.

[77] Shulock, Moore and Gill (2005) also provide carefully thought-out estimates for the instructional costs of undergraduate education per FTE in the three systems. In their computations, they adjust for the mix of graduates and undergraduates, differing costs for these two components, consideration of student fees, and inclusion of health science costs which are typically excluded, based on figures for the 2004-05 fiscal year. Their estimates of costs/FTE are $15,987 for UC, $10,874 at CSUs and $4,695 at CCCs. Shulock includes fees in her costs per FTE, which results in higher estimates at the CSUs and CCCs, but also adjusts costs upward for graduate instruction relative to undergraduates, which acts to deflate average costs relative to our estimates.

[78] The use of higher values for educational costs will inflate costs relative to benefits.

**Estimation of Enrollment Years**

Costs per year of enrollment are only half the story: to estimate the state investments in producing individuals who reach different stages in their educational career, we need to identify how long individuals are in school, where they attend, and how successful they are. Both UC and CSU provide summary figures tracking cohorts of entering freshmen and transfer students, identifying the fraction in each subsequent year who earn a BA or who remain enrolled without graduating. We use those figures to identify, by ethnicity and success in earning a degree, the number of years they are enrolled before leaving the system[79].

Table 4.4 provides estimates of the number of years that entrants to a UC or CSU will spend there before they leave, either by graduating or dropping out. Based on the years enrolled, the tables also show the average costs to the state of those who earn degrees and those who drop out, as well as a summary of the costs per BA granted[80]. These costs reflect *only* costs at UCs and CSUs, and exclude state expenditures supporting transfer students while they are preparing at CCCs. (The very different structure of enrollments and educational goals at community colleges makes the entry-attrition-completion model we use less applicable without some strong assumptions. We also look at CCC costs, but do so in a separate step.)

Beginning with those students who enter a four year college as first-time freshmen, successful graduates accumulate 4.6 years of attendance by their graduation date. Enrollment years differ by system, with CSU students averaging an additional .3 years of attendance. Cumulative years also differ by ethnicity, with Blacks and Hispanics enrolled about two-tenths of a year on average longer than non-Hispanic Whites and Asians, before graduating. Unsuccessful entrants, who leave without graduating, average about 1.6 years in college before leaving, with minor differences in length of enrollment before leaving by ethnicity. More importantly, the very different rates of successful completion between ethnicities and educational systems lead to substantial gaps in the number of years attended per BA granted. For each BA granted, CSU entrants accumulate 6.2 years of attendance, versus only 4.8 in the UC system. Overall, non-Hispanic Whites accumulate 5.3 years of attendance, about .3 years less than the average across ethnicities, while Hispanics average .6 years longer than average, and Blacks average 1.7 years beyond the average.

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[79] UC and CSU tracks entering cohorts of first-time full-time freshmen and full-and-part-time transfer students entering as sophomores or above (upper division in UC). Data concerning persistence and graduation at selected intervals are published in the UC Information Digest and at the Consortium for Student Retention Data Exchange (CSRDE ) web site. The published data do not fully describe year-to-year rates. We make the assumption that, in the CSU system, 75% of students still enrolled at 6 years will graduate with a mean number of years til graduation of 6.5. For UC, we assume that the fraction of students discontinuing after their second year can be represented as the fraction of students still enrolled after 2 years who have not graduated by the end of their sixth year (or for transfer students, the end of their fourth year). Standard life table methods are applied to calculate years in each system for entrants.

[80] We estimate years enrolled and persistence to degree by ethnicity and mode of entry (direct enrollment as Freshman vs. Transfer) for each system. Table 4.1 provides a summary by system and mode of entry for the entering student population with the same ethnic distribution as entering in 2001-2003.

Considering students who enter UC or CSU via transfer, similar patterns emerge. Successful students average 2.9 year of attendance before graduating, with entrants at the CSUs accumulating an additional .5 years before graduation relative to UC entrants. Black and Hispanic entrants take slightly longer than average to complete their degrees, and non-Hispanic Whites take slightly less time than average. These patterns also hold for transfer students who do not successfully complete their degree. In combination with the higher success rates for transfer students at UCs, transfers to the CSUs are enrolled for .7 more years per BA granted than are transfers to the UCs. The comparative disadvantage in earning a BA encountered by Blacks and, to a lesser degree by Hispanics, yields nearly 4 years of attendance after transferring per BA granted to Blacks, versus 3.5 years among Hispanics and Asians, and 3.2 years among non-Hispanics whites.

Because of large ethnic differences in enrollments in the UCs and CSUs, and the very different cost structures of the two university systems, the difference in length of attendance and relative success do not necessarily equate to higher levels of state support. How much support the state provides to entrants can be summarized in different ways. One way is relative to each entrant. On average, for each first-time freshman entrant, the state will provide $37,677 in general funds support. Transfer students, who have already completed some of the educational requirements, average only $20,119 in general funds support.

Costs per entrants are helpful in anticipating loads that the state could expect based on the mix of entering students. An alternative measure provides a sense of costs per success, by identifying state funds expended relative to entrants who achieve their educational goal. These costs include expenditures on both successful and unsuccessful entrants, but divide these costs only among the successful entrants. When measured relative to BA granted, rather than per entrant, costs are higher but less differentiated by ethnicity. Combining both students who enter directly as freshmen and those who enter via transfer, we can anticipate average costs per entrant of $29,618, and costs per BA granted of $43,528.

These costs do not include costs for transfer students at CCCs. Because CCC entrants have more diffused sets of goals, more intermittent attendance and a much broader age spread at entry, the techniques we use for estimating costs per enrollment are less applicable. Instead, we utilize synthetic cohort techniques and assume that existing age and ethnicity specific enrollment rates will remain fixed (or vary uniformly upward or downward in keeping with the assumptions of our scenarios). The age-specific participation rates we use include *only* post-high school pre-baccalaureate enrollments, and are identified in Table 4.5. However, we can use the differences in costs after enrollment to set some bounds on years of attendance before entry via transfer, or directly as freshmen, is cost-neutral. We have estimated that for every transfer student that gets a BA, the state expends $28,000, less than half the amount it spends for each BA granted to a directly entering student. This equates to over 10 years of support for a CCC enrollee (or more than 7 FTE years at a CCC).

Table 4.4 Summary of Success Rates, Years of Enrollment, and Costs in the four year Public Postsecondary System.

| | Summary of Years of University Attended by Degree Granted | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **First-Time Freshmen** | | **% No BA** | **Years** | **% BA** | **Years** | **Average Years/ Entrant** | **Total Years / BA granted** | **General Funds: non-Graduate** | **General Funds: Graduates** | **General Funds per Entrant** | **General Funds per BA Granted** |
| **Freshman Entrants** | | | | | | | | | | | |
| **CSU** | | 0.48 | 1.6 | 0.52 | 4.7 | 3.2 | 6.2 | $10,595 | $30,420 | $20,904 | $40,200 |
| **UC** | | 0.21 | 1.5 | 0.79 | 4.4 | 3.8 | 4.8 | $25,500 | $74,800 | $64,447 | $81,578 |
| **Combined** | | 0.36 | 1.57 | 0.64 | 4.56 | 3.5 | 5.59 | $17,004 | $49,503 | $37,677 | $57,993 |
| **Transfers into:** | | | | | | | | | | | |
| **CSU** | | 0.3 | 1.2 | 0.7 | 3.0 | 2.5 | 3.5 | $7,800 | $19,500 | $15,990 | $22,843 |
| **UC** | | 0.22 | 1.1 | 0.78 | 2.5 | 2.2 | 2.8 | $19,210 | $42,500 | $37,376 | $47,918 |
| **All** | | 0.28 | 1.19 | 0.72 | 2.90 | 2.4 | 3.4 | $10,082 | $24,100 | $20,119 | $27,858 |
| | | | | | | | | | | | |
| **All Entrants** | | 0.33 | 1.4 | 0.67 | 3.8 | 3.0 | 4.5 | $13,682 | $37,310 | $29,618 | $43,528 |

Table 4.4 identifies the proportion of students entering each system, directly or via transfer, who earn a BA (or don't), as well as the number of years they are enrolled while earning a degree (or before dropping out). Those years of attendance are costed out at average rates within each system to produce estimates of total costs per entrant, both successful and unsuccessful.

Cost estimates for transfer students DO NOT include costs in the CCC, and are based on median historical average costs. While costs across the public post-secondary systems clearly differ, we strongly caution against using those differences to attempt cost-benefit comparisons between systems. Although we cannot distinguish the different payoffs to degrees or enrollments earned in different majors or at different campuses, it is very likely that differences in those benefits exist. As a result, differences in costs per B.A. earned cannot be *directly* interpreted as identifying "better" paths to a degree.

Table 4.5 Age-Specific Participation Rates in the CCC System

| CCC | Gross Participation Rate | | | |
|---|---|---|---|---|
| | Hispanic | NH White | Asian / PI | Black |
| under 18 | 0.63% | 0.98% | 1.14% | 0.95% |
| 18-19 | 19.62% | 30.10% | 31.00% | 24.75% |
| 20-21 | 15.12% | 22.86% | 26.46% | 20.11% |
| 22-24 | 9.36% | 12.52% | 15.78% | 13.45% |
| 25-29 | 5.85% | 6.91% | 9.16% | 9.04% |
| 30-34 | 4.08% | 4.85% | 6.29% | 6.92% |
| 35-39 | 3.19% | 3.76% | 4.52% | 5.56% |
| 40-49 | 2.66% | 3.27% | 3.58% | 4.56% |
| 50-64 | 1.55% | 2.23% | 2.51% | 2.56% |
| 65 and over | 0.78% | 1.90% | 1.95% | 1.22% |

Participation rates include only Post High School pre-baccalaureate enrollments; significant fractions of CCC enrollees fall into those categories

**Findings**

At the secondary level:

- *California has made strong gains in the last three decades in the proportion of the adult population with high school degrees, but it has lost ground relative to other states*. In 1970, only 63% of the population age 25 and older had a high school diploma. By 2004, 81% of Californians held that credential. However, gains in other states pushed national rates from 55% in 1970 to 85% in 2004. These shifts reflect not only California's success in providing high school education, but also the educational differentiation in patterns of domestic and international migration to California.

- *A plethora of measures of high school success exist, placing graduation rates in California between 71% and 87%*. Officially, California reports a high school graduation rate of 86.9%. Administratively based measure of completion, such as the Cumulative Promotion Index, place the on-time graduation rate much lower, at 71%. Considering only those who were present in California as 14 and 15 year-olds and who entered high school would place high school completion rates at 79% in 2000. The ratio of high school diplomas to the number of 18 year-olds is lower, at 72%, but includes in the denominator many students who never entered high school in California.

- *There are large differences in graduation rates of members of different ethnic cohorts*. Regardless of the specific measure chosen, there are large ethnic disparities in high school graduation rates, with Asians earning degrees at substantially higher rates than members of other ethnic groups, non-Hispanic whites performing above average, Blacks doing much less well, and Hispanics trailing all other groups. These differences are accentuated when considering the level of coursework taken, and the extent to which that coursework qualifies graduates for admission to the UC and CSU system.

At the postsecondary level:

- *Public postsecondary education in California is separated into three distinctive systems, each with different missions, pools of students from which they draw enrollments, and ethnic compositions.* Enrollment in each system has grown between 70% and 100% since 1970, outpacing the increase in the college age population. During the same period, the proportion of enrollments comprised of non-

Hispanic whites has grown (especially in the UC system), as has enrollments of Hispanics (especially in the CCC and CSU).

- *Patterns of differing ethnic rates of success in graduation from high school are mirrored in college going rates and successful college completion.* Relative to the number of public high school graduates, Asians are more likely to enter college, attend an institution which grants 4 year degrees, and earn such a degree, while Hispanics are least likely to enter college and attend a four-year institution, although they are more likely to experience success after enrollment than Blacks. Overall, the likelihood that Asians will earn a BA is roughly double that of non-Hispanic whites, and non-Hispanic whites are in turn twice as likely to earn such a degree as Blacks or Hispanics.

- *Commensurate with their different missions, levels of full-time enrollments, and bases for funding, the costs per full time enrollment differs at each of the three public postsecondary systems. Current state funding levels are well below the historical average provided to fulfill those missions*. The historic median State General Funds per FTE at a UC is more than double that at a CSU, which is in turn about double the funding at a CCC. Because of sharp recent declines in funding, current funding differences between systems are both smaller (UC costs are only about 70% higher than at CSU) and the four year systems are funded well below their historic average levels.

- *By combining the expected number of years that students are enrolled in each system (based on ethnically specific dropout rates by year) with the average costs per year of enrollment, we can estimate levels of state support per enrollment in the four year systems.* We estimate that on average the state provides about $30,000 for each entrant to a public four-year college. That average includes about $14,000 for each entrant who fails to earn a B.A., and about $37,000 for each entrant who eventually is awarded a B.A. Costs at the four year institutions are, of course, lower for transfer students (about $20,000 per entrant) than those who enter directly from high school (about $38,000 per entrant). Estimation of CCC costs are not amenable to the techniques used for estimating state contributions at UC and CSU, and are not included in the totals. The relative differences in four-year costs, however, suggest a strong cost-effective role for the CCC in the pipeline to the baccalaureate.

**Qualifications/Caveats**

We focus on California's public education system, but the private education system supplements its public counterpart. Approximately 10% of secondary students in California are enrolled in private institutions, as are about 10% of college enrollments (about 28% if we consider only 4 year colleges). Representation of private institutions is slightly higher in terms of B.A.s granted, with about 22% of California baccalaureates awarded at private colleges and universities in the state. As a result, the story we can tell about the educational pipeline, while based on the experiences of the large bulk of students, does not address a significant fraction of enrollees. The focus on public institutions is particularly appropriate given concerns with state investment in education. State support of students in private colleges is only for low-income California students receiving CalGrants. A separate analysis is needed to address the flow of students in the private colleges and the role of CalGrants in supporting that path for qualified low-income students.

More generally, the focus on young adults in the educational pipeline assumes the completion of education fairly early in people's lives. The experiences of adults who start or return to school in their thirties, forties and fifties will not be fully captured. This is particularly pertinent to the community college system, which draws many students from later in life who have more intermittent patterns of attendance. We explicitly recognize this in the way we model post-secondary costs in the next chapter, and include the CCC costs in those models. In this chapter, however, we explicitly exclude community college costs in our estimates, and distinguish only between costs at four year institutions for transfer students and first-time students.

The issue of costs to the state for education is complex, given that education funding comes from multiple sources (e.g. the state general fund, lottery funds, local taxes, student fees), that costs may include both instructional and non-instructional costs, that the expense and intensity of services may differ across program types and level (e.g. graduate vs. undergraduate education, or health sciences versus engineering or social sciences), and the mode that funding takes may be direct or via student assistance and grants. We believe the use of average costs per student from state general funds to be simplest and appropriate for our needs, but other analysts may prefer different ways of estimating costs. Use of marginal or instructional costs rather than average costs will decrease the costs per student, particularly for the UC system, while inclusion of revenues from sources other than the state general fund will increase costs.

While costs across the three public post-secondary systems clearly differ, we strongly caution against using those average costs to attempt cost-benefit comparisons between systems. Although we cannot distinguish the different payoffs to degrees or enrollments earned in different majors or at different campuses, it is very likely that differences in those benefits exist. As a result, differences in costs per B.A. earned cannot be *directly* interpreted as identifying "better" paths to a degree.

## Conclusions

Although California has experienced strong growth in the educational attainment of its residents, considerable room for improvement remains. Among the most obvious concerns are the large differences in educational attainment between ethnic groups and the educational disadvantages accumulated by some ethnic groups in their progression throughout the educational pipeline. The lagging accomplishments among Hispanic students are particularly troubling given the direction of demographic shifts in California's future.

The contributions from the State General Fund for postsecondary education are substantially below historic levels, placing an additional burden on the systems and potential students. Overall, the state is expected to contribute about $30,000 per entrant to the public four year systems; whether this investment pays off for the state depends on how much the state can recoup in the form of taxes and reduced expenditures. That topic is the subject of the final chapter.

*In poll after poll, Californians consistently choose education as the issue they consider most important. Parents are equally consistent in identifying a strong education as the most important factor in their children's ability to get ahead and succeed in life. Clearly, people believe that education matters for them and their children. What may be less clear is what stake we have in the educational success of other Californians and their children. How does increasing the educational successes of our neighbors and the next generation affect our own well-being?*

*In response to these questions, we draw upon our demographic projections, our estimates of lifetime income, poverty, and incarceration, and our ethnicity-specific estimates of years enrolled and state costs per enrollment, and place those within the specific context of four scenarios. We ask, under varying conditions of ethnicity-specific rates of high school completion, college-going and college completion, and given the change in the demographic composition of cohorts entering their college-going years:*

- *How much do we expect the state to spend supporting young people's education in public high school, community colleges, and the four year systems? This amount represents the state's investment in the cohort, and it is based on the anticipated years of enrollment in public schools.*
- *We next ask: How much will this cohort pay in taxes over the period between the ages of 25 and 64? How much do we expect the state to spend on incarceration costs for this cohort? How much for social services? From these figures we can calculate the net benefits to the state for educational investments.*

## Chapter 5:
## State Costs and Benefits in a Synthetic Framework

To this point we have identified some of the important gains we expect when individuals and the state make investments in developing their knowledge and skills. Increasing educational attainment benefits not only the individuals who get educated - doubling a person's earnings over their lifetime if they earn a BA rather than only a HS diploma - but also the state of California itself. Educating its young people benefits California three ways. First, the state can claim a share of the gains experienced by its residents via additional tax revenues, which have averaged a virtually unchanging 7.5% of Californians' personal income over the last three decades. In addition, the state also gains from a reduction in the costs it must bear for educational failure: dependence on the state for financial support, health care and higher levels of crime and incarceration. These benefits are primarily financial, and help the state improve its bottom line. Equally fundamental, investments in education directly fulfill the state's rationale for existence by providing heightened equity, safety, well-being and community for the residents who have chosen to make their lives within its borders.

Educational progression rates and returns to education differ by ethnicity, and average costs differ substantially between systems and ethnic groups as well. Yet California's future population growth is likely to be concentrated among groups that are most disadvantaged with respect to educational progression. Only by eliminating educational disparities can California hope to capture the financial returns individuals and state government can obtain from their education. Doing so is urgent given the demographic trends identified in earlier chapters. Education tends to be occur fairly early in the life-cycle, with the ages between 17 through 24 being an especially crucial period for placing young adults on a life and career path. This age group is rapidly swelling in California, and it will continue to grow for the next ten to twelve years as the "Tidal Wave II" generation makes it decisions about preparing for the future.

The consequences of the decisions made by these young adults (and the infrastructure provide by the state) can be suggested by building on the projections we constructed and described in the Chapter 2, and the synthetic cohort based benefits and costs we reported in Chapters 3 and 4. Based on the latter, we provide indications of the future that will face eighteen-years olds once they have passed through that critical seven-year period, based on the decisions they collectively make. The synthetic cohort approach represents those consequences in terms of effects felt throughout their lives, collapsed in a fashion which summarizes the future costs and benefits expected between ages 25 and 64.

**Description of Scenarios**

We begin by looking at costs and benefits in the synthetic cohort framework, and adjust the composition of the cohorts to fit the changing ethnic composition of college age adults over the next 20 years. This first scenario, the "Current Conditions" future, is one in which both the educational achievements and the rewards they yield are fixed at the same ethnic-specific rates we find today. This rules out changes which might occur to make education either more or less worthwhile but, given the difficulties in predicting how returns to education might change, it provides the most reasonable starting point for contrasting outcomes based on future demographic change. This scenarios answers the question: What does the changing ethnic composition of young adults between 2000 and the future imply about the near term costs or long-term benefits we expect in the absence of any changes in educational progression rates?

In the worst-case scenario, the "Fixed Capacity" future, the capacity of our system of higher education is held constant, and the growth in the college age population results in increases in unmet demand and declining rates of college enrollment. The fixed capacity scenario means that short-term costs to the state do not change (although they will decline on a per potential entrant basis), but instead the state bears the costs of foregone revenues, increased need for public support, and a population which is poorer and less engaged in the labor market and politics.

The third scenario we sketch out, referred to as the "Increased College-Going" future, includes moderately increasing rates of high school graduation and college-going, commensurate with the last chapter's finding of upward trends in high school graduation and college preparedness, coupled with fixed rates of progression and completion once students are enrolled in a four year college. This scenario anticipates changes originating outside the system of higher education to which the systems respond at rates of effectiveness equivalent to those found today[81].

The fourth scenario, the "Increased Completion" future, incorporates a more efficient system response to increased demands for higher education, and includes lower rates of attrition among enrollees coupled with higher rates of completion of four-year degrees. This scenario shows the possible impacts of improving outcomes among those who enroll with the intent of earning a bachelor's degree, but who currently face barriers which dissuade them. It uses the same levels of college-going as does the third scenario, but assumes that ethnicity-specific attrition rates are halved.

These scenarios are not intended to be an exhaustive compilation of the many possible changes in participation and success in the California's public education system. However, they do highlight key issues which confront us in the near future: changing demographics, tight constraints on expansion, potential gains in demand from success early in the pipeline, and the efficiency and effectiveness of the state's postsecondary institutions. Any approach to confronting the future of higher education in California will have to consider those issues.

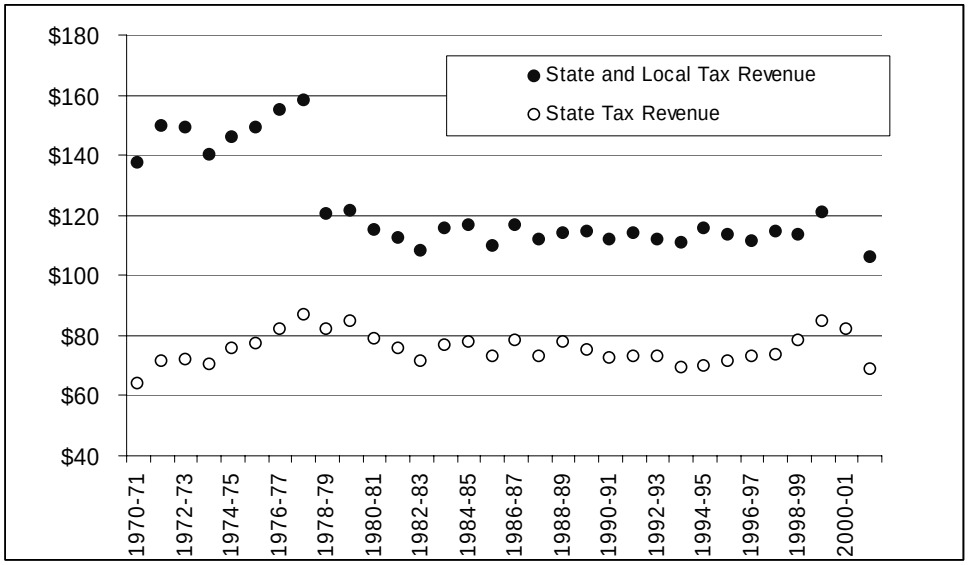
**Estimations of Tax Savings and Poverty and Prison-related Expenditures**

Costs for our model are a consequence of average number of years of enrollment and location of enrollment. Savings are calculated from three sources: changes in tax receipts, changes in spending for poverty-related support programs, and shifts in costs of incarceration. For our purposes, we are interested only in changes in the balance of the state's general fund, and do not consider saving to either local or federal governments.

Changes in tax receipts are calculated as a fixed percentage of total personal income. Figure 5.1 shows the ratio of tax revenues to personal income in California since 1970. Although the ratio varies moderately during the period, it rarely strays far from its median value of $75 per $1000 of income, and no secular trend in rates exists, either upward of downward. We apply this rate to the change in total income we calculate to derive gains (or losses) in state tax receipts.

[81] Effectively, these increases translate into an increase in rates of public HS graduation of 2% for Asians, 6% for non-Hispanic Whites, 8% for Blacks, and 18% for Hispanics by 2015. These are increases in the rates, not gains in absolute percentages, for completing high school. College-going rates - the rates of college entry among HS graduates - is set to increase by 2 absolute percentage points within each ethnic category.

Figure 5.1 Tax Revenues in California per $1000 of Personal Income




Source: California Statistical Abstract

Costs of incarceration are fixed at the discounted rate of $25,000 per year of incarceration. The California Department of Corrections places the average cost of housing an inmate at $30,929 per year. We could reasonably adjust this upward by as much as 33%, to match upper bound estimates avaialble from the Department of Corrections, or downward by a third, to consider the relatively fixed nature of many incarceration costs. However, neither adjustment dramatically affects the core conclusions we draw regarding total savings in our scenarios.[82] We do not estimate the broader costs of crime, which would include financial costs to victims, property damage and loss, costs of policing, and costs of courts, as well as non-monetary effects such as feelings of safety and security or reduced public trust. The proportion of total costs of crime attributable to incarceration varies from crime to crime, but Moretti (2004) places the range between about 4% (for arson) and 36% (for burglary). It is unclear what proportion of additional costs would be costs to the state, but they would be likely to be significant.

Costs of poverty-related programs are estimated by applying a fixed value per changes in years in poverty. This approach allows us to focus on the underlying rationale for programs of support without having to calculate costs on a program-by-program basis and allocate state shares of those programs costs. The latter task could be undertaken

[82] This cost figure is based on estimates from the California Department of Corrections shown at: http://www.corr.ca.gov/CommunicationsOffice/CapitalPunishment/history_of_capital.asp. Elsewhere, the California Department of Corrections places the average annual cost per inmate in 2003 at $33,531, and average cost per parolee at $3,549. (http://www.corr.ca.gov). Federal estimates of incarceration costs are lower, and set the annual cost of imprisonment at $23,205, with a cost at Community Corrections Centers of $20,102. (www.uscourts.gov).

using a survey that asks detailed questions about sources of income[83] (such as the SIPP). However, welfare related costs tend to be substantially under-reported, non-cash assistance values require imputation, and separation of state costs from federal costs is difficult. Moreover, the extent to which programs evolve over time suggests that a focus on core rationales for assistance, rather than on specific programs, could be more robust and is certainly more transparent. We estimate a cost to the state general fund of $3,000 per person year of poverty, based on *state* expenditures for MediCal, CalWORKs, and state supplements to SSI reported in the state budget, divided by Census Bureau estimates of the number of persons in poverty.

The estimation of costs for social support programs and incarceration are intentionally broad, and are not adjusted for life-cycle effects or marginal impacts. Both incarceration and social supports exhibit a strong association with age: social supports are typically focused on the dependent young and the elderly, while incarceration rates are highest for young adults. We assume that demand for social supports by the young is reflected in the education of their parents, and demand by the elderly is reflected in the earnings and accumulation of working age adults. Incarceration of adults 18-24 is not captured in our costs, but would likely incraese the positive the impact of education.

**Comparison of Scenarios**

The "current conditions" scenario is used as a baseline, and results in the remaining three scenarios presented relative to that reference scenario. That scenario, shown in Table 5.1, illustrates the impacts of the changing demographic composition of 18 year olds on educational distributions, income, measures of dependence, educational costs, and savings. Table 5.2 contrasts, for 18 year-olds in 2005, 2010, 2015, and 2020, how cumulative lifetime costs and savings under the alternative scenarios would differ from those resulting from the Current Conditions scenario. Table 5.3 parcels out the benefits, costs, and savings that accrue during each of the four decades of life between age 25 and 64 for the alternative scenarios, again contrasting results relative to the reference model, for the cohort of 18 year-olds in 2015.

*Current Conditions:* In the "current conditions" scenario, eventual education distributions are completely determined by trends in ethnicity and nativity and all changes in costs and outcomes reflect shifts in ethnic composition. Table 5.1 shows the declining state resources resulting from demographic shifts in the state under these assumptions. Relative to 2000, the fraction of 18 year-olds who will fail to complete high school increases steadily through 2020, with matching declines at higher levels of educational achievement. These declines, in combination with differences in the returns that education brings to different ethnic/nativity groups, result in an average lifetime loss

[83] Krop (1997) undertakes that analysis in his investigation of returns to educational investments. Those analyses allow the distinction of savings by program type and age in a much more detailed fashion, but collapse costs across source (i.e. federal, state and local expenditures are combined). This approach would be particularly useful in extensions of analyses focusing on effects for age-specific program expenditures among the young or elderly populations.

of nearly $25,000 in income by 2020 (a decline of 1.8% from 2000), largely resulting from loss of earnings. The number of years these cohorts can expect to live in poverty before age 65 increases slightly, creeping up by about half a month for the 2020 cohort, and by about a month and a half if we consider years under 200% of the federal poverty threshold. Similar trends are noted with respect to participation in cash assistance programs, with small changes in incarceration.

However, lower levels of educational achievement also create less demand for higher education, and average educational costs consequently decline: state support for secondary education drops by $150 by 2020, community college support declines by about $200 in the same period, and average UC/CSU support declines by nearly $400. Overall, the average educational expenditures required by the typical 18 year-old will decline by $750 for the 2020 cohort from that needed for the 2000 cohort. Despite these savings, the net cost to the state will far outweigh the savings. The declines in average income will cost the state nearly $2,000 in foregone taxes, the moderate increases in poverty will add an additional $100 in support payments and services, and incarceration costs will add more than $1,200 to the state's bill. Overall, the lifetime costs to the state are anticipated to increase by $3,200 per 18 year-old in 2020, and net costs will increase by $2,500 (after deducting the savings from reduced educational support).

*Fixed Capacity*: The losses and gains entailed under the current conditions scenario are bracketed above and below by the remaining three scenarios. Unlike the first scenario, in which changes are driven exclusively by shifts in the demographic composition of eighteen year-olds, the remaining scenarios explicitly incorporate the impacts on changing success in the educational pipeline. In the "fixed capacity" scenario, we estimate the original fixed rate model, compare the counts from the expected educational distribution to those from our 2000 estimate, and transfer any excess from the post-secondary categories into the high school only category. This treats the number of post-secondary educational slots as fixed, with any pegs which cannot fit in the slots moved to high school graduate category[84]. We apportion the available slots by ethnicity and nativity in the same proportion as estimated for each cohort from the fixed rate model.

The "fixed capacity" scenario is displayed in the first column for each of the cohorts from 2005 through 2020. Because it manipulates only the categories of high school completers, no differences emerge in the percentage with incomplete secondary education, relative to the model with fixed rates. The substantial absolute declines in college attendance, ranging in size from 6% to 10%, are matched by increases in the proportion that have only a high school diploma. The size of the lifetime income losses

[84] In short, we assume that students are turned away from the state's public community colleges and universities, and terminate their educations after completion of high school. Some students would undoubtedly move out-of-state in those circumstances, or apply to the private post-secondary system. There are a number of reasons to believe that these alternatives would not meet the frustated demand. First, much of that demand is quite localized, and potential students would be unwilling or unable to make the greater effort associated with longer travel or relocation. Capacity at other institutions is also competitive, and the addition of demand would be likely to increase competition and decrease acceptance rates. As well, many employment contacts and opportunities are acquired in the postsecondary setting, and expecting students to leave the state for educational opportunity but return for employment may be quite optimistic.

vary from $40,000 to $70,000, and lifetime years in poverty increase by an average of 6 weeks, with corresponding increases in cash assistance and incarceration. Per 18 year-old, the state can anticipate shaving more than $1,600 off its support for education on average, primarily from the four-year colleges. However, it will pay heavily for these savings, totting up costs between $4,000 and $7,000 in lost tax receipts, increased costs for incarceration, and subsidies for the poor. The state's net lifetime losses average between $3,000 and $5,000, and these losses cost the state more than 2 dollars over this cohorts' lifetime for every dollar it saved in curtailed educational support.

*Increased College-going*: If instead of limiting access, we allowed for reasonable increases in high school completion and college-going rates, a very different picture emerges. In the "increased college-going" scenario, changes to educational progression rates are gradually achieved over a fifteen year period, so later cohorts tend to benefit more. Even in the fairly early years, however, the advantages in term of educational distributions, income, and dependence are obvious. By 2005, the absolute percentage expected to lack a high school degree declines by two points, average lifetime income climbs by $16,000, and individuals can anticipate six fewer weeks lived in poverty. Participation in cash assistance programs and incarceration will decline, and political participation will rise. The cost will be modest - about $500 per person - and will reap about $1,500 in net lifetime savings for the state.

Both educational cost and benefits increase steadily in later years. By 2020, the fraction of the cohort with less than a high school diploma would drop 7.2 percentage points, the percentage with baccalaureates or more would increase by 2.2 percentage points, and lifetime income would total $70,000 more than under the current conditions scenario. Individuals will trim nearly half a year lived in poverty, on average, and registration and voting will increase by nearly a full percent. The state will pay nearly $2,000 per person to achieve these benefits, but it will, in turn, gain more than $5,000 in additional taxes and save nearly $4,000 in decreased supports for poverty-related programs. On net, the state will gain $7,000 per person over the life of this cohort, returning nearly four-for-one on its initial investment in their human capital.

*Improved Completion*: The final scenario considers the potential impact of halving the rate at which students terminate their four year college careers prior to earning their baccalaureate. Currently, nearly one-third of students who enter a four year public university in California leave without a degree. These rates are particularly low for Black students, among whom only one-half graduate. Like the third scenario, this increased completion scenario is phased in gradually and achieves its greatest gains in later years. Initially, lifetime income increases by $25,000, with attendant declines in poverty and public dependence, at a savings of around $800 per cohort member. The state gains $2,900 in additional taxes and reduced outlay, and nets about $2,000 per person. By the year 2020, when gains are fully realized, the proportion of the cohort with baccalaureate degrees would climb 7 percentage points, and average lifetime income gains would top $100,000. The gains would provide the state with an additional $8,000 in tax revenues which, in combination with the $4,000 in reduced expenditures for poverty and prisons, offsets the additional $3,000 in educational costs several times over.

**Lifetime Distribution of Costs and Benefits**

The gains and costs related to education are unevenly distributed over a lifetime. As with any investment, costs tend to be front-loaded, while benefits accrue over time[85]. In Table 5.3, we pick one cohort - the cohort of 18 year-olds in 2015 - and track their anticipated costs and gains in each of the four decades of their life between 25 and 64. As with the second table, the gains and losses are calculated with reference to the current conditions model, and each of the other three scenarios are considered in turn.

Between the ages of 25 and 34, the cohort experiencing the conditions created in the fixed capacity scenario lose about $7,000 in income, or about $700 per year, nearly all of it in lower earnings. They will spend about 10 days more in poverty, participate slightly more in cash assistance programs, and will spend an additional week in jail.[86] Because educational costs are front-loaded, they will enter their 25th year having already saved the state over $1,200, but the state will net only $277 by the end of their 34th year, due to lower tax receipts and higher outlays. In their next decade of life, the loss of an additional $11,000 in income, coupled with smaller increases in poverty and incarceration, costs the state $1,000 and push its net position into the red. Income losses increase steadily over the next two decades of life, but poverty and incarceration play an

[85] Effects for the synthetic cohort are based on differences found among those age 25-64. The lower age boundary is set at 25, since most of the educational transitions we are concerned with are completed by that age. This does not mean that education does not have a strong impact on adults before the age of 25. In fact, strong differences emerge in rates of incarceration, poverty and welfare use. However, for this age group it is not possible to distinguish impacts on those who have completed their education from those who are still in the process of pursuing it. (For example, the poverty rate for 19 year-olds who have only a high school degree at that age will reflect poverty among those who will never go to college, those who will attend some college, those who will finish their BA, and those who earn advanced degrees.) We expect that these relationships would persist, and probably more strongly, if we could distinguish final educational destinations in these age groups

Because education and labor market activity are competing alternatives, it is possible that education and income could actually have a negative relationship for this age group. Eventual college graduates could focus on pursuing their studies, while those who end their educations at high school are busy earning wages. To gauge some of these possible effects, we estimated income by age and education for each of our ethnic categories, but classified individuals currently enrolled in school as having an educational attainment one level higher than their current educational level. Hence, only non-enrolled persons with a particular educational level will be classified in that category, excluding possible lower earnings on the parts of students still in school. These analyses still show total income among those having some college experience equaling or exceeding that of high school graduates for all ethnic categories by age 25, and substantially exceeding that of those who fail to complete high school. Any opportunity costs on the parts of these students (and postponed tax revenues on the part of the state) appear to largely evaporate by age 25. Relative to those with some college, moderate declines in income among those placed in the BA and advanced degree categories exist, but total cumulative income by age 25 differs by less than 10% between these educational categories.

[86] These are averages. The population would experience substantial variation around each of these outcomes. Very few will, in fact, spend just 10 days in poverty or exactly one week in jail. The vast majority will experience no days of poverty and no time in jail. But those who do fall below the poverty line or land in jail will spend so much time there that the whole cohort will average 10 days more of poverty and seven of jail time.

increasingly small role. Nonetheless, the state loses an additional $2,000, split evenly between the decades, for its decision to curtail educational capacity.

Under the conditions of the increased college-going scenario, the state also garners a net gain for the cohort by time they turn 35, but this time due to increased returns rather than foregone investments. The cohort earns nearly $9,000 more, lives one month less in poverty and two weeks less in jail, and returns $1,800 to the state coffers for the $1,400 the state initially invested. By the end of the next decade, they average another $13,000 in income, and they return to the state $1,900 in additional savings. The remaining two decades see continued gains for themselves and the state, based on increases in terms of gains in income rather than reductions in dependency, but still netting the state an additional $3,000 during the period.

For the improved completion scenario, the relatively high costs of education at the beginning are balanced evenly by increased gains in early ages. With nearly $14,000 in additional income, and reductions of $1,200 in reduced need for support, this cohort returns the state's investment by the end of their 34$^{th}$ year. The higher returns continue to accumulate, with this cohort averaging an extra $20,000 in income in each of the subsequent decades. The tax revenues generated by this income, and the declines in state expenditures, yields the state $2,600, $2,300 and $2,000 respectively in the remaining three decades before retirement.

**Summary**

The state devotes a substantial portion of its budget to supporting education in California. That support is not wasted: the net costs of neglecting education are very substantial, and the net benefits this investment brings to the state are very great. Laudable though it may be, California's investment in higher education is insufficient. If things stay as they are now, that is, if future students progress through their educational careers at the same rates as their ethnic counterparts did in 2000, the state will suffer a net loss, and that loss will increase as years pass. With no other changes, the state will forgo revenues from the increased earnings that education encourages, and pay more to support a population in a situation of increased poverty and incarceration. If, rather than maintaining the per-person level of educational support and access, the state were to limit capacity, the situation would become even more dire, costing the state an average of two dollars in the long run for every dollar it failed to spend in the short run.

However, based on existing trends in educational demand, we expect that high school graduation rates and college going rates will increase, and demands on state support for education will climb commensurately. California will have to invest in community colleges and universities in the short run, but both the state and its residents will benefit handsomely from this additional support in the long run. Our calculations suggest net savings to the state will exceed the additional cost by three-fold or four-fold, while its population will enjoy lower levels of poverty, crime, and dependency, and higher levels of average income and political participation. The state can also do more; eliminating ethnic disparities in enrollment and graduation would make a rosy scenario

rosier. Raising black and Hispanic BA rates to those of Asians could serve to increase tax revenues further, primarily through increased tax revenues.

The payback for these investments is not immediate, but it is surprisingly quick: for most of the scenarios discussed, the state shows a positive balance 10 years after enrollment expands. Regardless of the specific educational investments the state chooses to make, one thing is clear: expenditures on post-secondary education are investments. They require an outlay when people are young but reap returns as they age. Investments in higher education pay off three ways: they enhance the lives of residents directly, pay back their initial costs quickly, and continue to return dividends for many years. The result is a more prosperous, higher quality of life, and a still "golden" California.

Table 5.1 Selected Lifetime Impacts of Changes in the Demographic Composition of 18 year-old cohorts in California, Current Conditions Scenario

| **Outcomes Relative to 2000 : Current Conditions Scenario** | **2005** | **2010** | **2015** | **2020** |
|---|---|---|---|---|
| **Education** | *Absolute Change in Educational Distribution at 25* | | | |
| < HS | 0.1% | 1.3% | 1.8% | 2.1% |
| HS Only | 0.2% | 0.0% | -0.3% | -0.4% |
| CCC Only | 0.0% | -0.1% | -0.3% | -0.5% |
| 4 Year College | -0.1% | -0.3% | -0.3% | -0.4% |
| BA + | -0.2% | -0.9% | -0.9% | -0.9% |
| **Income** | *Change in Average Lifetime (25-64) Dollars (2004 $)* | | | |
| Total | $7,150 | -$9,299 | -$22,829 | -$24,860 |
| Earnings | $5,418 | -$9,614 | -$19,914 | -$20,851 |
| **Dependence** | | | | |
| | *Change in Years in Poverty* | | | |
| Poverty 100% | -0.02 | 0.04 | 0.07 | 0.04 |
| Poverty 200% | -0.05 | 0.03 | 0.16 | 0.12 |
| | *Change in Years of Participation* | | | |
| Welfare | -0.01 | 0.05 | 0.04 | 0.03 |
| SSI | 0.00 | 0.04 | 0.01 | -0.01 |
| **Incarceration** | *Lifetime years in Institution* | | | |
| Corrections | 0.00 | 0.05 | 0.06 | 0.06 |
| **Educational Costs** | | | | |
| | *Change in State $ per person* | | | |
| UC/CSU | -$132 | -$459 | -$406 | -$381 |
| CCC | -$29 | -$118 | -$150 | -$208 |
| High School | -$4 | -$89 | -$125 | -$153 |
| *Total Cost* | -$164 | -$665 | -$681 | -$743 |
| **Change in State $** | | | | |
| | *Change in State $ per person* | | | |
| Change in Tax Receipts / Person | $536 | -$697 | -$1,712 | -$1,865 |
| Change in Dependency Payments | -$58 | $124 | $219 | $113 |
| Change in Incarceration $ | $3 | $925 | $1,211 | $1,274 |
| | $592 | -$1,746 | -$1,934 | -$3,252 |
| ***Net State Savings*** | $756 | -$1,080 | -$1,252 | -$2,509 |

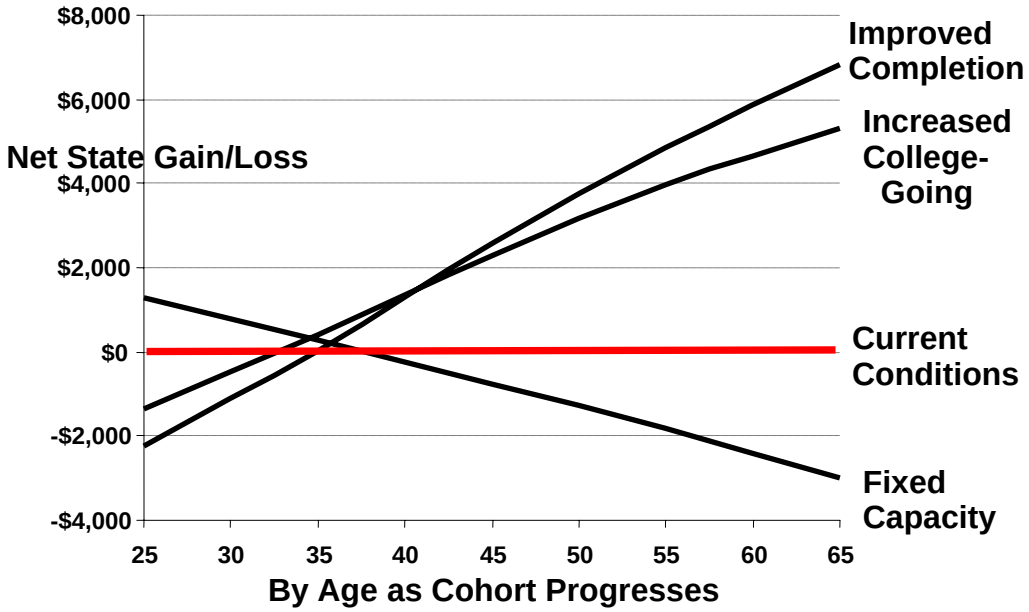
**Table 5.2** **Impacts on State Receipts and Expenditures Under Alternate Educational Scenarios, 2005-2020**

| *Outcomes Relative to Scenario 1 (Current Conditions)* | 2005 Cohort | | | 2010 Cohort | | | 2015 Cohort | | | 2020 Cohort | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Fixed Capacity | Increased College-Going | Improved Completion | Fixed Capacity | Increased College-Going | Improved Completion | Fixed Capacity | Increased College-Going | Improved Completion | Fixed Capacity | Increased College-Going | Improved Completion |
| **Education** | | | | | | | | | | | | |
| ***Change in Educational Distribution of Cohort*** | | | | | | | | | | | | |
| < HS | 0.0% | -1.7% | -1.7% | 0.0% | -3.5% | -3.5% | 0.0% | -5.3% | -5.3% | 0.0% | -7.2% | -7.2% |
| HS Only | 7.8% | 0.1% | 0.1% | 10.6% | 0.3% | 0.3% | 6.2% | 0.5% | 0.5% | 8.1% | 0.7% | 0.7% |
| CCC Only | -3.3% | 0.7% | 0.7% | -4.6% | 1.5% | 1.5% | -2.7% | 2.3% | 2.4% | -3.5% | 3.2% | 3.2% |
| 4 Year College | -1.5% | 0.3% | -0.9% | -2.0% | 0.6% | -1.8% | -1.2% | 0.9% | -2.8% | -1.5% | 1.2% | -3.7% |
| BA + | -3.0% | 0.5% | 1.8% | -4.0% | 1.1% | 3.5% | -2.3% | 1.6% | 5.2% | -3.1% | 2.2% | 7.0% |
| **Income** | | | | | | | | | | | | |
| ***Change in Average Worklife Dollars (2004 $)*** | | | | | | | | | | | | |
| Total | -$53,692 | $16,436 | $25,845 | -$72,173 | $34,063 | $52,479 | -$41,928 | $51,334 | $78,545 | -$54,845 | $69,564 | $105,648 |
| Earnings | -$48,056 | $15,293 | $23,887 | -$64,621 | $31,736 | $48,559 | -$37,592 | $47,863 | $72,748 | -$49,161 | $64,855 | $97,807 |
| **Dependence** | | | | | | | | | | | | |
| ***Change in Years in Poverty*** | | | | | | | | | | | | |
| Poverty 100% | 0.14 | -0.11 | -0.12 | 0.19 | -0.22 | -0.25 | 0.11 | -0.34 | -0.37 | 0.14 | -0.46 | -0.50 |
| Poverty 200% | 0.34 | -0.20 | -0.23 | 0.46 | -0.41 | -0.48 | 0.27 | -0.63 | -0.73 | 0.35 | -0.86 | -0.99 |
| ***Change in Years of Participation*** | | | | | | | | | | | | |
| Welfare | 0.05 | -0.03 | -0.04 | 0.07 | -0.07 | -0.08 | 0.04 | -0.11 | -0.12 | 0.05 | -0.14 | -0.16 |
| SSI | 0.05 | -0.04 | -0.04 | 0.06 | -0.08 | -0.08 | 0.04 | -0.11 | -0.13 | 0.04 | -0.15 | -0.17 |
| **Incarceration** | | | | | | | | | | | | |
| ***Change in institutionalized years*** | | | | | | | | | | | | |
| Corrections | 0.04 | -0.03 | -0.03 | 0.05 | -0.06 | -0.07 | 0.03 | -0.09 | -0.10 | 0.04 | -0.12 | -0.14 |
| **State General Fund Expenditures for Education** | | | | | | | | | | | | |
| ***Change in State costs per cohort member*** | | | | | | | | | | | | |
| UC/CSU $ | -$1,365 | $229 | $525 | -$1,809 | $460 | $1,036 | -$1,069 | $695 | $1,561 | -$1,406 | $935 | $2,085 |
| CCC$ | $0 | $229 | $229 | $0 | $223 | $223 | $0 | $419 | $419 | $0 | $614 | $613 |
| High School $ | $0 | $79 | $79 | $0 | $168 | $168 | $0 | $259 | $259 | $0 | $354 | $353 |
| *Total Cost* | **-$1,365** | **$537** | **$833** | **-$1,809** | **$851** | **$1,427** | **-$1,069** | **$1,373** | **$2,239** | **-$1,406** | **$1,903** | **$3,052** |
| **Change in State Tax Receipts and Selected Expenditures** | | | | | | | | | | | | |
| ***Change in State costs per cohort member*** | | | | | | | | | | | | |
| Change in Tax Receipts | -$4,027 | $1,233 | $1,938 | -$5,413 | $2,555 | $3,936 | -$3,145 | $3,850 | $5,891 | -$4,113 | $5,217 | $7,924 |
| Change in Dependency Payments | $428 | -$318 | -$353 | $577 | -$667 | -$736 | $338 | -$1,014 | -$1,116 | $434 | -$1,370 | -$1,503 |
| Change in Incarceration Expenditures | $737 | -$571 | -$640 | $1,020 | -$1,200 | -$1,343 | $597 | -$1,839 | -$2,052 | $765 | -$2,494 | -$2,772 |
| *Total Savings* | **-$5,192** | **$2,121** | **$2,932** | **-$7,010** | **$4,421** | **$6,014** | **-$4,079** | **$6,703** | **$9,059** | **-$5,312** | **$9,082** | **$12,198** |
| ***Net State Savings*** | **-$3,826** | **$1,584** | **$2,099** | **-$5,201** | **$3,570** | **$4,588** | **-$3,009** | **$5,329** | **$6,820** | **-$3,906** | **$7,179** | **$9,147** |
| ***Savings / Investment*** | 2.80 | 2.95 | 2.52 | 2.87 | 4.20 | 3.22 | 2.81 | 3.88 | 3.05 | 2.78 | 3.77 | 3.00 |

**Table 5.3** **Impacts on State Revenues and Expenditures By Stage in Life under Alternate Scenarios, Cohort of 2015**

| Outcomes Relative to Scenario 1 (Current Conditions) | Ages 25-34 | | | Ages 35-44 | | | Ages 45-54 | | | Ages 55-64 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Fixed Capacity | Increased College-Going | Improved Completion | Fixed Capacity | Increased College-Going | Improved Completion | Fixed Capacity | Increased College-Going | Improved Completion | Fixed Capacity | Increased College-Going | Improved Completion |
| **Education** | | | | | | | | | | | | |
| *Absolute Change in Educational Distribution at 25* | | | | | | | | | | | | |
| < HS | 0.0% | -5.3% | -5.3% | 0.0% | -5.3% | -5.3% | 0.0% | -5.3% | -5.3% | 0.0% | -5.3% | -5.3% |
| HS Only | 6.2% | 0.5% | 0.5% | 6.2% | 0.5% | 0.5% | 6.2% | 0.5% | 0.5% | 6.2% | 0.5% | 0.5% |
| CCC Only | -2.7% | 2.3% | 2.4% | -2.7% | 2.3% | 2.4% | -2.7% | 2.3% | 2.4% | -2.7% | 2.3% | 2.4% |
| 4 Year College | -1.2% | 0.9% | -2.8% | -1.2% | 0.9% | -2.8% | -1.2% | 0.9% | -2.8% | -1.2% | 0.9% | -2.8% |
| BA + | -2.3% | 1.6% | 5.2% | -2.3% | 1.6% | 5.2% | -2.3% | 1.6% | 5.2% | -2.3% | 1.6% | 5.2% |
| **Income** | | | | | | | | | | | | |
| *Change in Average Lifetime (25-64) Dollars (2004 $)* | | | | | | | | | | | | |
| Total | -$7,054 | $8,841 | $13,852 | -$10,853 | $13,143 | $20,729 | -$11,896 | $14,726 | $21,631 | -$12,125 | $14,624 | $22,332 |
| Earnings | -$6,963 | $8,990 | $13,835 | -$10,308 | $13,013 | $20,265 | -$11,156 | $14,305 | $20,756 | -$9,165 | $11,554 | $17,892 |
| **Dependence** | | | | | | | | | | | | |
| *Change in Years in Poverty* | | | | | | | | | | | | |
| Poverty 100% | 0.03 | -0.09 | -0.11 | 0.03 | -0.09 | -0.10 | 0.03 | -0.08 | -0.09 | 0.02 | -0.07 | -0.08 |
| Poverty 200% | 0.08 | -0.16 | -0.19 | 0.08 | -0.17 | -0.20 | 0.07 | -0.16 | -0.18 | 0.05 | -0.15 | -0.17 |
| *Change in Years of Participation* | | | | | | | | | | | | |
| Welfare | 0.02 | -0.04 | -0.04 | 0.01 | -0.04 | -0.04 | 0.01 | -0.02 | -0.03 | 0.00 | -0.01 | -0.01 |
| SSI | 0.01 | -0.02 | -0.02 | 0.01 | -0.02 | -0.03 | 0.01 | -0.03 | -0.04 | 0.01 | -0.04 | -0.05 |
| **Incarceration** | | | | | | | | | | | | |
| *Lifetime years in Institution* | | | | | | | | | | | | |
| Corrections | 0.02 | -0.04 | -0.05 | 0.01 | -0.03 | -0.04 | 0.00 | -0.02 | -0.02 | 0.00 | 0.00 | 0.00 |
| **Educational Costs** | | | | | | | | | | | | |
| *Change in State $ per person* | | | | | | | | | | | | |
| UC/CSU | -$1,069 | $695 | $1,561 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| CCC | -$216 | $419 | $419 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| High School | $0 | $259 | $259 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| **Total Cost** | **-$1,285** | **$1,373** | **$2,239** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** |
| **Change in State $** | | | | | | | | | | | | |
| *Change in State $ per person* | | | | | | | | | | | | |
| Change in Tax Receipts / Person | -$529 | $663 | $1,039 | -$814 | $986 | $1,555 | -$892 | $1,104 | $1,622 | -$909 | $1,097 | $1,675 |
| Change in Dependency Payments | $96 | -$282 | -$316 | $99 | -$273 | -$300 | $86 | -$250 | -$271 | $55 | -$210 | -$229 |
| Change in Incarceration $ | $383 | -$830 | -$901 | $133 | -$642 | -$728 | $68 | -$321 | -$358 | $12 | -$46 | -$65 |
| **Total Savings** | **-$1,009** | **$1,775** | **$2,256** | **-$1,047** | **$1,900** | **$2,583** | **-$1,046** | **$1,675** | **$2,251** | **-$977** | **$1,352** | **$1,969** |
| *Net State Savings* | $277 | $402 | $17 | -$1,047 | $1,900 | $2,583 | -$1,046 | $1,675 | $2,251 | -$977 | $1,352 | $1,969 |
| *Cumulative Savings* | $277 | $402 | $17 | -$770 | $2,302 | $2,600 | -$1,816 | $3,977 | $4,851 | -$2,793 | $5,329 | $6,820 |
| *Savings / Investment* | -0.22 | 0.29 | 0.01 | 0.60 | 1.68 | 1.16 | 1.41 | 2.90 | 2.17 | 2.17 | 3.88 | 3.05 |

**Figure 5.2 Net Cumulative State Gains and Losses by Age (for each Scenario relative to "current conditions" model)**



**Findings**

*Current Conditions:* If educational progression rates are fixed at the current ethnicity-specific levels, the changes in demographic composition will lead to declines in expected levels of educational attainment. These will, in turn lead to fairly small declines in average levels of lifetime income of around $25,000, small increases in poverty and incarceration, and lower average years of enrollment in public education. The declines in average educational investments per person of around $750 are more than balanced by declines in the state's net levels of revenues and expenditures totalling around $3,250, leaving a net state loss of $2,500 per cohort member. Over the lifetime of this cohort, total losses could reach $1.3 billion. This scenario, referred to as the "current conditions" scenario, serves as the baseline for all remaining scenario comparisons.

*Fixed Capacity*: The "fixed capacity" scenario considers the case in which post-secondary capacity is held constant, so that the growth in the college going cohort could not be fully accommodated in California's public schools. The state achieves substantial initial savings, since the average level of student support declines. However, negative impacts on tax revenues and increased spending result in net lifetime losses that average between $3,000 and $5,000, and these losses cost the state more than two dollars over this cohorts' lifetime for every dollar it initially saved in curtailed educational support.

*Improved College-going*: If instead of limiting access, we allowed for reasonable increases in high school completion and college-going rates similar to levels predicted in our initial demographic projections, gradually phased in over the next 15 years, a very different picture emerges. In the "increased college-going scenario", modest increases in state costs result in modest lifetime gains, and returns to the state average more than 3 dollars net gain for every dollar invested.

*Improved Completion*: The final scenario considers the potential impact of halving the rate at which students terminate their four year college careers prior to earning their baccalaureate. Currently, nearly one-third of students who enter a four year public university in California leave without a degree. A phased in decrease in attrition over 15 years would provide the state with gradually increasing investments and rewards, netting the state an average of 3 dollars for every dollar invested. For the cohort of 2015, this results in lifetime gains of more than 3.5 billion dollars.

**Qualifications/Caveats**

The estimated returns from changing educational distributions are based on the costs and benefits estimated in previous chapters, and assumptions made about whether and how to adjust benefits or costs upward or downward will affect the estimate of net returns. In particular, if we believe that differences in earnings reflect self-selection of higher ability individuals, Chapter 3 suggest that returns on the state's educational investments should be reduced by 20%. If returns to education are understated, as suggested by other analysts, we might wish to increase our estimate of net benefits by 20%. Similarly, our beliefs about what costs to include will influence estimates on returns: use of marginal instructional costs rather than historic median costs will inflate returns in the increased college scenario by around 30%, and in the improved completion scenario by about 50%. (The level of improvement varies by both year and scenario: the changes shown are representative and approximate). Use of current average costs will also increase the estimated return, while inclusion of state contributions for the financial support of student will decrease the returns by 10-15%. Inclusion of increasing gains due to time trends would increase net benefits and returns.

The full return to the state for its investment is highest when each individual who increases his or her education remains in California throughout his or her adult life. If individuals earn their diplomas and leave the state, California is not a direct benefactor of taxes on their wage gains. Similarly, if individuals drop out and leave the state, California does not suffer from increased costs for social programs and incarceration. However, analyses suggest that California does not tend to export its educationally successful residents. Comparisons of place of residence during college years with place of residence after receipt of a baccalaureate degree suggest that Californians who earn their diplomas in-state are quite likely to remain here to work. In both 1990 and 2000, between 80 and 85 percent of individuals with baccalaureates who lived in California while aged 19-22 still lived in California 5 years later.

Estimation of costs for social support programs and incarceration are intentionally broad, and are not adjusted for life-cycle effects or marginal impacts. Both incarceration and social supports exhibit a strong association with age: social supports are typically focused on the dependent young and the elderly, while incarceration rates are highest for young adults. We assume that demand for social supports by the young is reflected in the education of their

parents, and demand by the elderly is reflected in the earnings and accumulation of working age adults. Incarceration of adults 18-24 is not captured in our costs, but would likely inflate the impact of education. If, on the other hand, those costs/savings were overstated by as much as half, estimated benefits and returns might be inflated by around 20%.

The full costs to the state for foregone investments (the fixed capacity scenario) assume that potential students in the public post-secondary system in California do not react to constraints by enrolling in private institutions or attending out-of-state. If students pursue these alternate strategies and return to California to earn their rewards for advancing their education, California will not face the full penalties for diminished investments. The increasing competition for slots at American universities makes it difficult to believe that going out-of-state is a realistic and affordable alternative for these students.

## Conclusions

The state devotes a substantial portion of its budget to supporting education in California. That support is not wasted: the costs of neglecting education are high, and the return this investment brings to the state is equally high. Laudable though it may be, California's investment in higher education is insufficient. If things stay as they are now, that is, if future students progress through their educational careers at the same rates as their ethnic counterparts did in 2000, the state will suffer a net loss, and that loss will increase as years pass. With no other changes, the state will forgo revenues from the increased earnings that education encourages, and pay more to support a population in a situation of increased poverty and incarceration. If, rather than maintaining the per-person level of educational support and access, the state were to limit capacity, the situation would become even more dire.

However, based on existing trends in educational demand, we expect that high school graduation rates and college going rates will increase, and demands on state support for education will climb commensurately. California will have to invest in community colleges and universities in the short run, but both the state and its residents will benefit handsomely from this additional support in the long run. Our calculations suggest net savings to the state will exceed the additional cost by three-fold or four-fold, while its population will enjoy lower levels of poverty, crime, and dependency, and higher levels of average income and political participation.

The costs and benefits we identify for the state are financial, but the finances are far from the whole story for either the investments or the gains. Confronting the future of higher education means more than simple changes in funding: it requires careful consideration of the way that students are prepared for higher education, the barriers and specific needs which affect their success, and reasonable and cost-effective ways to increase access to, participation in, and successful completion of education in California. Solutions will need to consider the changing demographics of the state and its youngest residents, the importance of high school completion, increasing demand for workers with postsecondary credentials, and ways to support students who have already entered the postsecondary settings.

Education is not the only infrastructure investment that California could make, but it is an essential part of any set of investments that we should make.

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