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ABSTRACT

This report investigates whether the state of California can return to the levels of access to higher education envisioned in its Master Plan adopted in 1960. Chapter 1 is an introduction which discusses the state's commitment to access, the structure of the educational sector under the Master plan, the effects of the recession of the early 1990s on state finances, and the approach and organization of this report. Chapter 2 focuses on the decrease in the number of students served, the demand for public undergraduate education, and estimation of baseline demand. Chapter 3 discusses the deficit in available spaces for applicants to state institutions of higher education and labels this gap the "access deficit." The chapter also presents projections of the supply and demand implications of the state's expected and optimistic supply scenarios. Chapter 4 discusses the prospects for closing the access deficit, focusing on economic growth, improved efficiency, higher fees and tuition, and the three-year degree. Chapter 5 presents the conclusion that the state of California will not be able to close the access deficits and must reconsider the relationship between the people of the state and the public education enterprise detailed in the Master Plan. Seven appendices present various modeling scenarios to deal with the problems of supply and demand in public higher education as well as an analysis of total public enrollments. (Contains 64 references.) (CK)

Higher Education for the 21st Century

The Future of Public Undergraduate Education in California

Michael A. Shires

INSTITUTE ON EDUCATION AND TRAINING

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INSTITUTE ON EDUCATION AND TRAINING

RAND

FOREWORD

RAND's Institute on Education and Training (IET) conducts analytic research and provides technical assistance to improve education policy and practice in all sectors that offer education and training in the United States. Higher education is a major area of the IET's research. With this foreword, we are pleased to announce the launching of a new series—*Higher Education for the 21st Century*—that will highlight our work in this area.

Over the next several years, the IET will publish a number of monographs on subjects ranging from new decisionmaking tools for higher education leaders to projections and analyses of demographic and fiscal trends. We will also report on large and small means for improving efficiency and effectiveness in postsecondary education. Finally, we will stimulate and participate in a needed debate over what the higher education system should be like in the next century—that is, why and how it should be redesigned.

It is appropriate to begin the series with several monographs that will support the work of the California Education Roundtable, with whom RAND is collaborating to revisit the assumptions of the California Master Plan for Higher Education.

Near the start of the twenty-first century, it is timely and necessary to rethink the purposes and design of California's higher education system. Perhaps more than any other state's higher education system, this system embodies the legacy of the Jeffersonian-based land grant model. The California Master Plan (also known as the Kerr plan) articulated the most ambitious postsecondary system yet developed:

- A community college system open to all high school graduates and adults throughout their life
- A state university system (California State University) devoted to high-quality undergraduate education that would enroll the top 33 percent of high school graduates
- The University of California, open to the top 12.5 percent of high school students.

Currently enrolling 1.6 million undergraduates, the three systems have an enviable track record: CSU, for example, graduates 10 percent of the United States' K-12 teachers. The recent National Academy of Sciences ranking placed the University of California, Berkeley, at the top of all research universities in the United States. UCLA, UC/San Diego, and UC/Irvine also won recognition for many nationally ranked departments.

Nevertheless, a combination of factors warrants the reexamination of the postsecondary sector in California. While the three public postsecondary systems are still reeling from severe budget cuts imposed in the early 1990s, even greater budget cuts may be in store in the next several years. At the same time, the sector must somehow respond to what Clark Kerr calls "Tidal Wave 2," a dramatic increase in enrollment demand fueled by a more than 30 percent increase in high school graduates, projected by 2002. Moreover, there is increasing evidence that the quality of instruction is declining. And more than 2,000 of the same faculty that formed much of the basis for the superlative national rankings have taken early retirements offered by the University of California as part of a cost-cutting effort.

The higher education sector in California is, in fact, being redesigned—but in an episodic, piecemeal manner driven by the new fiscal limits the California public sector faces. The question is whether a new strategic bargain can be designed and agreed to by the state government, citizens, and the higher education sector's leadership that will enable the next generation of high school graduates to have the same opportunities for a high-quality postsecondary education that recent generations of high school graduates have enjoyed.

Can policymakers undertake the needed redesign of the higher education sector? It is clear that the problems faced by the higher education sector in states such as California are daunting.

However, the early history of higher education in the United States suggests that the task is not impossible. Our leaders in the mid-nineteenth century, spurred by Jefferson's arguments on behalf of public higher education, designed the state-based land grant system that, in concert with strong private colleges and universities, changed the face of higher education for more than a century. It is only natural that after 100 years of operation, some restructuring is needed. Are we really not up to redesigning the system our forefathers invented for us? At the end of the twentieth century, the choices will be made *by* higher education leaders or *for* them. The path taken matters a great deal for the United States' role in the twenty-first century.

Leading off the *Higher Education in the 21st Century* series, Michael Shires' monograph examines the probable effects of budget cuts on undergraduate enrollment in California's postsecondary education and argues that the effects make it imperative to revisit the Master Plan. His conclusions will stimulate much needed discussion about how higher education might respond to the changed environment he depicts. Shires' work was supported by a grant from the Lilly Endowment, Inc.

Roger Benjamin
Director, Institute on Education and Training

Stephen Carroll
Senior Economist

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SUMMARY

In 1960, the state of California adopted the language of the California Master Plan for Higher Education as its policy and strategy for higher education. That plan had two major components: (1) it specified the roles and missions of each of the four segments of the state's higher education sector, and (2) it stated that each Californian who could benefit from higher education should have access to it.

The Master Plan has successfully served as the model through which the state's higher education sector has grown and thrived. This growth has in turn provided the fuel for the state's economic engine and supplied the seed for the growth of its high technology and aerospace sectors.

THE IMPACT OF CURRENT POLICIES: REDUCED ACCESS

California's recent recession has had a major impact on the state's three public university and college systems. It reduced the public sector's capacity to provide undergraduate education through decreased funding, and it decreased the demand for education as a result of increased fees and managed enrollment strategies. Consequently, enrollments in these systems have dropped in a period when the state population has continued to grow. The state's ability to meet the Master Plan's access goal has been sharply reduced in this period. ***The number of students actually served in 1994–95 declined by more than 200,000 students from the number that would have attended had participation remained at prerecessionary levels. This drop represents an 11 percent decrease in the overall level of service.***

ACCESS DEFICITS WILL GROW IN THE FUTURE

As the state economy begins to recover from the economic problems of the early 1990s, the question arises, "Can the state return to the levels of access envisioned in the Master Plan?" If so, then the state's higher education systems should map out a strategy for accomplishing this goal and should enter a compact with the state legislature to fund that plan. If not, then the Master Plan as the document for shaping the sector should be revised to reflect the realities that will shape the state's future.

This report is an effort to answer the fundamental question posed above. ***This research shows that there is and will continue to be an access crisis in California.*** The collision between the state's rising demographic trends and its declining discretionary revenues (from which higher education draws its resources) has resulted in a major shortfall in the number of seats supplied, compared to the number of seats demanded—what is termed in this report an *access deficit.*

The level of access is expected to decline from today's 89 percent of prerecessionary levels to 62 percent in 2005–06 and to 56 percent in 2010–11. Even in an optimistic fiscal scenario, the service levels would rise to only 65 and 58 percent for 2005–06 and 2010–11, respectively. This would be a marked decrease in the level of higher education access provided in the state and would eventually ***leave more than one million students unserved*** in 2010–11.

ACCESS DEFICITS ARE HERE TO STAY

To close this deficit through increased state revenues, the higher education sector would have to reverse its current trend toward a declining share of state revenues and nearly double its share from about 10 percent today to more than 18 percent in 2010–11. While that share is not unreasonably high in historical terms, the increasing demands of the state's mandated spending programs, such as K-12 education, corrections, and health and welfare programs render it highly unlikely in the future. Given the fiscal context of the state and the competition for discretionary resources, this scenario is extremely unlikely.

Furthermore, California must also consider how to address the sector's capital needs. Even if it could provide the faculty and operating resources, it must have physical space for additional students. This analysis estimates that the sector will require almost $16 billion dollars of bonded capital investment to fund capital upgrades and expansion at an average annual cost (including repairs and renovation) of $1.2 billion dollars.[1] This amount of new debt would severely tax the state's capacity to issue debt. Experts in the state's bond markets estimate that California's total annual new-issue capability is approximately $2 billion per year. Between the demand for new prisons (driven by the "three strikes" law[2]) and the need for new K-12 facilities (which is driven by the same demographic forces as higher education), there is certain to be aggressive competition for the $30 billion that the state is capable of borrowing over the next 15 years.

Closing the access deficit through pure cost reductions is also problematic. Consider that it would require reducing the cost of education by 70 percent to close the deficits. Such a reduction is very unlikely. Because of the recent major reductions in operating costs in all three systems, it is unlikely that major productivity improvements can be made without seriously impacting the quality of the education provided. This is not to say that progress cannot be made in this area, as will be discussed in the recommendations for immediate action below.

IMPLICATIONS FOR HIGHER EDUCATION

Because of the prospects of continued access deficits in California, two actions are proposed. First, the state must commit to its investment in higher education and the sector must find new ways of maximizing the state's return on that investment. Second, the state must restate or readdress the Master Plan in light of current and future realities. It can no longer provide the level of access it envisioned in 1960, and some new guidance has to be given for allocating the precious and scarce units of education that will be available in the future.

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[1]This amount is included in the "buy out" costs described in the preceding paragraph.

[2]California's three-strikes law mandates 25 years to life in prison for anyone convicted of a felony following two prior convictions for serious crimes.

New Investments and Higher Returns

Higher education is a crucial part of the success of the California experience, and declining levels of access will have long-term negative consequences for the state. The public commitment to the sector must be made explicit and institutionalized, especially in light of competition from mandated and constitutionally protected programs. In return, the state's three public higher education systems and their constituent institutions must commit to elevating the state's return on that public investment.

The state's higher education sector must restructure, across systems, across campuses, across colleges, and across departments. It must reevaluate the centuries-old models of governance and organization that currently define the institution and develop new structures and alliances to provide education more efficiently. It must also embrace new technologies and approaches to teaching to maximize the productivity of its human and capital resources.

Revisiting Access Under the California Master Plan for Higher Education

One conclusion is inescapable—the access goals of the California Master Plan for Higher Education, in today's and tomorrow's fiscal and demographic environments, are not viable given the state's current fiscal and demographic trends. It is time for the state's policymakers to reconsider the Master Plan and to develop a new strategy for the state's higher education systems.

The fact of the matter is that change is already happening but without a plan. The state is *de facto* devising schemes for rationing access to education through increased fees and other strategies. But instead of resulting from well-considered, macro-level choices between alternative visions, the access provided by the state's higher education sector is being shaped by a mishmash of local factors and compounded by a highly uncertain budget picture. Students are being explicitly kept out of the system by price increases. Capacity as a share of demand is decreasing, with no explicit vision for higher education.

California appears to be in a state of denial regarding the ongoing viability of the Master Plan. Budgets are no longer considered from the perspective of what is required to support the needs of the state's higher education sector, but rather of how much of the budget is left to be spent on it. And, whereas there is a statewide concensus on the goals of the Master Plan, it is also clear they are not currently being met. This analysis shows that they will likely not be met in the future, either.

The time has come, therefore, for the state to convene a new Committee on the Master Plan to address the state's goals for its public education sector into the future. This Committee will need to consider

- The capabilities and the strategic role of the state's higher education sector well into the next century
- The fiscal and demographic context in which the state's higher education institutions must operate
- The strategic alliances between higher education as an education and training mechanism for the private sector as well as the sector's role in producing a significant portion of the nation's basic research
- How to strengthen the linkages between the state's public and private eduation sectors.

But the challenges of today are no more formidable than those of 35 years ago. The current Master Plan was the product of a long process and the last in a series of efforts to consider the structure and character of the state's higher education sector. The new effort should likewise be the result of a carefully considered process. Participation should come from all aspects of the higher education sector and should include members of all four major higher education segments (private institutions constituting the fourth), lawmakers, and other leading policy players.

The current Master Plan is arguably a major reason for the state's tremendous success over the past 35 years. A new Master Plan will be the key to the state's next 35 years. The sooner such an effort can be undertaken, the sooner the sector's goals and objectives can be redirected to springboard the state into the next century.

The failure of the state to provide ongoing support to its higher education systems will be a costly failure indeed. A significant share of the state's burgeoning population will be denied access to higher education, and in an increasingly technological society that demands an increasingly skilled workforce, such short-term policy choices could well leave the state unable to compete. Now is the time to act—to provide a sophisticated and thoughtful plan for those systems—before the unfocused policies of the present result in an unintentioned dismantling of a success that has taken 35 years to build and before the effects of such a process ripple through the state's social fabric.

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A wide range of people and institutions have contributed to this analysis. The Institute on Education and Training (IET) at RAND has generously provided funding and support for this research. In addition, Roger Benjamin, Director of the IET, served as both mentor and, during the development of this analysis, as chair of the dissertation committee.

Several other RAND colleagues deserve special mention for providing advice and support. RAND colleagues and dissertation committee members Steve Carroll and Peter Rydell were invaluable in the completion of this sometimes daunting effort, and the quality of this report is due in significant part to their efforts. I am also indebted to Steve and Peter and to Eugene Bryton for collaborating with me on another IET effort to assess the prospects for California's fiscal future—an effort from which this report borrows some of its economic inputs. My thanks also go to Charles Goldman and Dominic Brewer whose final review comments strengthened the arguments and technical methodology used in the study. Finally, Cathy Krop worked closely with me on the Proposition 98/111 model and has served as a friendly ear over the course of this project.

The California Postsecondary Education Commission provided key data for this analysis; I am indebted to their staff for their advice and especially to Jan Taylor for overseeing the preparation of those data. In addition, I would like to thank the staff of the Demographic Research Unit at the Department of Finance, especially Paula Flores, who provided invaluable assistance and information over the course

of this project. Carol Bingham and Bob Loessberg-Zahl at the Office of the Legislative Analyst also contributed advice and information.

I am also appreciative of the advice and assistance of the many individuals I have spoken with at the University of California Office of the President, the Chancellor's Office of the California State University, and the Chancellor's Office of the California Community Colleges. Dr. Frank Jewett at California State University deserves special credit, as it was a dialogue with him that served as the conceptual inspiration for this entire effort.

This section would be incomplete without acknowledging the extensive support I have received from my family and friends. Their moral support and patience with five years of graduate school and endless conversations about the policy issues surrounding higher education and state finance are greatly appreciated. Without their support, neither this work nor the accomplishment it represents would have been realized.

Finally, and most important, I would like to thank my wife for her support and patience throughout this effort. She deserves at least equal billing on the author page for all those long hours and tedious conversations about the best approaches and the logistics associated with executing this research. Furthermore, she endured the trials and tribulations of my entire doctoral program and always managed to find a smile and a supportive word just when it was most needed.

Whereas the dissertation is the product of the efforts and support of a number of people, I would like to remind the reader that this research represents the views of the author alone and not the views or opinions of any other individuals or their respective organizations.

Chapter One

INTRODUCTION

Higher education in today's society serves many important roles—training a skilled workforce; providing a mechanism for upward social mobility; serving as an equalizing mechanism to historically underserved groups; producing basic research that has launched this country into space and the information age; training tomorrow's doctors, lawyers, bankers, and business people; and serving the public by training and providing a skilled set of expert analysts to inform and assist public policy at all levels. It has been further linked to the economic performance of the nation.[1]

Nowhere have the consequences of this link been more evident than in California. The state's Master Plan for Higher Education exhibits the state's commitment to higher education and has been the cornerstone for the emergence of one of the world's premier higher education sectors. At the same time, the state has emerged as one of the most powerful economic entities in the world, with a gross state product that would rank it in the top ten worldwide if it were a separate country.

This report addresses concerns that have been raised in the public debate over the future health of this Master Plan for Higher Education. In the next several sections, the two key provisions of the Master Plan—structure and access—will be discussed as a motivating context for this analysis.

[1]See Sturm (1993) for a more detailed analysis of this relationship.

CALIFORNIA'S COMMITMENT TO ACCESS: THE CALIFORNIA MASTER PLAN FOR HIGHER EDUCATION

In 1960, the legislature of the state of California passed the Donahoe Act that placed into effect the California Master Plan for Higher Education. The Master Plan included two important provisions. First, each of the integral parts of the state's higher education sector was given a specific role. In this document, each of the four segments in California's higher education sector was given a specific set of missions in educating the population of the state. Second, the Master Plan contained an explicit commitment to access. The stated purpose of the legislation was to "provide every Californian who might benefit" with access to higher education.

Structure of the Sector Under the Master Plan

The Master Plan addressed a wide range of issues. Most important was the definition of relevant student populations for each set of institutions and a formalization and differentiation of the missions of each set of institutions. The definition of student populations was in response to the competition between the various public institutions for the high-caliber students. The Plan resulted in the University of California admitting only the top one-eighth of the high school population. The Plan also calls for the California State University system to admit students from the top one-third of the high school population. Junior colleges (now called community colleges) were to serve the needs of the remainder of the state population. The driving force behind the plan was that all Californians should have access to postsecondary education, without respect to their level of preparation, while balancing the different needs of the postsecondary institutions for high-quality students.

The Plan also differentiated between the missions of the three groups of public institutions. Each was allocated a specific set of roles to support the overall objective to provide a postsecondary educational opportunity to all Californians. Each of these roles is a reflection of the institution's history, as well as the student population at which it

is targeted.[2] The role of each institution is discussed in further detail below.

California Community Colleges. California community colleges (CCC) have three basic roles in the Master Plan, each of which can be traced, at least in part, to the history of the community college as an institution. Community colleges are expected to "offer instruction but not beyond the fourteenth grade level, including, but not limited to, the following":[3]

- **Standard courses for transfer to higher institutions.** The junior college is chartered to provide classes for individuals who will eventually transfer to other four-year institutions of higher learning. Historically, the junior college was an offshoot of high schools (with which they had their initial affiliations) and were modeled to provide the courses typically encountered in the first two years of college.
- **Vocational-technical courses in fields leading to employment.** Vocational courses have long been a component of junior college programs, dating back to the Smith-Hughes Act of 1917. The formalization of the community college's role as the sole provider of this type of training was important, however, because it established a specialization within the postsecondary educational framework.
- **General or liberal arts courses.** This category of courses exemplifies California's commitment to provide access to postsecondary education to all Californians. This particular category of courses allows individuals to pursue general courses in academic areas without having to make a long-term commitment to a degree program. Incorporated into this role was the introduction of the Associate in Arts and the Associate in Sciences degrees.

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[2]This relationship goes both ways, inasmuch as the history of each system reflects the roles assumed by that system as well.

[3]California State Department of Education, *A Master Plan for Higher Education in California, 1960–1975*, (Sacramento, 1960), p. 2.

The local governance aspect of the community college system also brought the community college and its curriculum decisions much closer to the market they served. This development allows local communities to establish their own priorities for programs of local community interest.

California State University. The role of the California State University (CSU) system was also revised and expanded in the Master Plan. To quote the Plan:

> The state colleges shall have as their primary function the provision of instruction in the liberal arts and sciences and in professions and applied fields that require more than two years of collegiate education and teacher education, both for undergraduate students and graduate students through the master's degree. The doctoral degree may be awarded jointly with the University of California, as hereinafter provided. Faculty research, using facilities provided for and consistent with the primary functions of the state colleges, is authorized.[4]

Recall that the state colleges and universities started as "normal schools" (committed exclusively to training elementary and secondary teachers). This charter reflects both their origins in teacher preparation and the trend toward expansion and liberalization of their curricula. The expansion of the professional degrees to be offered reflected, in part, the changing demographics of a state undergoing massive population growth.

The University of California. The mission of the University of California (UC) is also explicitly defined in the Master Plan:

> The University shall provide instruction in the liberal arts and sciences, and in the professions, including teacher education, and shall have exclusive jurisdiction over training for the professions (including but not by way of limitation), dentistry, law, medicine, veterinary medicine, and graduate architecture. The University shall have the sole authority in public education to award the doctor's degree in all fields of learning, *except that* it may agree with the state colleges to award joint doctor's degrees in selected fields. The University shall be the primary state-supported academic agency

[4] *Ibid.*, p. 2.

> for research, and the Regents shall make reasonable provision for the use of its library and research facilities by qualified members of the faculties of other higher educational institutions, public and private.[5]

This text almost exactly echoes the mission statements that go back to the University's nineteenth-century inception as a land grant university.

The uniqueness of the California Master Plan arose from the integration of the diverse functions of the three previously independent systems into a single, intentional framework for meeting the needs and objectives of the people of California while simultaneously matching the needs of the institutions for high-quality students. It was the departmentalization and formalization of the diverse roles of the constituent institutions that made the Master Plan unique, coupled with the overarching objective of providing access to post-secondary education to all Californians.

Private Colleges and Universities. Private colleges and universities were not left out of the state's vision for its higher education sector. Each of these institutions was enlisted to provide higher education in accordance with its individual charter and mission. The Cal Grant aid program was instituted to provide lower-income students with the opportunity to attend these private institutions. Inasmuch as these specific missions and roles are beyond the control of public policymakers and the state fiscal resources committed to these institutions are significantly lower than those committed to public institutions of higher education, the focus is on public institutions in this analysis.

Access Under the Master Plan

The Master Plan also speaks clearly on a commitment to access to education—"to every Californian who can benefit." This area of the Master Plan is the fundamental focus of this report. The fundamental question is, "Can the state of California provide the levels of ac-

[5] *Ibid.*, pp. 2–3.

cess envisioned in the Master Plan today and in the future?" To answer this question, one must first define what access really means.

What Is Access? Access to education may be defined in a number of ways. For example, access could be defined merely as the existence of institutions of higher education in the state—hence, the opportunity. Or it may be defined in other ways. If an institution exists and admits everyone, but does not provide enough classroom seats, it will take students an unacceptably long time to complete their degrees. Access carries with it a dimension of affordability. The quality of the education provided could also be poor—in which case, it could be argued that the opportunity provided is not really access to education.

The dimensions underlying a definition of access may be summarized as follows:

1. **Availability**: An adequate quantity of educational opportunities must exist.

2. **Affordability**: The opportunities must be economically within the means of the population that the institution is serving.

3. **Attainability**: The institution must maintain an environment conducive to the ultimate product of an undergraduate education—learning and, more quantifiably, a degree. The opportunity to complete a degree in a reasonable period of time is one dimension of attainability.

4. **Equity**: Inasmuch as education is considered an important social adjustment mechanism for historically suppressed groups, it must provide opportunities for those individuals to attend institutions of higher learning. Because of the special social, cultural, and economic difficulties experienced by many of these potential students, it is often considered incumbent on higher education institutions to provide special and additional opportunities for these students.

5. **Quality**: The opportunity to attend an institution whose curriculum and faculty reflect a certain level of quality is a crucial dimension of access. If everyone is provided access to a low-quality program, there is a legitimate concern whether the needs of society have been met.

Why Think About Access Now? But why consider this issue now? Why not in five years? Ten years? The answer is that recent economic conditions have brought about significant changes in the way higher education is funded in California, resulting in significant reductions in public support to higher education. The recent recession in California and a wide range of voter-approved ballot initiatives have combined to bring about a crisis in California state finance.[6] For the first time in the history of the Master Plan, state funding decisions for the state's public higher education systems have recently been driven more by how much money was available rather than by the number of students they enrolled. Even in community colleges, where minimum funding guarantees were put into place with the passage of Proposition 98,[7] there have recently been years in which the average per-pupil state support has fallen.[8]

With these changes as a backdrop and highly uncertain fiscal prospects for the future, continued access to undergraduate education is becoming increasingly problematic in the context of the California Master Plan.

Because of the shifts in the funding paradigm, major changes have occurred in the three public systems.[9] Fees charged to students have risen dramatically in all three systems. Institutional responses to decreased funding have varied. In the CSU system, each campus has pursued independent solutions, including such diverse approaches as laying off all part-time faculty or terminating all library acquisitions or sharply reducing support staff. One consequence of

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[6]See Stephen Carroll, Peter Rydell, Eugene Bryton, and Michael Shires, *California's Fiscal Future*, MR-570-IET, 1995, and Stephen J. Carroll, Kevin McCarthy, and Mitchell Wade, "California's Looming Budget Crisis," *RAND Research Review*, Fall 1994, Vol. 18, No. 2, for a more detailed discussion of these issues.

[7]Proposition 98, subsequently modified by Proposition 111, sets a floor on K-14 spending and requires that, except in very bad economic years, the level of funding for this sector shall not drop below the greater of a fixed share of General Fund revenues or a level that maintains the prior-year real per-pupil expenditure.

[8]Because Proposition 98 addresses K-14 finance, it is possible to meet the overall guarantee amount while decreasing the proportion of the combined share that goes to community colleges. This has been the case in fiscal years 1992–93 and 1993–94.

[9]Public enrollments are the focus of this report. The private sector accounts for less than 8 percent of undergraduate enrollments in California in the baseline year (1989–90) and 12 percent overall (National Center for Education Statistics, *Digest of Education Statistics 1991*, Table 186, p. 191).

these changes has been the limitation of the number of students enrolled on the various campuses—both in response to the fee increases and through the offering of significantly fewer sections of courses. In the UC, the responses have taken a range of forms as well. One campus, UCLA, has merged several schools and programs into a single school, while the system overall has encouraged the retirement of more expensive, senior faculty through attractive early retirement programs.[10]

Any and all of these changes could have been well overdue, and the changes seen in the public education sector may well represent market adjustments to oversubscribed activities and overproduced goods. However, this does not seem to be the perception of many leaders in the state today. In fact, there is a belief that much of California's success during the 1980s was directly attributable to its highly trained and educated workforce and the synergies that developed between its academic research institutions and its high-technology industries. Furthermore, as the state's and the nation's economies become more service- and technology-oriented, it is likely that the demand for trained and skilled workers will increase. The Higher Education Members of the Education Roundtable point out that:

> California's emergence as one of the world's major economic powers did not occur by accident. It happened because the Golden State nurtured a work force that was among the best educated on earth. It happened because employers knew that California, through its higher education system, could be counted on to lead the world in both technologic and industrial innovation, as well as in the creation of a large, talented, and well-trained labor force. Recognizing the value of California's dominance in research, as well as the wisdom of locating in an area with well-developed human resources, native-born entrepreneurs as well as out-of-state and immigrant businesspersons flourished. They established small busi-

[10]The implications of this early retirement program may be long-lasting. These senior faculty account for a significant share of the extramural research monies raised by the university, which in turn contribute directly to the quality of the instructional programs. Senior faculty also provide significant support for graduate students who, in turn, will become faculty. However, the direct implications to California are not clear because the market for faculty is national.

> nesses and developed entire new industrial sectors, resulting in unprecedented prosperity for California's residents.[11]

In the 1970s and 1980s, the original Master Plan document was reviewed and revisited by committees appointed by the legislature. In each case, even though some of the specific mechanisms and missions were debated, the overall objective of the Master Plan was reiterated—to provide higher education to every Californian who may benefit therefrom. Today, there is widespread uncertainty as to whether the state can afford to finance that goal. The purpose of this report is to discuss California's prospects of funding the Master Plan into the future.

OTHER RESEARCH ON THIS TOPIC

This research effort is not the first to address the issue of access in California. The issue has long been one of great concern and attention for the decisionmakers in the state, as the California Master Plan itself shows. In the past several years, even more attention has been turned to the subject.

A major contributor to the discussion of the issue of access in the state is the agency charged with serving as a coordinating and reporting mechanism for the state's postsecondary sector—the California Postsecondary Education Commission (CPEC). A milestone report on the issue of access in the state's recent history was the January 1990 publication, *Higher Education at the Crossroads* and its accompanying technical paper.[12] The illustration on the cover of that document, shown in Figure 1.1, typifies the concerns at that time. The statutory limits on state finances imposed by the Gann Initiative raised the concern that revenues to the sector would remain flat while projected enrollments were expected to skyrocket—all before the fiscal crisis of the early 1990s. The recommendations of the report focused on making special provisions for higher education un-

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[11]Higher Education Members of the Education Roundtable, *A Joint Statement on the Crisis Facing Higher Education*, March 1993.

[12]CPEC, *Technical Background Papers to Higher Education at the Crossroads: Planning for the Twenty-First Century*, CPEC Report 90-2, January 1990. This is an excellent source of information regarding the finance and enrollments within the state's higher education sector.

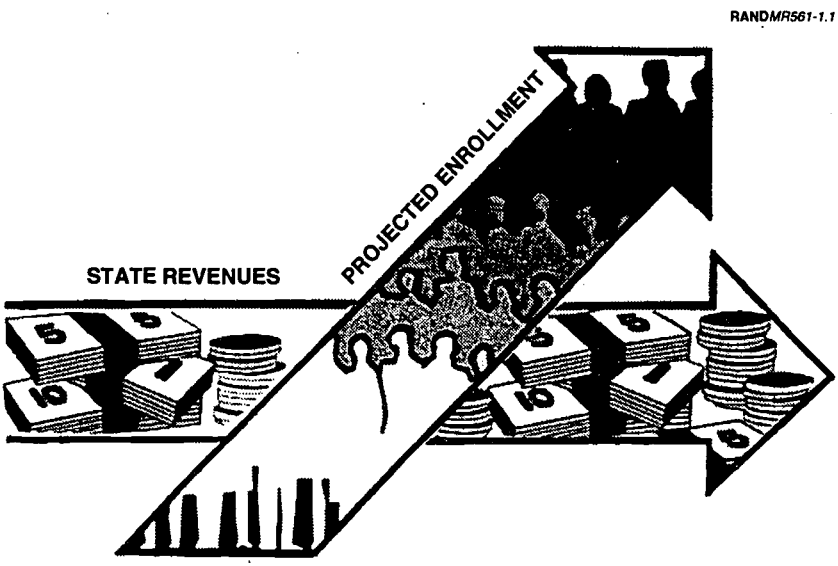

Figure 1.1—Cover Illustration from *Higher Education at the Crossroads*[13]

der the state's spending limits and or initiating plans for growth in each of the systems.

Subsequent to this report, a severe recession buffeted the state and drove the state revenues downward, while census results indicated that the state population had grown and was expected to grow even faster than anticipated. As a result, CPEC Executive Director Warren Fox made the following statement in the 1992 report *Meeting the Challenge: Preparing for Long-Term Changes in California Higher Education*, under the heading "The Fundamental Issue":[14]

> The State of California alleges one set of commitments—access for all qualified individuals to a quality academic or vocational education—and in fact is delivering a very different product. For the first

[13]CPEC, *Higher Education at the Crossroads: Planning for the Twenty-First Century*, CPEC Report 90-1, January 1990.

[14]CPEC Report 92-25, p. 11.

> time in California's history, an ethnically and racially diverse population is graduating from high school academically prepared to meet the higher admissions standards at our public universities. . . . Unfortunately, and also for the first time in California's history, the public's willingness to invest in higher education does not appear to be commensurate with the demand for academic and vocational education.

The distinction between this report and these early CPEC efforts is that this report uses updated census and economic information and projections, more detailed methodologies for estimating participation across the sectors, and focuses specifically on the access issue. The analysis in this report is better attuned to the significant changes in the state's demographic composition. It also presents an overall assessment of the state's entire public postsecondary sector using consistent methodologies and assumptions for each. This integration allows the policymaker to assess the overall prospects of providing access.

Another CPEC study roughly parallels the analysis contained in this report.[15] On the demand side, it contains projections of the demand for higher education within the state. Unlike this analysis, it starts with the present as the basic reference point and projects future enrollments. This analysis allows one to question whether the *de facto* consequences of untargeted policies should in fact be the baseline point. The CPEC report contains an analysis of the state's physical (capital) capacity on its postsecondary campuses. These preliminary estimates are incorporated into this analysis. Finally, the CPEC report contains parallel economic projections for the state's fiscal future, but it does not convert these economic assumptions into real estimates of the prospective capacities of the state's higher education sector. Overall, the CPEC document is an excellent and separate analysis of many of the issues raised in this analysis. This report takes the analysis forward another step and maps the

[15]The references contained in the report, *A Capacity For Growth: Enrollments, Resources, and Facilities for California Higher Education, 1993–94 to 2005–06*, refer to the draft dated June 5, 1994, and listed on the Commission's Agenda at the June 5, 1995, meeting as Item #4. Note that any references and findings cited herein are preliminary and may change before final publication by CPEC.

future projections into a singular assessment of the state's ability to provide access in the future.

The state legislature has also commissioned two studies of the California Master Plan. In 1972–73, it was reviewed by a legislative joint committee. In 1984, another study, commissioned by the legislature, was prompted by "a more general concern regarding the capacity of our institutions of higher learning to respond to California's rapidly changing demographics."[16] This study, which anticipated a state population of 35 million people by 2010, called for the opening of one UC and two CSU campuses by the year 2000 to accommodate demand. Since then, the state's expected population in 2010 has jumped by more than 20 percent to more than 42 million people, and the participation rates by the population in higher education have risen dramatically. While the machinery was put into motion to open the three new four-year campuses, only one, California State University, San Marcos has actually opened. The other two campuses have been in hiatus because of the recession.

Another study, which most closely parallels this analysis, was commissioned by the California Higher Education Policy Center (CHEPC) and done by the National Center for Higher Education Management Systems (NCHEMS) in Boulder, Colorado. Using a less detailed methodology to estimate the expected demands on the state's public systems,[17] the researchers found a growing access problem in the state as well. Their model defined an expected level of demand and tested various fee and economic scenarios in the context of those demand levels. It did not, however, develop separate projections of the state's prospective supply (capacity) of higher education. This analysis begins with separate estimates of both supply and demand

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[16]Joint Committee for Review of The Master Plan in Higher Education, *California Faces . . . California's Future: Education for Citizenship in a Multicultural Democracy,* June 3, 1988, p. Ii. This report reviewed the report of the Commission for the Review of the Master Plan for Higher Education, *The Master Plan Renewed: Unity, Equity, Quality, and Efficiency in California Postsecondary Education,* July 1987. Both reports were in response to the legislation passed in 1984.

[17]The NCHEMS study used 1990–91 as a base year and estimated enrollments at a more aggregate level. Their study makes many of the same assumptions used in this model and is described in Patrick M. Callan and Joni E. Finney, *By Design or Default?* CHEPC, June 1993.

and the consequences of those scenarios as measured by their results in the context of the access goals set by the Master Plan.

Finally, each of the systems has done internal estimates of its expected demand. The University of California system projects the demand for each campus individually. The California State University system has developed an elaborate life table model to project its expected enrollment.[18] The results of this demand model have not been updated since their development in 1989. In April 1992, the Board of Governors of the California Community Colleges, in response to a requirement of the Supplemental Language of the 1991 Budget Act, prepared a *Funding Gap Study* assessing the effects of the several fee scenarios on their ability to meet their Master Plan mission. This study combined an analysis of expected supply and demand for the CCC system. The applicability of this analysis today, which is one of the few public efforts to assess both the supply and demand sides of the problem, is limited by its expectations of General Fund revenue growth in the years following 1991–92. The analysis projected, as did many others, a General Fund revenue total of $53.3 billion in 1995–96, whereas the most recent Department of Finance estimate shows $42.5 billion.

This report fills an important niche in the body of research available on the prospects of the state to meet the access goals of the California Master Plan for Higher Education. It combines recent demographic projections of the state's populations[19] with projections of the state's fiscal resources to estimate these prospects. The overall combination of these issues in the broader context of the issues affecting higher education is an important contribution of this report.

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[18]See Philip Garcia, *The California State University System: Projections of Enrollment Demand, 1990 to 2005*, professional paper from the Division of Analytic Studies, Office of the Chancellor, CSU System, Long Beach, Calif., September 1991 and the accompanying report by the Office of the Chancellor, *Growth and Diversity: Meeting the Challenge, The 1989 California State University Growth Plan for 1990–2005*, Long Beach, Calif., 1989.

[19]For a detailed side-by-side comparison of the various enrollment projections available, see David W. Breneman, Leobardo F. Estrada, and Gerald C. Hayward, *Tidal Wave II: An Evaluation of Enrollment Projections for California Higher Education*, CHEPC Technical Report 95-6, September 1995.

THE RECESSION AS A TURNING POINT

The recession of the early 1990s and its associated fiscal pressures on the state budget brought about some fundamental changes in the way higher education is funded. Prior to the onset of the recession, funding for the state's public higher education systems was largely *demand-driven*, as shown in Figure 1.2. Each of the two four-year systems would estimate the number of students they expected to accommodate under the provisions of their various missions. Using historical cost factors, they would then request enough resources from the legislature and administration to serve that quantity of students. After some negotiating, the state would then establish the appropriation for each of the systems—typically an amount relatively close to the initial request by the system.

The difficult fiscal realities of the recession of the early 1990s changed the complexion of this process. The recession sharply curtailed growth in the state's General Fund revenues and the demands for services grew. As a result, the resources available to higher education were limited. The process associated with negotiating the state's allocation to higher education disappeared. Instead the legislature and administration calculated how much they felt the state could afford to expend on higher education and each of the systems was to do what it could with that allocation.

As a result, fees were raised in all three public systems. Competition for classroom seats in each of the three systems intensified and, in

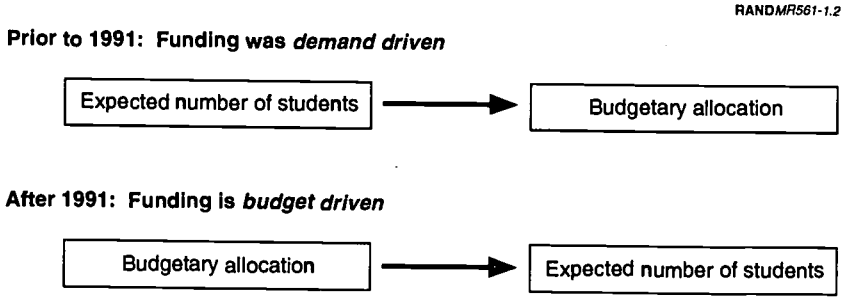

Figure 1.2—The Recession Changed How Higher Education Was Funded

some cases, students were turned away. In still other cases, enrollment and admissions policies were interpreted much more narrowly, resulting in the admission of a lower proportion of the population. In all three systems, there is anecdotal evidence that the increasing fees and other managed-enrollment strategies deterred students who otherwise might have enrolled from applying to the state's public undergraduate institutions.

This report addresses the recent impact of these managed-enrollment strategies and the future prospects for expansion of these strategies and issues. This report also seeks to identify the short-term impacts of these policies over the past few years and then turns to the prospects for reversing the trends associated with these policies. It looks at the magnitude of future student flows likely to be diverted due to the growing constraints on the state's ability and willingness to fund public undergraduate education.

APPROACH OF THIS REPORT

To assess California's future prospects for providing access to higher education, a series of dynamic simulation models of the various components of the state's higher education sector was developed. Two sides to the problem are presented: demand for public education and supply of public education. When this research finds a growing shortfall in the production of public undergraduate education opportunities, it calls into questions the access goals of the Master Plan itself and raises the problems of either expanding the pool of education provided or contending with the implications of a less well-educated population.

This analysis focuses on the production of undergraduate education[20] because it is one of the basic policy goals of the Master Plan.[21] College and university graduates from the undergraduate level provide a significant source of the skilled labor pool in the state and

[20]By undergraduate education, we mean enrollments in the freshman, sophomore, junior, and senior classes in the four-year institutions and only credit enrollments in the two-year institutions.

[21]Total enrollments, which include graduate enrollments in the four-year systems and non-credit enrollments in the two-year system, are discussed in Appendix G.

represent the vast majority of the student output of the state's higher education sector. A similar model could be generated for graduate education, but the policy issues and implications are different and are left for another study.

The general approach of this analysis is to develop a projection of the demand for public undergraduate higher education, based on a certain set of assumptions described below, and to develop a projection for the supply of public undergraduate education that will be available to these students. In the context of this comparison, one can see whether there is likely to be a surplus of public capacity (an *access surplus)* or a shortfall in capacity (an *access deficit*).

ORGANIZATION OF THIS REPORT

The next chapter discusses the development of our baseline scenario and the implications of the most recent policy changes on the state's public higher education systems' provision of undergraduate education. Chapter Three considers the long-term projections of both the supply and demand for public undergraduate education and the access deficit that arises as a result of the collision of the state's burgeoning population and its fiscal limits. Chapter Four discusses the magnitude of the problem identified in Chapter Three, identifying the magnitude of fiscal and productivity improvements that would be necessary to address the access deficits. Chapter Five provides a summary and briefly discusses the implications of this report's findings.

Chapter Two

CALIFORNIA HIGHER EDUCATION TODAY: MANY FEWER STUDENTS SERVED

In light of the changes in higher education finance brought about by the recession of the early 1990s in California, this chapter discusses the impact of those changes on the state's higher education sector. Specifically, it introduces a measure of the impact of the policy changes enacted in response to the sector's fiscal malaise on demand for higher education. Using this comparative measure, called baseline demand, it is shown that current enrollment levels represent a significant decrease in the level of service provided by the state's public higher education systems.

THE DEMAND FOR PUBLIC UNDERGRADUATE EDUCATION

The demand for public undergraduate education is complicated to define and estimate. Higher education is a complex good. The choice to pursue higher education is couched in many opportunity-cost choices that are hard to measure. The opportunity costs associated with the decision to pursue higher education at all are also complex, trading off foregone years of income in the short term for perceptions of higher-income streams in the future for varying degrees of completion of higher education; even this trade-off varies across systems and institutions.

In addition, the good itself is not homogenous—not all degrees from all institutions have the same comparative values. In addition, the actual purchase of the good is selective on both the demand and supply sides of the equation—even as students have a choice as to which higher education institutions they wish to attend, higher edu-

cation institutions select which students they wish to accept. The difference in the demands for public and private institutions also adds a degree of complexity to the problem. For example, while private institutions may be competitive and selective in their range of applications accepted, public institutions are there explicitly to serve the public and must instead accept all eligible students.[1]

In light of the difficulties of a microeconomic approach to estimating demand for public higher education, an alternative approach was used. This approach ascertains the demand for education, given the conditions at a certain time, and then adjusts that estimate for changes in the state's population at a detailed level. This demand estimate, called the baseline demand in this report, reflects expected enrollments if the conditions in the baseline year are sustained into the future.

A BASELINE FOR COMPARISON

Because the recession represented a significant change in the way the state went about funding higher education, this analysis starts with the question, "What would public undergraduate enrollments look like if the recession and its attendant enrollment management policies had never occurred?" This scenario is referred to as the baseline scenario in this study because it holds everything constant at pre-change levels and represents a measure against which we can assess the outcomes of various scenarios.

To generate the baseline scenario, a dynamic simulation model is used to apply participation rates from the baseline period to freshman and transfer entries into each of the public systems. These students are then aged through the systems, on a year-by-year basis, until they finish. The participation rates are also derived from the baseline reference year. This approach has the strength of considering the year-to-year variation in student populations and the underlying source populations. The interaction among the systems is also considered in this baseline model, because transfers among the three public systems are tracked. Transfers to outside institutions and

[1]This caveat has recently been violated as public institutions have turned away students, using predominantly a first-come, first-served criterion.

from other institutions are considered as well. The baseline approach thus has the additional advantage of allowing the consideration of all three public systems simultaneously and in aggregate.

Estimating Baseline Demand

The baseline demand model used in this study generally applies the participation and population rates in the baseline year to detailed population projections for the state. The detailed description of the technical dimensions of the models described in this report are found in Appendices A through F. This model uses 1989–90 as the baseline year for reasons discussed below and uses the most recent detailed population projections from the California Department of Finance's Demographic Research Unit.[2]

The General Methodology. The basic methodology for estimating public undergraduate demand in this report uses a sophisticated simulation model to track students through the three public systems. It is based on actual participation and transition rates in the baseline year (see below) and details each cohort of students along several important dimensions: age, gender, ethnicity, enrollment status (full or part-time), and system. It tracks each subcohort of each class in each system through its tenure in the system.

The model does this in two stages: (1) it admits students into the respective systems and (2) it ages them through the systems using class-to-class transition rates. Students are admitted into each system through two sources—freshmen and transfers. Freshmen admissions are generated by calculating subcohort-specific participation rates across all the individual groups described in the paragraph above.[3] Transfer entries are generated by calculating transfer prob-

[2]The values in this study are from the summer of 1993. Although the Department has issued revisions to the overall numbers reported in these projections, these are the latest series with the detail necessary to execute this model. Sensitivity comparisons of the robustness of this model's results to the downward revisions found in the Department's most recent estimates show that the findings reported herein would drop by only 1.5 percent in the most sensitive scenario.

[3]It has been argued that using high school student graduating classes will provide a better pool for estimating new enrollments at some institutions. Whereas this is possibly true for the University of California, where most students enter directly from high school, it is less appropriate for the California State University and the California

abilities for each class in each of the systems and then aggregating the resulting transfers into the appropriate recipient institution subcohort. Students are aged through the system by estimating aggregate probabilities of movement into the next class, again by subcohort detail.

The entire baseline model is estimated at the subcohort level, retaining detail throughout the model until the final period is calculated. The subcohorts are finally aggregated to produce the enrollment levels reported in this chapter—namely how many students would be expected in each of the systems if participation and transition levels had remained at baseline year levels.

1989–90 as a Baseline Year. The baseline reference year selected for this analysis was the academic and fiscal year 1989–90. This year was selected for several reasons. The academic and fiscal years 1989–90 and 1990–91 were the last two years in which the funding process for higher education was predominantly driven by enrollments. As a result, the number of students enrolled by each of the systems represents some proxy for the number of students interpreted as those they should be serving under the Master Plan. This baseline year also occurs before the advent of the fee increases and managed-enrollment strategies brought about by the recession.

The year 1989–90 was chosen instead of 1990–91 largely as a measure of conservatism, because 1990–91 was the peak year overall in participation rates, and the findings of this study would have been higher. The projections were also executed using the average participation and transition rates from the 1980s. Although the resulting series were slightly lower, the overall trend was toward increasing participation and retention—in part the result of numerous outreach programs by the systems themselves. As a consequence, holding participation and retention rates constant at 1989–90 levels may well underestimate what future participation and retention rates would have been without the fiscal and structural shocks of the early 1990s. The approach using average rates for the 1980s also produced a slight

Community College systems, where more older and nontraditional students enroll. In the interest of consistency across the three systems, population-based subcohorts are used. As long as graduation rates remain relatively consistent over time, this methodology is equivalent to using high school graduation-based cohorts.

disjunction in the transition between the actual and projected data, so the 1989–90 baseline was used to assure continuity.

FINDINGS: THE RECESSION HAS DRIVEN ENROLLMENTS DOWN SIGNIFICANTLY

Using the methodology described above, projections for the most recent complete academic year were generated for the three public systems and are presented in Table 2.1, along with current enrollments in each of the systems. The second column in this table presents the number of undergraduate students that would have enrolled in the state's public systems, absent the impact of the policies of the 1990s. The third column represents the actual number of students attending public undergraduate institutions in 1994–95. The fourth column is the difference between the two enrollment figures, and the fifth column indicates what proportion of the baseline level was not enrolled.

As a result of the policies instituted during the past few years, *more than 200,000 undergraduates* are not attending the state's public higher education systems who otherwise could have been expected

Table 2.1

Baseline and Actual Public Undergraduate Enrollments, 1994–95 (thousands of students)[4]

System	Baseline Projection	Actual Enrollment	Enrollment Reduction	Percentage Reduced
California Community Colleges	1,370	1,206	164	12%
California State University	301	267	34	11%
University of California	127	121	6	5%
Total	1,798	1,594	204	11%

SOURCE: Derived from this analysis. See Appendix A for details.

[4]These enrollment series are reported in headcount enrollments in this report. The actual models are executed in full-time equivalents and then converted to headcount enrollments for reporting here. See the Appendices A through C for details.

to attend. This table indicates that *11 percent* of the overall number of undergraduate students one would have expected if the recession had not occurred did not attend the state's public institutions. Arguably, these decreases were a function of limited space, managed-enrollment strategies, and fee increases. Most of these offsets were in the California Community College system, although significant numbers were also deflected from the California State University system. The fee increases and managed enrollment had a much smaller impact in the University of California.[5]

As a consequence of these reductions, the overall level of service provided by the state's public systems is less than the level provided in prerecessionary periods. What is the import of a decreased level of service? One answer is that the level of service provided by the state's public institutions represents one measure of the level of the access (as discussed in the Master Plan) that students have to higher education. If the future continues on the path of the past several years and the level of service continues to decline, the prospects and realities of meeting the access goals of the Master Plan will worsen and decline. The next chapter of this report will look at those future prospects in greater detail.

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[5]One possible explanation for the lesser impact in the University of California is that UC competes more directly with private institutions that had increased their tuitions significantly during the 1980s while UC's fees remained flat.

Chapter Three

CALIFORNIA HIGHER EDUCATION TOMORROW: ACCESS DEFICITS

Beyond the effects of current policies on overall potential enrollments, the state's ability[1] to accommodate future demand for higher education is an area of concern. The state's population is expected to grow by about 10 million people over the next 15 years. At the same time, the demands on the state's discretionary resources are expected to grow significantly.[2] This chapter looks at both the future demand and future supply. It puts these two sets of numbers together and identifies sustained shortfalls—termed "access deficits"—in the state's prospective capacity to meet the future demands for access to higher education.

A GROWING FUTURE DEMAND FOR PUBLIC UNDERGRADUATE EDUCATION

The future demand for higher education is projected as a function of the baseline projections of demand introduced in the prior chapter. The baseline projections are extended into the future and the impacts of current policy choices already implemented are then carried into the future. The baseline projections, which represent overall enrollment demand without the impacts of recent and possible future policy changes, are presented in Table 3.1. As this table shows, the demand for public undergraduate education, driven only by the de-

[1] "Ability" is used loosely in this context to encompass both the state's capacity to provide resources and its willingness to expand that capacity through revenue enhancements.

[2] See below and Stephen J. Carroll, 1995.

Table 3.1

Projections of Baseline Demand for Public Undergraduate Education (students)

Year	California Community Colleges	California State University	University of California	Total
1995–96	1,403,288	301,497	127,040	1,831,825
1996–97	1,435,113	303,320	127,836	1,866,269
1997–98	1,466,524	306,363	129,381	1,902,268
1998–99	1,498,711	310,887	131,851	1,941,449
1999–00	1,532,542	316,943	135,266	1,984,751
2000–01	1,566,487	323,230	138,722	2,028,439
2001–02	1,600,170	330,045	142,180	2,072,395
2002–03	1,634,309	336,895	145,433	2,116,637
2003–04	1,668,474	342,584	147,982	2,159,040
2004–05	1,703,162	348,293	150,566	2,202,021
2005–06	1,737,934	353,663	152,934	2,244,531
2006–07	1,772,627	358,579	155,036	2,286,242
2007–08	1,808,208	363,808	157,340	2,329,356
2008–09	1,845,707	369,402	160,004	2,375,113
2009–10	1,886,656	376,671	163,867	2,427,194
2010–11	1,930,094	384,885	168,325	2,483,304

SOURCE: Derived from this analysis. See Appendices B and C for details.

mographic forces in the state's population, would rise by 36 percent over the next 15 years, with the majority of the growth coming in the California Community College system. This represents an increase of more than 650,000 students.

The state has already implemented a series of policy initiatives, however, that will affect these enrollments. In the prior chapter, it was shown that these changes have a significant impact on the number of students who desire or are able to attend public undergraduate programs. It is unlikely that any of these new policy initiatives will be fully undone.

For purposes of comparison, therefore, a series was developed factoring these policies into account. These projections were created by multiplying the baseline projection for a given year by the fraction, in each system, of baseline enrollment currently accommodated in the three systems (denoted in the fifth column in Table

2.1).[3] The resulting enrollment demand series, called *expected demand* here, is presented in Table 3.2 below. This enrollment series reflects the expected number of students who would want to attend each system if a place were available—given a continuation of current enrollment, fees, recruiting effect, and admissions policies.

These series show a comparable percentage growth in enrollments over the next 15 years, increasing 35.5 percent (note that it is a comparable growth in a smaller base). The result represents an increase of more than 570,000 students. It shows, however, that the continuation of current policies in 2010–11 will exclude more than 300,000 students who otherwise would have attended.

Table 3.2

Projections of Expected Demand for Public Undergraduate Education (students)

Year	California Community Colleges	California State University	University of California	Total
1995–96	1,222,365	266,023	121,722	1,610,110
1996–97	1,250,086	267,632	122,484	1,640,202
1997–98	1,277,448	270,317	123,965	1,671,730
1998–99	1,305,485	274,308	126,332	1,706,125
1999–00	1,334,954	279,652	129,603	1,744,209
2000–01	1,364,523	285,200	132,914	1,782,637
2001–02	1,393,863	291,213	136,228	1,821,304
2002–03	1,423,600	297,256	139,344	1,860,200
2003–04	1,453,361	302,276	141,787	1,897,424
2004–05	1,483,576	307,313	144,263	1,935,152
2005–06	1,513,865	312,052	146,532	1,972,449
2006–07	1,544,086	316,390	148,545	2,009,021
2007–08	1,575,079	321,003	150,754	2,046,836
2008–09	1,607,743	325,938	153,306	2,086,987
2009–10	1,643,413	332,353	157,007	2,132,773
2010–11	1,681,250	339,600	161,278	2,182,128

SOURCE: Derived from this analysis. See Appendix A for details.

[3]The actual methodology used to accomplish this adjustment is presented in Appendices B and C. Note that the proration is not exactly this fraction but includes some minor adjustments for possible policy changes. The net impact of this adjustment is negligible and, if anything, is conservative, causing demand projections to be smaller.

A SHRINKING FUTURE SUPPLY OF PUBLIC UNDERGRADUATE EDUCATION

The supply of public undergraduate education is a complex phenomenon. The supply available is also dependent on a wide range of uncertain parameters such as the state General Fund revenues, each system's share of those revenues, the cost of producing undergraduate education units in each system, the expected level of property tax revenues, the ratio of undergraduate to graduate students, and the expected levels of other revenue sources such as lottery revenues and federal funds.

The supply of undergraduate education has two major dimensions—operating capacity and capital capacity. Operating expenditures are those that fund the day-to-day operations of the institution. Expenditures on the operating side of the equation include such things as faculty salaries, support staff, library acquisitions, administration, utilities, and general maintenance. Capital expenditures are those that expand the physical capacity of the system and include such things as new buildings and major repairs and upgrades of existing buildings.

The actual monies for capital expenditures generally come from bond issues that are then paid off in annual bond payments. These annual payments are the primary budgetary issue because they represent a fiscal obligation of the state. The bond issues themselves, however, have become more problematic; California voters have recently refused to approve the necessary ballot initiatives to authorize the education bonds. While the focus here is on the budgetary dimensions of the capital, the hesitance of the people of the state to approve such capital investments must also be considered.

In addition to the concerns about the availability of capital resources, the fiscal context of the state's primary source of operating resources to the sector—General Fund revenues—is uncertain. The next section will discuss some of the issues associated with the state's fiscal context.

The State Budgetary Picture

California's budget has suffered a series of setbacks in recent years. Although the severe recession in California has had a tremendous impact on the future prospects for revenues, the forces that precipitated the crises began in the mid-1970s with the passage of Proposition 13. This initiative rolled back local property taxes and made it much more difficult to increase taxes. Because of the major fiscal effects of this initiative on local districts and governments, the state replaced much of the lost local funding dollars from its General Fund coffers. As a consequence, the support of many programs and activities was removed from the local government and placed, indirectly through the purse strings, in the hands of the state government. In times when the state budget was robust, this was not an issue. In recent years, however, and especially in the context of the recession, the competition for the state's General Fund revenues has become quite intense. Additional voter-approved initiatives, such as Proposition 98[4] and the "three strikes initiative"[5] have increased the demands on the state's General Fund revenues.

Rapidly rising caseloads in numerous federally mandated programs have also caused an explosion in the demand for state monies. Current estimates from RAND research indicate that these demands will rapidly outstrip the availability of resources.[6] The growth in just a few of these mandated programs will more than outstrip the future availability of funds. Table 3.3 represents an estimate of the future program expenditures in California. In that analysis, a caseload-

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[4]This initiative, approved by the voters in 1988, established minimum spending levels for K-14 education.

[5]When taken in conjunction with the court-determined requirements for prison overcrowding, this law will result in a significant increase in the demand for state funds to support prison construction and operations. California's three-strikes law mandates 25 years to life in prison for anyone convicted of a felony following two prior convictions for serious crimes.

[6]The RAND model synthesizes much of the work in the state regarding the demand for General Fund revenues. The RAND projections, while falling toward the lower end of the spectrum, are generally consistent with other available projections. The reader is referred to Stephen Carroll, Peter Rydell, Eugene Bryton, and Michael Shires, *California's Fiscal Future*, MR-570-IET, 1995, and Stephen Carroll, Kevin McCarthy, and Mitchell Wade, "California's Looming Budget Crisis," *RAND Research Review*, Fall 1994, Vol. 18, No. 2 for more detailed discussions of the available literature and research on this topic.

Table 3.3

Overall Share of State Expenditures, by Program (percentage of General Fund revenues)

Category	1994–95	2004–05
K-14 Education	39	39
Health and Welfare	33	32
Corrections	8	20
Higher Education	10	10
Other	10	10
Total	100	111

SOURCE: 1994–95: Office of the Legislative Analyst, *Focus Budget 1994: Highlighting Major Features of the 1994 California Budget*, July 13, 1994; 2004–05: Carroll, et al., *Projecting California's Fiscal Future*, RAND, MR-570-IET (1995).

based estimate of the demand for mandated and constitutionally defined programs has been prepared.

In this table, state General Fund expenditures are separated into five categories corresponding to the major budget spending areas. The amounts for K-14 education are constitutionally mandated by the provisions of Propositions 98 and 111, and the amounts used in this table represent the actual amounts for 1994–95 and the projected *minimum* amount required to be funded to K-14 education, given what is expected to happen with the state's demographics and finances, for 2004–05.

The "health and welfare" category includes the range of state-supported health and welfare programs mandated by federal law.[7] Large-ticket items in this category include the state Medi-Cal program, Supplemental Security Income (SSI), and Aid to Families with Dependent Children (AFDC). This estimate is based upon a detailed analysis of the caseloads and costs associated with "health and welfare." The findings indicate that payments associated with these amounts are unlikely to decrease as a share of state the General Fund budget and, if anything, are expected to increase. The current fiscal

[7]Note that Medicare is not included in this account because the federal government provides the funding for this program and the monies are passed directly to the service providers, bypassing the state.

year share of the General Fund budget is therefore retained as an estimate of the 2004–05 budget share.[8]

The "corrections" figures reflect the consequences of the "three strikes" law and the figures used here are from RAND's recent report on the consequences of this law.[9] It is important to remember that this law was approved by the voters as a ballot initiative in the November 1994 election and will subsequently require a similar vote or finding of unconstitutionality to reverse it. Readers are referred to this report for a more detailed review of the implications and details of this law. The 2004–05 amounts are derived from the RAND report amounts for necessary General Fund expenditures to implement the "three strikes" law.

"Higher education" includes state support of the two public four-year systems as well as its support for a range of other institutions such as the state library, the California Maritime Academy, and the California Postsecondary Education Commission. When community colleges are included, the three public systems account for 95 percent of total state support for higher education. For this comparison, the share for the two public four-year systems has been carried over to 2004–05 for comparison.

"Other" includes all other spending categories in the state, including, among others, the legislature, the courts (not included under corrections), and the California Environmental Protection Agency. The 1994–95 share has been carried over to 2004–05 for comparison.

The table shows that estimated demand for spending outstrips the resources available. The state would spend 111 percent of its rev-

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[8]Remember that the research referenced in this section holds the current structure of entitlements constant. If federal block grants are enacted, these findings may change. It is not immediately clear that the state will achieve any cost savings from such an occurrence. In fact, if block grants are enacted in their current form, it is likely that the state will experience increases in the demands for state monies in this area as federal dollars are reduced.

[9]Peter W. Greenwood, C. Peter Rydell, Allan Abrahamse, Jonathan P. Caulkins, James Chiesa, Karyn E. Model, and Stephen P. Klein, *Three Strikes and You're Out: Estimated Benefits and Costs of California's New Mandatory-Sentencing Law*, Santa Monica, Calif.: RAND, MR-509-RC, 1994.

enues,[10] equivalent to a deficit of almost $5 billion in the current fiscal year. Obviously, the state cannot outspend its revenues at this level and will have to cut back somewhere—but where?

The first three categories listed in Table 3.3 (K-14 education, health and welfare, and corrections) are currently mandated either by state constitutional provisions or federal law. In 1994–95, they accounted for 78 percent of the General Fund budget. In 2004–05, these three mandated categories will account for 91 percent of the expected revenues. This leaves only 9 percent of the General Fund revenues to pay for both higher education (the two four-year systems and other miscellaneous programs) and the operation of the state government and many state agencies.

Note that the "general government" entities with which higher education must compete have already experienced significant cutbacks over the past several years because of budget difficulties and specific voter interventions. Because higher education must compete with the legislature, the courts, the Environmental Protection Agency (EPA), and other state agencies for the remaining 9 percent,[11] prospects for sustaining its current revenue share without a significant constitutional revision or federal welfare reform are bleak.

These latter issues—the possibility of a state constitutional reform or a major federal welfare reform—are important possibilities to consider. Given this fiscal scenario, it is clear that something will have to change. Because of the highly speculative nature of the possible forms these reforms could take, this analysis does not address them but instead analyzes the problem only in the context of the current structures existing in state finance.

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[10]These are shares and the author readily recognizes that the total shares cannot exceed 100 percent. The 111 percent figure was derived by estimating the total demands for General Fund revenues in 2002–03 based on caseloads and other assumptions and dividing by the expected General Fund revenues. The resulting dilemma is precisely the issue.

[11]The exception to this situation is the California Community College system, whose revenues are at least in part guaranteed by the provisions of Propositions 98 and 111. Note, however, that this protection is not guaranteed, as history has shown. In the 1993–94 fiscal year, the community college share of Proposition 98 monies was decreased to maintain a higher per-pupil expenditure level in the K-12 sector.

The Supply of Higher Education

As indicated above, the supply of higher education in the state has two dimensions—operating supply and capital supply. The effective supply of education available in the state is the lesser of these two items. If there are not enough resources to fund faculty, for example, it does not matter that a system has physical seats available on its campuses. Likewise, if there is not adequate classroom space available, then the availability of resources to hire faculty is irrelevant. These two series are estimated separately below.

Operating Supply. Because state support is an important element of the financing of public undergraduate institutions and the level of that support is uncertain, two scenarios are calculated for estimating the supply of education available in the future. The first scenario, the "expected supply" scenario, linearly reduces the higher education share of General Fund revenues for the two four-year systems over 10 years to half their share in 1993–94. The minimum levels of state support for the California Community College system are set by the provisions of Propositions 98 and 111 and are kept at these levels in the expected supply scenario.[12]

The "optimistic supply" model is identical to the expected supply model except that the share of state General Fund revenues going to UC and CSU are held constant at their 1994–95 levels. In light of the discussion, this prospect is highly unlikely, but it is a useful bound for sensitivity analysis. These changes affect only the operating side of the supply equation. The capital dimension is handled differently, as described below. The results of the expected and the optimistic operating supplies will therefore be described separately from the capital results, which remain constant.

The operating supply model adds these projections of the state General Fund support of higher education to projections of other sources that are generally available to support undergraduate education.[13] It divides these funds by a unit operating cost (see below) to

[12]The RAND economic models and this research all use a 3 percent inflation rate for all projections. The models are estimated in constant dollar terms and then restated in current dollars for understandability.

[13]This includes most categories on noncapital, nonresearch funds.

arrive at a total campus operating capacity projection. The total campus operating capacity is then allocated between graduates and undergraduates using the current ratio.

The unit operating cost per full-time equivalent (FTE)[14] associated with producing operating capacity in both models is assumed to grow at between 1.4 and 2.0 percent annually in real terms. The growth in costs is based on historical levels. The basepoint for costs is the most recent year for which detailed actual information regarding resources and enrollments were available (1993–94). The costs in this reference year reflected the effects of significant budget cuts from the prior three fiscal years and, hence, a relatively lean cost structure.[15]

The resulting projections of operating capacity for the "expected scenario" and for the "optimistic scenario" are shown in Tables 3.4 and 3.5, respectively.

Capital Capacity. Capital capacity in both the expected and the optimistic supply scenarios is held at current estimated capacities. These capacities are derived in part from the recent CPEC draft agenda item *A Capacity for Growth: Enrollments, Resources, and Facilities for California Higher Education, 1993–94 to 2005–06.*[16] While all three systems have plans on paper for significant expansions, the resources to fund them are not expected to be available. As an example, the Central Valley campus of the University of California has been under consideration for several years. The exception is the Monterey Bay campus of the California State University system, which will be funded largely by federal base-

[14]FTE is a measure that accounts for part-time enrollments by weighting their numbers by the proportion of a full-time load they take. Suppose the full-time load in an institution is 15 hours and that two students attend 10 hours each. Together the students represent 1.33 FTEs, or they would use resources equivalent to those of 1.33 full-time students.

[15]Community colleges were not completely immune to this effect. The language enacted by Proposition 111 provides for reductions in the Proposition 98 guarantee in bad budget years for the state. See Appendix E for a detailed discussion of these provisions.

[16]See Chapter 4, "The Need to Expand: A Discussion of Physical Capacity" (pp. 65–82). Note that these numbers are drawn from a draft dated June 5, 1995, and as such are subject to change and revision by the Commission. Capacities for years after 2005–06 are held constant at 2005–06 levels.

Table 3.4

Projections of Expected Operating Supply for Public Undergraduate Education (students)

Year	California Community Colleges	California State University	University of California	Total
1994–95	1,232,006	271,051	120,656	1,623,713
1995–96	1,207,569	264,731	110,239	1,582,539
1996–97	1,230,038	254,975	106,460	1,591,473
1997–98	1,245,976	243,656	102,257	1,591,889
1998–99	1,251,460	230,421	97,240	1,579,121
1999–00	1,259,290	217,765	92,405	1,569,460
2000–01	1,264,833	204,101	87,116	1,556,050
2001–02	1,270,585	190,363	81,747	1,542,695
2002–03	1,276,458	176,441	76,252	1,529,151
2003–04	1,283,368	162,512	70,710	1,516,590
2004–05	1,287,841	148,732	65,184	1,501,757
2005–06	1,287,575	147,834	64,961	1,500,370
2006–07	1,278,485	146,874	64,725	1,490,084
2007–08	1,277,099	145,669	64,395	1,487,163
2008–09	1,285,655	144,367	64,032	1,494,054
2009–10	1,294,037	142,973	63,628	1,500,638
2010–11	1,302,439	141,513	63,192	1,507,144

SOURCE: Derived from this analysis. See Appendix A for details.

conversion dollars. The additional capacity represented by this campus is included in the initial number. The resulting projections are presented in Table 3.6.

ACCESS DEFICITS: A SHORTAGE OF PUBLIC UNDERGRADUATE EDUCATION

Detailed estimates of the supply and demand of public undergraduate education in California are important, but a more important question must be addressed: What are the state's prospects for providing the level of access to undergraduate education envisioned in the California Master Plan? To answer this question, the estimates of the baseline and expected demand for public undergraduate education are combined with the estimates of the supply of public undergraduate education above.

Table 3.5

Projections of Optimistic Operating Supply for Public Undergraduate Education (students)

Year	California Community Colleges	California State University	University of California	Total
1994–95	1,232,006	271,051	120,656	1,623,713
1995–96	1,207,569	277,516	115,307	1,600,392
1996–97	1,230,038	280,803	116,749	1,627,590
1997–98	1,245,976	282,719	117,891	1,646,586
1998–99	1,251,460	282,505	118,184	1,652,149
1999–00	1,259,290	283,061	118,784	1,661,135
2000–01	1,264,833	282,285	118,845	1,665,963
2001–02	1,270,585	281,307	118,822	1,670,714
2002–03	1,276,458	279,888	118,612	1,674,958
2003–04	1,283,368	278,247	118,311	1,679,926
2004–05	1,287,841	276,627	118,016	1,682,484
2005–06	1,287,575	275,078	117,751	1,680,404
2006–07	1,278,485	273,453	117,462	1,669,400
2007–08	1,277,099	271,375	116,991	1,665,465
2008–09	1,285,655	269,137	116,454	1,671,246
2009–10	1,294,037	266,714	115,832	1,676,583
2010–11	1,302,439	264,153	115,143	1,681,735

SOURCE: Derived from this analysis. See Appendix A for details.

COMBINING DEMAND AND SUPPLY PROJECTIONS

To understand the supply and demand implications of the expected and optimistic supply scenarios, the four categories of series discussed above are combined. Figure 3.1 is an example of this effort using the expected operating supply scenario and looking at the overall total of public undergraduate education.

The four series in the first figure represent the baseline demand (Table 3.1), the expected demand (Table 3.2), the expected operating supply (Table 3.4), and the capital supply (Table 3.6). In any given year, the quantity of education actually produced and consumed will be marked by the lowest of these four lines. For example, in 2005–06, the lowest line is the operating supply, so the number of units of higher education consumed (i.e., the projected enrollment) will be the estimated operating supply for that year, or 1.5 million students.

Table 3.6

Projections of Capital Supply for Public Undergraduate Education (students)

Year	California Community Colleges	California State University	University of California	Total
1994–95	1,177,553	271,939	124,840	1,574,332
1995–96	1,177,553	272,628	124,840	1,575,021
1996–97	1,177,553	273,041	124,840	1,575,434
1997–98	1,177,553	273,470	124,840	1,575,863
1998–99	1,177,553	273,901	124,840	1,576,294
1999–00	1,177,553	274,336	124,840	1,576,729
2000–01	1,177,553	274,762	124,840	1,577,155
2001–02	1,177,553	275,214	124,840	1,577,607
2002–03	1,177,553	275,685	124,840	1,578,078
2003–04	1,177,553	276,288	124,840	1,578,681
2004–05	1,177,553	276,905	124,840	1,579,298
2005–06	1,177,553	277,629	124,840	1,580,022
2006–07	1,177,553	277,629	124,840	1,580,022
2007–08	1,177,553	277,629	124,840	1,580,022
2008–09	1,177,553	277,629	124,840	1,580,022
2009–10	1,177,553	277,629	124,840	1,580,022
2010–11	1,177,553	277,629	124,840	1,580,022

SOURCE: Derived from this analysis. See Appendix A for details.

The binding constraint cannot be a level represented by a line above the bottom. If it were represented by the capital capacity line, for example, which is above the expected operating capacity, the systems would be providing physical seats for students for which there would be no faculty and no libraries. Similarly, if one of the two demand series were the lowest line, then it would be the binding constraint. If this were the case, the quantity of education consumed/produced would be the amount demanded, and building more capacity, whether operating or capital, would not affect it.

The difference between the demand, which represents a measure of the sector's goal level of production, and the binding constraint represents a reduction in the overall level of service from prerecessionary levels. This reduction in service represents a reduction in the level of access to public undergraduate education—an "access deficit." In Figure 3.1, the access deficit is the number of students

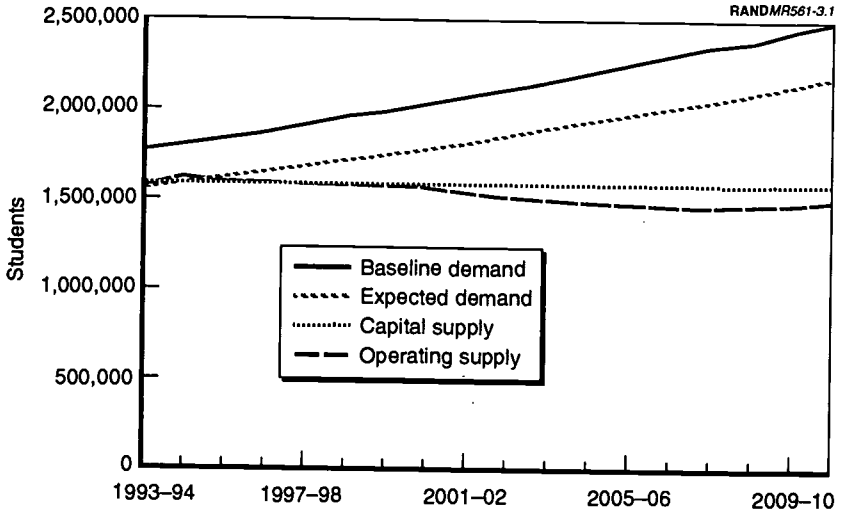

Figure 3.1—Demand and Supply of Public Undergraduate Education (Expected Operating Supply Scenario)

represented by the difference between the baseline demand and the binding constraint (in this case expected capital capacity).

Figure 3.2 contains the same series as Figure 3.1, except that the series labeled "operating supply" is the optimistic operating supply from Table 3.5.

Note that the capital supply is now the binding constraint in the optimistic scenario. Furthermore, even though the operating supply is much higher, it still remains relatively flat while the expected and baseline demands continue to rise—signaling that the access deficit will continue even in the most optimistic fiscal outlook.

In both Figures 3.1 and 3.2, it is also important to note that both supply lines mostly fall far below *both* the baseline and the expected demand lines. This occurrence indicates that even a continuation of current policies will not close the overall access gap and that that gap will widen in the future. The state's public higher education sector will have to consider new approaches to rationing those few seats available.

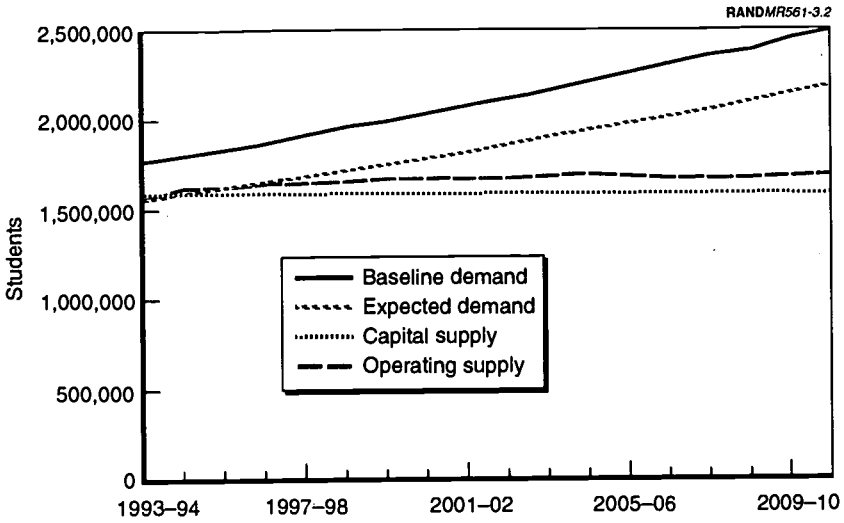

Figure 3.2—Demand and Supply of Public Undergraduate Education (Optimistic Operating Supply Scenario)

Another way of considering this problem is to look at only one year at a time. In the year 2005–06, 2.25 million students would have attended the three public higher education systems as undergraduates. The extended impact of current managed enrollment and fee policies means that 272,000 students will not be able to attend, leaving 1.97 million students demanding seats. Supply constraints will result, however, in only 1.39 million available seats. As a result, only 1.39 million students will be served in the state's public higher education institutions. Using the baseline level of service as a reference point, the state will be providing only 62 percent of the level of service provided in the late 1980s. Figure 3.3 summarizes this finding graphically. Note that more than one-fourth of the decline in the level of service is caused by supply constraints.

Even the optimistic operating supply scenario, in which higher education's share of state General Fund revenues remains constant at 1994–95 levels, does not close the access deficit. Figure 3.4 portrays the findings in this scenario and, while the overall level of service does rise by 8 percent to 70 percent of baseline levels, the scenario

RANDMR561-3.3

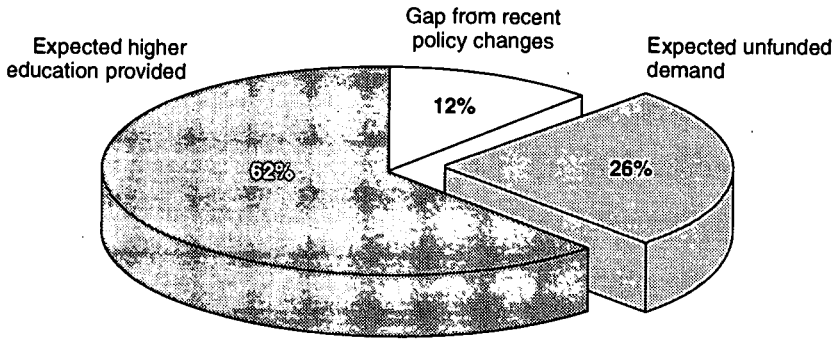

Figure 3.3—Comparison of Public Undergraduate Education in 2005–06 to Baseline Levels with Expected Operating Supply

RANDMR561-3.4

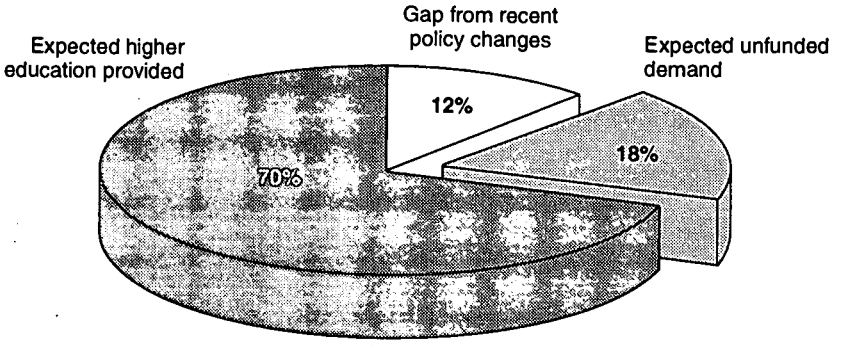

Figure 3.4—Comparison of Public Undergraduate Education in 2005–06 to Baseline Levels with Optimistic Operating Supply

still represents a decline in the level of service of 30 percent—of which 12 percent can be attributed solely to supply-related constraints.

The experience of the three systems varies significantly, however. For example, Figure 3.5 presents the experience of the University of California. In this case, the gap arising from current policies is quite small, accounting for only 4 percent of the baseline level of service. The actual service level is less than half the prerecessionary level. Even with the optimistic operating supply, the University still produces only 77 percent of prerecessionary levels.

In the case of the California State University system (Figure 3.6), the results are quite comparable, although the gap arising from policies already implemented by the system has a much larger impact. The expected higher education provided is also at about 42 percent of baseline levels. Like the University of California, the optimistic supply scenario results in the system providing about three-fourths of the baseline level of service.

Figure 3.7 shows that not even Proposition 98 can protect the California Community Colleges from the collision between the state's demographic and fiscal futures. The system will provide only

Figure 3.5—Comparison of Public Undergraduate Education Provided by the University of California System in 2005–06 to Baseline Levels with Expected Operating Supply

RANDMR561-3.6

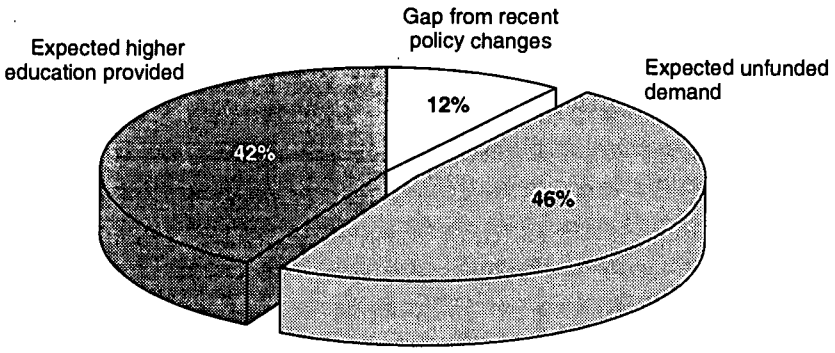

Figure 3.6—Comparison of Public Undergraduate Education Provided by the California State University System in 2005–06 to Baseline Levels with Expected Operating Supply

RANDMR561-3.7

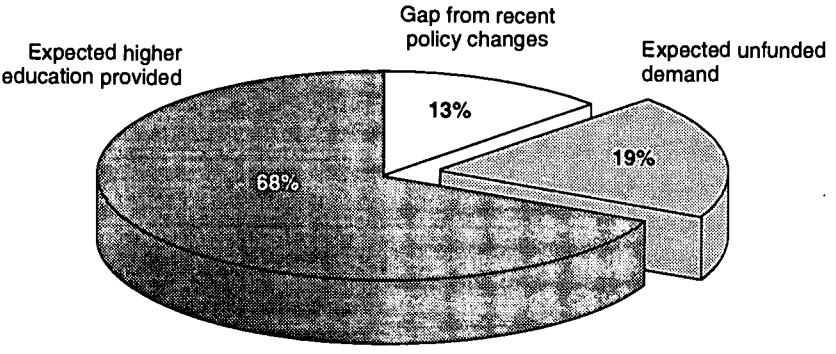

Figure 3.7—Comparison of Public Undergraduate Education Provided by the California Community College System in 2005–06 to Baseline Levels with Expected Operating Supply

two-thirds of the level of service it did in the late 1980s. Because the funding for the California Community Colleges is calculated under the auspices of Propositions 98 and 111, the chart applies to both the expected and the optimistic supply scenarios.

One finding is clear from the analysis to this point—absent a major change in the financing or productivity of higher education—***the combination of the state's burgeoning population and dire fiscal limits will result in a significant reduction in the level of educational services provided by the state's public higher education sector—an access deficit.*** This finding is consistent across all three public systems, even in the California Community College system whose funding is protected by Proposition 98. It is also persistent—even in the optimistic state funding scenario.

Chapter Four

PROSPECTS FOR CLOSING THE ACCESS DEFICIT

The prior chapter has demonstrated that, unless circumstances change, the level of service provided by the state's higher education sector is likely to decline in the future—and by a significant amount. The proliferation of the lower level of service into the next century will drastically reshape the perceptions of what, until now, has been considered and operated as a public good.

It has been argued by some and is perceived by many that these issues are exclusively the result of the recent recession and that many of the problems will disappear as the state emerges from the recession and money becomes more available. Advocates of this position point to Governor Wilson's "compact with education" in the 1995–96 budget cycle in which the state essentially promised 4 percent annual increases over the next four years.[1] Others argue that the budget and fiscal scenario contained in Chapter Three is much too pessimistic. In response to these criticisms, this chapter looks at the access deficits in two different ways. First, it considers the impacts of changing the underlying budgetary scenarios in this model, revisiting the findings of the previous chapter under both high and low fiscal scenarios. Second, it approaches the problem by starting with the desired goal and estimating the cost of reaching that goal—both in terms of closing the access deficit through increased financial support and through increased productivity.

[1]Note, however, that this increased commitment represents only a 1 percent real increase if inflation runs at 3 percent.

WILL BETTER-THAN-EXPECTED ECONOMIC GROWTH CLOSE THE GAP?

One of the first responses by the public to the concerns and issues raised by the access deficit scenario detailed in the previous chapter is that the recent recession is a unique time in California history and its effects are only temporary. The recent RAND study (see Carroll, 1995) that provided the inputs used in the previous chapter addresses this issue from a broad perspective and indicates that the state's fiscal problem is structural, not merely a function of the business cycle. In this section, a sensitivity analysis is done on the impacts to the specific findings of this report under alternative fiscal scenarios.

In the RAND study, a high and a low projection of the state's economic performance were developed. A brief description of the assumptions underlying these alternative scenarios is provided here, and the reader is referred to the original report for more detailed information. In general, the RAND model is driven by a model of the state's personal income. The components of growth in that model are largely based on the overall performance of the state economy over the past 20 years, adjusted for demographic and inflationary changes.

In the case of the optimistic revenue series, personal income is adjusted to reflect, after adjustments for inflation and population growth, the growth rates of the strongest half of the 20-year period. The pessimistic scenario adjusts personal income growth rates, after considering inflation and demographic changes, to reflect those of the weakest half of the 20-year period. Both these series are applied to the present and projected into the future.[2] The personal income series are then used to estimate General Fund revenues in the state under each set of assumptions.

To estimate the overall sensitivity of the persistence of the access deficit to the economic projections, these alternative series were inserted into the model. The general finding is that these series had little effect on the overall level of service provided by each system.

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[2]The actual values for these series may be found in Tables D.3 and D.5 in Appendix D of this report.

Table 4.1 shows a comparison of the level of service provided in 2005–06 by each system under the optimistic, middle, and pessimistic series if the impacts of changes in state revenues are esti-

Table 4.1

Proportion of Baseline Demand Supplied Under Alternative Fiscal Scenarios, Fiscal Year 2005–06 (percentage of baseline service level)

System	Pessimistic Fiscal Scenario (%)	Middle Fiscal Scenario (%)	Optimistic Fiscal Scenario (%)
Total Overall			
Expected Higher Education Provided	62	62	65
Gap from Recent Policy Changes	12	12	12
Expected Unfunded Demand	26	26	23
Total	100	100	100
University of California			
Expected Higher Education Provided	41	42	45
Gap from Recent Policy Changes	4	4	4
Expected Unfunded Demand	55	54	51
Total	100	100	100
California State University			
Expected Higher Education Provided	40	42	45
Gap from Recent Policy Changes	12	12	12
Expected Unfunded Demand	48	46	43
Total	100	100	100
California Community Colleges[a]			
Expected Higher Education Provided	68	68	71
Gap from Recent Policy Changes	13	13	13
Expected Unfunded Demand	19	19	16
Total	100	100	100

SOURCE: Derived from this analysis.

[a]Community Colleges remain the same throughout the pessimistic and the middle scenarios because the binding constraint is the capital supply, not the operating supply, and a decrease in available resources only shrinks the number of excess operating spaces produced.

mated on operating supplies. While there is some improvement in performance in the CSU and UC systems overall, it still only closes a small portion (3 percent in each) of the overall access deficit.

The values for the California Community College system remain flat between the pessimistic and middle scenarios because in the middle fiscal scenario, the system is producing an excess of operating supply over capital supply and the decrease in operating resources does not bring the operating supply below the capital supply. In the optimistic fiscal scenario for community colleges, the increased resources are first spent to expand capital supply to equal operating supply and then used to expand both to the levels indicated in Table 4.1.

Overall, it is expected that the more optimistic scenario will account for only a 3 percent decrease in the unfunded demand; it is likely that any optimistic scenario, while improving the level of service provided by the state's public higher education sector, will not close the gap.

STARTING WITH THE GOAL

To project the costs of achieving a goal, the goal must first be defined. In this section, the desired level of service is discussed and the baseline demand is selected as the level most consistent with the goals of the Master Plan. An important question regarding the access goals of the Master Plan is "What is the appropriate level of service envisioned in the Master Plan?" For example, the Master Plan states that the University of California system should serve the top one-eighth of high school graduates. This guarantee does not mean that the University of California should enroll all students in the top one-eighth of high school graduates, but that it should serve all students in that group who wish to be served. This means that UC should admit and enroll all students in the eligible group who wish to attend.

The question blurs, however, if other policies are instituted that effectively restrict the potential applicants before they evidence their desire to attend the University. One such policy is that of instituting fee increases, an act that may directly (through reduced ability to afford the institution) and indirectly (through negative publicity) reduce the number of students in the service population who demonstrate their desire to attend by applying and enrolling. Such policies

represent a constructive reduction in the level of service the system provides while technically still remaining in compliance with the letter of the Master Plan.

Do such effects constitute a real reduction in access to the Master Plan? The answer depends in large part on how one views the nature of the fee increases. If the fee increases are perceived as reflecting the gradual increase in the basic costs that have always been borne by students, then it could be argued that the increases do not represent real reductions. Another approach would be to compare the fee increases with the typical student's ability to pay for education—if the fees rise at the same rate as the student's ability to pay, no students are excluded or included.

Note, however, that an increase in fees in a market in which some people have a limited ability to pay[3] will produce a reduction in the number of students able to attend. This reduction in the number of students is a decrease in access by at least one definition of access—the number of students served.

For purposes of this analysis, reductions in access are defined as an overall reduction in the level of service and the availability of education relative to a certain benchmark level. This research uses the level of service provided in the 1989–90 academic year.

The year 1989–90 is selected for several reasons. First and foremost, it occurs before the significant changes in the early 1990s in the way public higher education is funded. Second, because of the way higher education was funded in this period, public institutions were providing a level of service consistent with the contemporary economic context and their individual missions. As such, this represents a period when systems were aggressively serving the state.

The periods 1989–90 and 1990–91 are also the end points of a consistent upward trend of increasing participation during the 1980s and were the last years before all three systems instituted major fee increases in response to the cutbacks associated with the recession. It also represented a time when systematic efforts to encourage and

[3]In economic terms, if the market is at a market-clearing price, then an increase in the price will have two effects—an increase in the quantity supplied and a decrease in the quantity demanded.

expand transfer enrollments from community colleges were bearing fruit and producing transfer levels consistent with those envisioned by state policymakers.

With 1989–90 service levels as a baseline, any reductions in the level of service represent real reductions in the level of service provided by the state's public systems. If such a reduction is caused by suppressing demand (such as through higher fees), then the number of students with access to the sector has decreased. A restriction on the number of seats available to students is another form of reduced access. If a reduction in student demand is fueled by decreasing perceptions of quality, then the level of service to the people of California has decreased and it may be argued that the level of access (in this case to a higher-quality education) has also declined.

This research focuses on the first two dimensions of access—namely effects on the demand or supply of education associated with capacity constraints and evidenced reductions in demand. The quality dimension, while crucial to considerations of educational policy in California, is very difficult to measure and is left for future research.

FUNDING THE ACCESS DEFICIT

In the prior chapter, the question was asked, "All things being held constant, what proportion of demand is likely to be served by the state's public undergraduate institutions?" Another way of thinking about this is to ask, "Assuming that the state served the entire student demand, what level of resources would be necessary to accommodate that demand?" This approach is similar to how higher education was funded as recently as six years ago.

In this approach, the analysis begins with the desired level of students and then applies historical cost factors to those student levels to develop an estimate of the level of resources needed to fund higher education.

Assumptions of the Approach

A wide range of issues must be considered in such an approach. To simplify the interpretation of the results, all the factors discussed in the prior chapter regarding the costs of higher education and fee

levels over time have been maintained for this portion of the analysis. The number of undergraduates to be taught has been set equal to the baseline demand projections, and the proportion of undergraduates to graduates (credit to noncredit enrollments in the CCC system) has been held constant. Only the revenue streams have been allowed to vary.

The costs associated with the capital side of the equation have been drawn from the California Postsecondary Education Commission's report,[4] which is the most current source for estimates of the costs of maintenance and expansions of new and existing campuses. If there is a shortfall in physical capacity in the systems, new capacity will be built and financed with 20-year bonds at a nominal interest rate of 6 percent (3 percent in real terms), and construction begins four years before it is actually needed.

The Cost of Meeting Baseline Demand

With these assumptions in hand, the cost of accommodating the baseline level of demand may then be estimated. The first issue to be encountered, however, is the cohort of students that is excluded by extensions of current fee and managed-enrollment strategies. To reach baseline demand levels, these policies must be reversed to their 1989–90 levels (in real terms). This means that fees would be reduced and non-fee strategies implemented to suppress demand would be reversed.[5] The resulting costs are presented in current dollars in Table 4.2 and in constant (1992–93) dollars in Table 4.3.

The growth over this 15-year period represents more than a 172 percent increase in the actual dollars spent on higher education. Even disregarding inflation, higher education expenditures would have to grow by 75 percent to meet the full baseline demand level. Remember that this is revenue growth without the recently implemented fee

[4]CPEC, *A Capacity for Growth: Enrollments, Resources, and Facilities for California Higher Education, 1993–94 to 2005–06,* (draft) agenda item #4 for the June 5, 1995 meeting of CPEC.

[5]The author recognizes that these events are unlikely. To obtain a clear sense of the fiscal magnitude of the problem of closing the access deficit, however, this measure is the appropriate one to use.

Table 4.2

Real State Revenues Necessary to Expand Expected Supply to Close the Access Deficit (thousands of dollars)

Year	California Community Colleges	California State University	University of California	Total
1995–96	1,964,720	2,210,155	2,089,241	6,264,116
1996–97	2,140,328	2,332,886	2,209,442	6,682,657
1997–98	2,330,921	2,476,823	2,355,773	7,163,517
1998–99	2,525,199	2,640,463	2,522,794	7,688,456
1999–00	2,734,680	2,824,329	2,713,227	8,272,236
2000–01	2,945,736	3,021,596	2,916,332	8,883,664
2001–02	3,170,637	3,236,080	3,132,048	9,538,765
2002–03	3,409,046	3,462,851	3,356,419	10,228,316
2003–04	3,662,456	3,692,434	3,583,520	10,938,411
2004–05	3,917,851	3,938,753	3,819,043	11,675,647
2005–06	4,191,123	4,196,483	4,074,478	12,462,084
2006–07	4,483,346	4,470,291	4,337,550	13,291,187
2007–08	4,748,707	4,744,886	4,596,412	14,090,006
2008–09	5,035,923	5,040,708	4,880,449	14,957,081
2009–10	5,351,972	5,376,412	5,217,496	15,945,879
2010–11	5,695,371	5,746,028	5,594,063	17,035,461

SOURCE: Derived from this analysis. See Appendix F for details.

hikes, so most of this increase must come from other sources such as the state and local governments.

While these funds are generic in character, it is unlikely that any other organization or agency will provide these operating funds on an annual basis. The federal government is the most likely prospect, and the federal deficit seems to preclude any expectations of significant revenues increases. Local government in California is increasingly scrambling to balance its own budgets, let alone take on the additional burden of financing higher education. This leaves the state budget as an unlikely benefactor.

If these spending levels were applied to the projected General Fund revenues, higher education as a sector must consume an ever-increasing share of the public revenue pie. Figure 4.1 below shows that the proportion of the General Fund revenues committed to the three higher education systems would have to rise from 10.1 percent

Table 4.3

Real State Revenues Necessary to Expand Expected Supply to Close the Access Deficit (thousands of 1992–93 dollars)

Year	California Community Colleges	California State University	University of California	Total
1995–96	1,797,997	2,022,605	1,911,952	5,732,554
1996–97	1,901,654	2,072,739	1,963,061	5,937,454
1997–98	2,010,673	2,136,529	2,032,111	6,179,313
1998–99	2,114,815	2,211,346	2,112,800	6,438,961
1999–00	2,223,545	2,296,438	2,206,102	6,726,085
2000–01	2,325,391	2,385,276	2,302,180	7,012,847
2001–02	2,430,030	2,480,186	2,400,454	7,310,669
2002–03	2,536,650	2,576,686	2,497,491	7,610,828
2003–04	2,645,836	2,667,493	2,588,811	7,902,141
2004–05	2,747,902	2,762,562	2,678,600	8,189,064
2005–06	2,853,951	2,857,601	2,774,521	8,486,073
2006–07	2,964,020	2,955,389	2,867,632	8,787,040
2007–08	3,048,015	3,045,562	2,950,262	9,043,838
2008–09	3,138,221	3,141,203	3,041,335	9,320,758
2009–10	3,238,031	3,252,818	3,156,671	9,647,519
2010–11	3,345,430	3,375,186	3,285,922	10,006,538

SOURCE: Derived from this analysis. See Appendix F for details.

today to 16.7 percent in 2005–06 and 18.4 percent in 2010–11. Contrasted with the state's expected level of support, the difference is large.

Included in these calculations are the annual debt service costs associated with maintaining the current infrastructure of the systems plus estimates of the new construction costs to accommodate increasing demand. To finance this new capacity, a significant quantity of new bond issues will be necessary. Table 4.3 details the corresponding bond issues that must occur[6] to meet the capital capacity

[6]For the purposes of this analysis, it is assumed that the state will issue 20-year general obligation bonds for this capacity expansion with a nominal interest rate of 6 percent. The key issue is the total quantity of dollars needed to accomplish the necessary expansion. In the case of the University of California system, an allowance has been made for expected private donations. The numbers used in the development of this

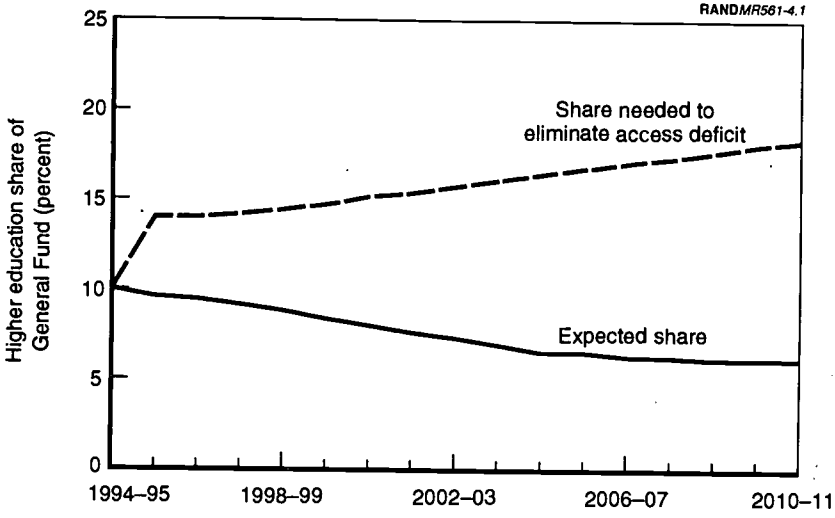

Figure 4.1—Share of State General Fund Budget Committed to Higher Education Necessary to Eliminate the Access Deficit

demands[7] for the period 1995–96 to 2006–07.[8] Both real and nominal dollars are included in Table 4.4 to give the reader an understandng of the magnitude of total bond issues needed.

In addition, a significant portion of these bond issues are required immediately just to raise the systems to the capital capacity to accommodate the baseline demand level today. For example, in the California Community College system, total baseline demand for 1995–96 is 1,403,288 students, and yet the system has a capacity of only 1,177,553 students—a difference of 225,735 students, or more

model were from published reports of the California Postsecondary Education Commission. See Appendix F for details.

[7]The total bond amounts include both undergraduate and other education. The total quantity is included because it is assumed that campuses will be constructed as integral units and that the proportion of undergraduate education will remain constant as a share of the whole.

[8]Because of the assumption that four years lead time is necessary to build capacity and the demand projections are extended only through 2010–11, projected capital costs can be estimated only through 2006–07.

Table 4.4

Total Bond Issues Needed to Expand Capital Supply to Accommodate Baseline Demand, 1995–96 to 2006–07

Institution	Total Bonds Required (thousands of 1992–93 dollars)	Total Bonds Required (thousands of current dollars)
California Community Colleges	8,122,072	9,787,442
California State University	2,439,522	2,987,824
University of California	2,487,986	3,129,837
Total	13,049,580	15,905,103

SOURCE: Derived from this analysis. See Appendix F for details of the calculations used to derive these amounts.

than 19 percent of current capacity. The cost of expanding the system to serve the baseline demand in 1995–96 is $2.3 billion dollars. The state would have to invest this amount immediately (and have it in place by 1995–96) to increase capital capacity enough to meet the baseline demand levels. The University of California and the California State University systems do not have such initial capacity shortfalls in 1995–96.

In addition to the problem of initial shortfalls, new capacity takes time to build (four years is assumed). As a result, the immediate round of construction must expand to meet the needs for the next four years. All three systems face this issue. The California Community College system requires another $1.8 billion dollars in bonds in 1995–96 to meet these demands, while the University of California and the California State University systems require another $0.7 billion and $1.0 billion dollars respectively, for a total of $5.8 billion dollars in new construction bond issues.

Increased state borrowing of this magnitude is highly unlikely, even if the voters decided to approve such bond levels. The demographic trends shaping higher education are also shaping the state's other major expenditure categories, resulting in increased capital demands in corrections, K-12 education, and general infrastructure. The state has also recently begun borrowing from future years to fund current operations, although continued state economic growth and hesitant financial markets will likely reverse this trend. Furthermore, the

costs associated with this borrowing (interest rates) are likely to rise, increasing the debt service amounts listed in Table 4.4, as the state's borrowing levels grow.

Increases in public revenues and borrowing of the magnitude shown in this section are unlikely and probably impossible. It is improbable, therefore, that the state or any other public entity will be able to buy the state out of its current access deficit.

IMPROVING EFFICIENCY TO CLOSE THE ACCESS DEFICIT

The preceding section held constant the costs associated with higher education and estimated the cost of closing the access deficit through increased funding. In this section, the revenues are held constant and the operating cost[9] of providing higher education is allowed to vary. This approach is useful in terms of estimating the magnitude of the overall productivity enhancements necessary to close the access deficit.

Because this model incorporates a very broad definition of operating cost, reductions may be accomplished by a range of methods. Operating costs include all dimensions of the noncapital costs necessary to bring about the production of the good called higher education—including salaries and benefits for faculty, administrators, and support staff; library acquisitions; office supplies; and student services. As is the case in the scenario above, the price of education must be set to baseline levels.

A systematic reduction in any of these categories while maintaining the same output would be a way of decreasing the per-unit cost of education, or in economic terms, increasing the productivity of the assets used in the production of education. In either case, a reduction in the cost of production would increase the number of units to be produced by a given amount of revenues. If costs were cut enough, then the total baseline demand for public undergraduate education could be met by current resources. Table 4.5 presents the

[9]The author acknowledges that there are opportunities for significant capital productivity improvements that could go a long way toward closing the access deficit. These comparisons were not included in this version and are left for the next stage of research.

Table 4.5

Percentage Cost Reductions Necessary to Meet Baseline Demand (percentage of expected costs)

Year	California Community Colleges (%)	California State University (%)	University of California (%)
1995–96	36.5	35.7	31.2
1996–97	36.8	38.4	34.2
1997–98	37.4	41.8	38.0
1998–99	38.8	45.7	42.3
1999–00	39.9	49.6	46.5
2000–01	41.1	53.6	50.8
2001–02	42.3	57.5	55.0
2002–03	43.4	61.4	59.0
2003–04	44.4	65.0	62.9
2004–05	45.5	68.6	66.5
2005–06	46.8	69.2	67.4
2006–07	48.7	70.0	68.3
2007–08	49.3	70.3	68.7
2008–09	49.4	70.7	69.1
2009–10	49.7	71.3	69.7
2010–11	50.0	71.8	70.4

SOURCE: Derived from this analysis. See Appendix F for details of the calculations used to derive these amounts.

percentage by which operating costs would have to be slashed to accommodate the baseline demand.[10]

As may be seen, real operating costs would have to be slashed by more than half from expected levels in 2010–11 for productivity increases to close the access deficit. While these productivity improvements may come from either operating or capital productivity improvements, the direct benefits of the latter are mitigated by amortization over 20 years of up-front capital costs.

The starting point for these cuts is also an important aspect of this policy choice. Because of the dire state financial condition since

[10]These estimates include provisions for both operating and capital capacity.

1991–92, the systems have already implemented major cost reduction efforts. Over the three-year period from 1989–90 to 1992–93, each of the systems cut their real operating cost per FTE significantly: CCC by 15.8 percent, CSU by 8.0 percent, and UC by 9.1 percent. The two years since then have been marked by a continuation of the state economic crisis, and real costs have remained flat for all three systems.

These reductions mean that the cost cuts shown in Table 4.6 must come from systems that have already faced five years of no growth or negative growth in costs. This cost performance is the result of almost heroic efforts to affect cost reductions in the context of the current structure of the institutions. In the University of California, senior (usually more expensive) faculty have been lured to leave with three early retirement incentive programs. At the same time, those faculty remaining have received no salary raises for two of three years and a 3.5 percent salary reduction in the third.[11] Some campuses have significantly reorganized and eliminated entire schools to reduce cost. In the California State University and California Community College systems, a range of effects, including wholesale layoffs of part-time faculty, has occurred. In one case, all library acquisitions were terminated, and in other examples, administrative cutbacks reduced support and administrative staffs, frequently having negative impacts on instruction itself.

It is from this already trimmed starting point that these cost reductions must begin. A significant portion of the operating costs goes toward salaries, especially faculty salaries.[12] If the costs were to come from decreasing the systems' pay scales, there is an increasing concern that the systems will not be able to attract high-quality faculty and will thereby reduce the quality and value of the education, as well as the quality of the research and public service provided.

However, at least part of the answer to elimating the access deficit lies in productivity improvements. All three systems and many individual campuses within the systems are pursuing technology-

[11] *Los Angeles Times*, January 14, 1995.

[12] One system administrator estimated this amount to be in excess of 80 percent of operating costs.

oriented solutions to providing the higher-education good, with many fewer resources, to a larger student population.

SOME PRELIMINARY DISCUSSION OF OTHER POLICY PROPOSALS

Numerous other policy initiatives have been put forth to address the access deficit. One of the policy options currently pursued by the state sector is raising student fees. Another proposed solution is to let all eligible students into the systems, no matter what the capacity of those systems. Another idea put forth is to implement a three-year undergraduate degree. These three proposals are discussed briefly below, although the model in this paper does not specifically address them. Each would require significant reworking of the modeling underlying this report, and the discussion is consequently limited to a more general level.

Raising Fees and Tuition

All three public systems have raised their fees during the recent recession. Estimating the direct impact of these fee increases is an extremely difficult undertaking, requiring detailed knowledge of the income profiles of all applicants, the exact supply of seats available in each system,[13] and the specific impacts for each income group on attendance in the three public systems. Such a detailed analysis is beyond the scope of the research project.

Note, however, that increasing tuition and fees may result in improved levels of service when the supply available is significantly below the expected level of demand. In these cases, increasing fees (which can expand the quantity of education supplied) can be beneficial until the point at which the decrease in demand from the fee increases suppresses demand below the supply level and demand becomes the binding constraint. In terms of overall level, however,

[13]This supply would have to be measured consistently across periods in which the rules for entering the institution were changing. For example, the narrowing of the definition of who is considered an "eligible" student has direct impacts on the size of the eligible populations. Policies, such as limiting the number of sections and the number of students in each section, would also have to be considered.

such a strategy guarantees that the number of seats produced will be below the baseline level, and the embracing of such an approach is a commitment to produce a level of service significantly below the target baseline—and the goals of the Master Plan.

Universal Access: Let Them All In!

In this approach, all eligible students are admitted to the system, whether there is space for them or not. As a consequence, much larger numbers of students are competing for the same number of slots and, consequently, a smaller share of the total student population gets all the courses required to complete the program in a timely manner. As this number becomes large enough, the opportunity cost of pursuing a higher education will increase (as a function of time-to-completion) and the economic conditions assumed to be constant over the 15-year period will no longer be constant. This approach would require a significant expansion of the demand model to include time-to-completion as an independent variable.

The estimated time to completion for some undergraduate programs already exceeds six years. The entry of students into systems in which there is already a constrained capacity will exacerbate this problem, and with the scale of deficits portrayed in Chapter Three, completion times of more than ten years could occur. This outcome is clearly undesirable. In the *Supplemental Report of the 1994 Budget Act*, the California Legislature expressed its intent that both the UC and the CSU "establish four-year degree pledge programs on all campuses by 1995–96."[14] Such a pledge would commit the institution to providing enough course sections for the enrolled student population so that they could finish within four years. Because average times-to-completion have in fact ranged above four years, this legislative initiative requires that the systems admit even fewer students per supply unit available, or in the language of this analysis, effectively increase the cost of production. Full implementation of this policy would exacerbate the access deficit problems already documented.

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[14]Office of the Legislative Analyst, *Focus Budget 1994: Highlighting Major Features of the 1994 California Budget*, July 13, 1994, pp. 8–9.

The Three-Year Degree

Another approach is the adoption of a three-year undergraduate degree. Proponents of this approach argue that the general education portion of the curriculum could be concentrated into fewer courses, freeing up capacity to teach more upper division courses and accommodate more students. The impacts of this model for undergraduate education are not clear. It would affect all dimensions of the demand for higher education. Participation, transition, and transfer rates would change. Responsiveness to price changes (as the cumulative price of the overall degree) would also change.

A crude way of estimating the effects of this approach is to look at the overall quantities demanded. Implementing a three-year degree would decrease overall demand in four-year colleges (assuming participation, transition, and transfer rates do not change) by 25 percent. Depending on the actual implementation of the program, it could decrease demand for community colleges by up to 50 percent (if the entire year were removed from the first two years). Turning back to Figures 3.2 to 3.6, the access deficits in the later years for the CSU and UC systems are considerably higher than 25 percent of baseline demand and, hence, it does not appear that a three-year degree would address the entire problem. In the CCC system, however, the entire access deficit could be addressed by this approach if the dropped portion of the curriculum were concentrated in the first two years of instruction.

Many other issues cloud the viability of the three-year degree concept, not the least of which is several centuries of inertia in the nation's higher education sector. Concerns also exist regarding the quality of the overall baccalaureate education that a student would receive in the shorter program. Even if the quality were held constant, a student would receive 25 percent less of it. A large number of logistical and procedural issues would also have to be addressed to transition to such a system, including the recognition of the shorter degree both nationally and internationally. Prospects for a three-year degree, at least in the near term, seem weak.

Combinations of Policy Initiatives

The most likely solutions will include some combinations of the policy proposals included in this report. Increased dollars, fees changes, and increased productivity may all be combined to reduce the access deficit expected in the state. In addition, different policies may be pursued in each of the systems.[15] The inescapable fact, however, is that the scale of the problem is large. Even in combination, exploratory runs of the simulation model have shown the scale of fiscal and productivity increases necessary to accommodate future student demands to be unlikely.

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[15]The simulation model used in this research has the capability to address these possibilities.

Chapter Five

CONCLUSIONS AND IMPLICATIONS

There is an access crisis in California. This research finds that the recent hodgepodge of responses to the recession and fiscal crisis have had a direct impact on the level of access to undergraduate education in California. Furthermore, the reduced level of access will be sustained and will worsen in the future, producing growing deficits in access to public undergraduate education. The state will not be able to close these deficits and must redouble its efforts and creativity to minimize their magnitude. Even so, because it will not be able to close the access deficits, it must reconsider the role and relationship between the people of the state and the state's public education enterprise detailed in the Master Plan.

RECENT POLICIES HAVE HAD A MAJOR IMPACT

As a result of the recent recession and the demands placed on the public revenues, public financial support of higher education has fallen dramatically. In the past four years, numerous cutbacks in the funds available to the public sector were implemented and fees were raised to record levels. In response to the fiscal cutbacks, the public systems have instituted a series of managed-enrollment strategies such as restricting admission to a first-come, first-served basis, interpreting eligibility and service populations more conservatively, and reducing outreach. These measures have resulted in an overall decrease in the level of service.

This research has found that, as a result of the policies put into place by the recession of the 1990s, more than 200,000 undergraduate students have been denied access to the state's public higher education

systems. This number is 11 percent of the students who would have attended if the changes in participation resulting from the new policies had not occurred. It is possible that some of these students went elsewhere, but with rising fees as one of the likely primary barriers to attendance, the higher cost of private and out-of-state institutions makes this unlikely. A major reduction has occurred in the real level of access to public undergraduate education in California.

ACCESS DEFICITS ARE HERE TO STAY

Perhaps even more alarming are the future prospects for providing access to undergraduate education in California. Beyond the direct consequences of the policies initiated as a result of the recession are the indirect consequences of numerous voter actions at the ballot box. Several propositions and initiatives have limited public revenues and created constitutional mandates for spending on certain activities, such as K-14 schools and corrections. These mandates, combined with federal rules and mandates regarding other classes of spending, result in a decreasing share of public revenues available for public education.

At the same time, the state's population is projected to continue its explosive growth—rising by more than 10 million people over the next 15 years. The demand for services will rise at the same time. As a result, the level of access to public undergraduate education is expected to decline precipitously—producing large access deficits in the higher education sector. The level of access is expected to decline from today's 89 percent of prerecessionary levels to 62 percent in 2005–06 and to 56 percent in 2010–11. Even in an optimistic fiscal scenario, the levels would rise to only 65 and 58 percent for 2005–06 and 2010–11, respectively. This is a marked decrease in the level of higher education access provided in the state.

To close this deficit through increased state revenues, the higher education sector would have to reverse its current trend toward a declining share of state revenues and nearly double its share from about 10 percent today to more than 18 percent in 2010–11. While that share is not unreasonably high in historical terms, the increasing demands of the state's mandated spending programs, such as K-12 education, corrections, and health and welfare programs render it highly unlikely in the future context. Given the fiscal context of the

state and the competition for discretionary resources, this scenario is extremely unlikely.

Furthermore, California must also consider how to address the sector's capital needs. Even if it could provide the faculty and operating resources, it must have physical space for additional students. This analysis estimates that the sector will require almost $16 billion of bonded capital investment to fund capital upgrades and expansion at an average annual cost (including repairs and renovation) of $1.2 billion dollars.[1] This amount of new debt would severely tax the state's capacity to issue debt. Experts in the state's bond markets estimate that California's total annual new issue capability is somewhere around $2 billion. Between the demand for new prisons (driven by the three strikes law) and the need for new K-12 facilities (which is driven by the same demographic forces as higher education), there is certain to be more than ample competition for the $30 billion of state borrowing capacity available over the next 15 years.

Closing the access deficit through cost reductions alone is also problematic. Consider that it would require reducing the cost of education by 70 percent to close the deficits. This event is very unlikely. Because of the recent major reductions in operating costs in all three systems, it is unlikely that major productivity improvements can be made without seriously impacting the quality of the education provided. This is not to say that progress cannot be made in this area, as will be discussed in the recommendations for immediate action below.

THE IMPLICATIONS OF SUSTAINED ACCESS DEFICITS

It would seem that, without significant changes in the way higher education is produced and funded in California, access deficits are here to stay and are going to grow in the future. This conclusion has at least two major implications for the state. First, the state must consider doing all it can to close these deficits. Second, the state must reconsider the access provision of the Master Plan and recraft it to reflect the realities of the 1990s and the 2000s.

[1]This amount is included in the "buy out" costs described in the preceding paragraph.

Improving Access to Public Undergraduate Education

This research has focused on the prospects for access if there are no additional changes in overall productivity—the way the good is provided—and the level of support. In light of the magnitude of future access deficits, it is clear that changes will be necessary to mitigate their impact and size. The sector must take immediate steps to protect and expand the level of resources it has and to maximize the level of access provided with those resources.

Support for Public Higher Education. In conjunction with these internal changes, the state *must* continue to fund the capital expansion of the systems. The current capacity is inadequate for today's needs, let alone for the state's future needs. Capital expansion takes significant time and resources and cannot be ignored. The state's population is exploding, and the state's higher education sector will need to grow to serve the state's future needs. The decision to expand must be made with the long-term perspective in mind, and higher education cannot be left out of the equation in the competition for funds.

To mitigate the access problem, the level of support to the sector must be maintained, whether through a sustained share of the public dollar or through new public/private partnerships. The failure of the state to provide on-going support to its higher education systems will be a costly failure indeed; a significant share of the state's burgeoning population will be denied access to higher education. In an increasingly technological society that demands an increasingly skilled workforce, such short-term policy choices could well leave the state unable to compete.

Increasing Productivity. Even as sustaining and expanding the level of fiscal support are important, the sector must also learn new ways to do more with the resources it receives, and, while increasing productivity is important, it is also crucial to retain quality. Increased access to an inferior education is not a winning scenario for the state. Bearing this in mind, there are numerous actions the systems may take to improve productivity. Note that this research does not analyze the specific implications of any single policy proposal but rather considers productivity overall. The discussion below is provided as a starting point for professional dialogues both from within the sector and from the broader public arena.

The current sectoral and institutional structures are largely the product of long histories and are often more focused on the structure than on the production of education. Restructuring within the system and the campus is a crucial first step in solving the sector's short-term problems. The three-year degree proposal is an example of how these histories and their underlying assumptions may be challenged.[2] Numerous other institutions, both public and private, have reassessed their institutional foci and reorganized their curricula, schools, information systems, and approaches to the business of higher education.

Restructuring for its sake alone, however, should be avoided. The restructuring process should focus on innovation and mission within the institutional context.[3] Beyond overall restructuring initiatives, the systems must also work to achieve cost efficiency in their production process. As stated earlier, the emphasis will probably not easily come from the more traditional approaches to cost reduction—salary and staff reductions—although these may also be appropriate, but will more likely come from new ways of providing educational services. Such approaches may include changes in the school year, and in the hours, mode, and location of instruction. Ways may also be found to expand the state's use of private institutions to accommodate the growing demand.

Another hope for increased productivity may be found in the information revolution. New technologies may significantly leverage the productivity upward of the higher education teaching process. Advances in systemic and institutional information systems may be used to strengthen and improve their decision processes. Teleconferenced and telecommuting campuses may someday eliminate the physical boundaries of today's local campuses.

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[2]This does not constitute an endorsement of this alternative but merely shows it as an example of a restructuring initiative.

[3]Roger Benjamin, Stephen J. Carroll, Maryann Jacobi, Cathy Krop, and Michael Shires, *The Redesign of Governance in Higher Education*, Santa Monica, Calif.: RAND, MR-222-LE, 1993.

The Future of the California Master Plan for Higher Education

Absent major reforms in the state's fiscal machine or heroic improvements in the sector's productivity, sustained access deficits have major implications for the California Master Plan for Higher Education itself. The access goal is almost certainly not achievable. While it may be useful to have lofty goals, those goals must appear attainable or they become lost—much as the Master Plan's goal of access to every Californian who can benefit has become lost in the demographic and economic trends of the recent past, the present, and the future.

What goal should be pursued if that goal is lost? Some choices and goals should be set for the state's public higher education sector. If nothing else, the state is investing more than 10 percent of its resources in the enterprise, and the contract specifying the state's expected return on that investment should be clear. Such a contract will then guide the policy choices and directions of the next 35 years, as the current Master Plan has guided the past 35 years.

Failure to consider and renegotiate such a contract does not obviate the need for one. Not developing a new vision of the sector's role in the state results in an ad-hoc, incremental policymaking process. But instead of resulting from well-considered, macro-level choices between alternative visions, the access provided by the state's higher education sector is shaped by a mishmash of local factors and compounded by a highly uncertain budget picture. Students are being kept out of the system by price increases, and capacity as a share of total baseline demand is decreasing, with no explicit vision on where it is all headed.

The state appears to be in a state of denial as to the ongoing viability of the Master Plan. Budgets are no longer considered in the context of what is required to support the needs of the state's higher education sector, but rather what is left that can be spent on it. And while everyone agrees on the goals of the Master Plan, everyone also agrees that they are not currently being met. This analysis shows that they will most likely not be met in the future, either.

Therefore, the state should convene a new committee on the Master Plan to address the sector's future role. This committee will need to consider

- The capabilities and strategic role of the state's higher education sector well into the next century
- The fiscal and demographic context in which the state's higher education institutions must operate
- The strategic alliances between higher education as an education and training mechanism for the private sector as well as the sector's role in producing a significant portion of the nation's basic research
- How to strengthen the linkages between the state's public and private education sectors.

And these are just the first order of questions that need to be address.[4]

The challenges are no more formidable than those of 35 years ago. The current Master Plan was the product of a long process to consider the structure and character of the state's higher education sector. The new effort should also be the result of a carefully considered process. Participation should come from all aspects of the higher education sector and should include members of all four major higher education segments (private institutions constituting the fourth), members of the private and public sectors, lawmakers, and other leading policy players.

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[4]The concepts of institutional reform, improved linkages between the public and private sectors, and rethinking the roles defined in the California Master Plan are not new. In *A Fresh Look at California Higher Education: A Discussion Paper Focusing on the Future*, the staff of CPEC discuss many of these issues, proposing some possible approaches to the problems documented in this report. The California Higher Education Policy Center has also discussed many of these issues in its works. Examples include Jack McCurdy and William Trombley, *On the Brink: The Impact of Budget Cuts on California's Public Universities*, August 1993; Clark Kerr, *Preserving the Master Plan*, October 1994; Patrick Callan and Joni Finney, *By Design or Default?* June 1993; and *Time for Decision: California's Legacy and the Future of Higher Education*, March 1994.

The current Master Plan is arguably a major reason for the state's tremendous success over the past 35 years. A revised Master Plan will be the key to the state's next 35 years. The sooner such an effort is undertaken, the sooner the sector's goals and objectives may be redirected to springboard the state into the next century.

NEXT STEPS

A limited body of literature has already been established on the approaches and consequences of institutional and systemic restructuring efforts. Higher education as a sector, however, studies itself less than almost any other enterprise—this must change. The effectiveness of restructuring processes and strategies as well as the needs for information systems and the appropriate architectures to facilitate these efforts must be understood.

New education technologies must be developed to enhance the quality and quantity of education produced by higher education institutions. The linkage between higher education and the private sector must be expanded and the areas for joint effort must be enlarged. Toward this end, the areas of mutual interest must be identified and developed.

Finally, the role and missions of higher education in the modern postindustrial society must be studied. No historical precedent exists for tomorrow's information-rich and technology-based world. The needs and demands of that society are not clear, and yet the higher education sector must anticipate and respond to those needs and demands. Only by looking well into the next century can today's higher education systems be able to best serve the citizens of California.

Appendix A

MODELING THE DEMAND FOR PUBLIC UNDERGRADUATE EDUCATION

The demand for public undergraduate education is difficult to model directly. Because an individual chooses higher education over other career options, one component of a direct demand model would necessarily estimate the direct opportunity costs of pursuing higher education.[1] These costs must be offset by an estimate of the direct benefits of higher education. In the literature, most of these studies are carried out with national-level data and usually include private institutions. The applicability of these studies is often limited to the specific context and institutions included in the data set. Because this research focuses on a different context—California's public institutions—these other studies are not directly applicable to this analysis.

This study's goals are more specific than just estimating the overall demand for higher education. It attempts to estimate the demand for higher education under a variety of scenarios. Ample information is available, in the form of historic participation rates, on the demand for public undergraduate education in California under a variety of circumstances. This information may be combined with projections of demographic information to estimate the future demand for undergraduate education in California. This approach uses a dynamic simulation model to address the demand behaviors indirectly. To implement this concept, a period of time is selected when the supply-side constraints are nonbinding (a "baseline period") and the

[1]Such a model would focus on the individual. This research focuses on the system level and, hence, such an approach is not appropriate.

population participation rates at that time are applied to future population estimates to project future enrollment demands.

For example, take a student graduating from high school. That student is choosing between career alternatives, weighing the relative returns on investment (in both time and money) of various education choices, and weighing personal preferences for a host of factors, such as size, location, and expected time to completion. The end result, however, is that that student decides whether to enroll in one of the public education systems.[2] The historical record of the result of that decision in the past is available in the form of enrollments in the various systems.

As a consequence of that decision and its accompanying record, the data contain information on which, if any, system that student chose to enroll. By aggregating this information across the population, a profile of the participation rate of that student's population subgroup in each of the public systems may be generated. If this information is aggregated across all the public education institutions and across all the population's subgroups, a map of participation and nonparticipation in the state's public higher education systems is developed. It is through the development of this type of a participation matrix that projections of the state's demand for public undergraduate enrollment are developed.

IMPORTANT UNDERLYING ASSUMPTIONS

This "baseline approach" contains some important assumptions. Each of these assumptions represents decisions and choices in the model that may be revisited in subsequent iterations of the model.

The Baseline Period

The first assumption of this approach is that the baseline period is a period that is representative of a time when there were no significant supply-side constraints. It further presumes that the sector was indeed providing the desired level of opportunities for education within the sector. In the context of the California Master Plan, it pre-

[2]The student could enroll in a private institution.

sumes that the state's public systems were operating in accordance with their missions under the Master Plan and that each Californian who could benefit was indeed benefiting under the conditions exhibited at that time.

For the purposes of this model, the 1989–90 fiscal/academic year has been chosen as the baseline period. This period represents one of the last years before the state's fiscal crisis caused a shift in the budgetary process whereby public system funding was based heavily on expected enrollments. In 1991–92, the state generally decreased the funding for the public postsecondary systems, and funding was separated from expected enrollments. The exception to this trend was the California Community College system, which was protected by the provisions of Propositions 98 and 111. This year serves as a good baseline for this system because it was one of the first years in which the provisions and funding mechanisms of Proposition 98 were in effect.

Another reason for the selection of 1989–90 as the baseline year was that real fees to the students were at stable and relatively low levels.[3] Figure A.1 below presents the real total fees for the CSU and UC systems. While comparable series were not available for the CCC system, state enrollment fee remained at $100 from 1984–85 to 1990–91.[4]

As this figure shows, real total fees for CSU were relatively flat from 1983–84 until 1991–92, while UC fees were somewhat more variable, peaking around 1982–84 and falling until the mid-1980s, at which time total fees returned to near 1982–83 levels. UC total fees also show a sharp increase in 1991–92. Because 1989–90 was one of the last years before the separation of enrollments from the funding decision, it is an appropriate choice.

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[3]Fees were at low levels relative to the fees in subsequent years and comparable to real fees in the preceding ten years.

[4]California Postsecondary Education Commission, *Fiscal Profiles 1992*, CPEC Report 92-9, Display 26.

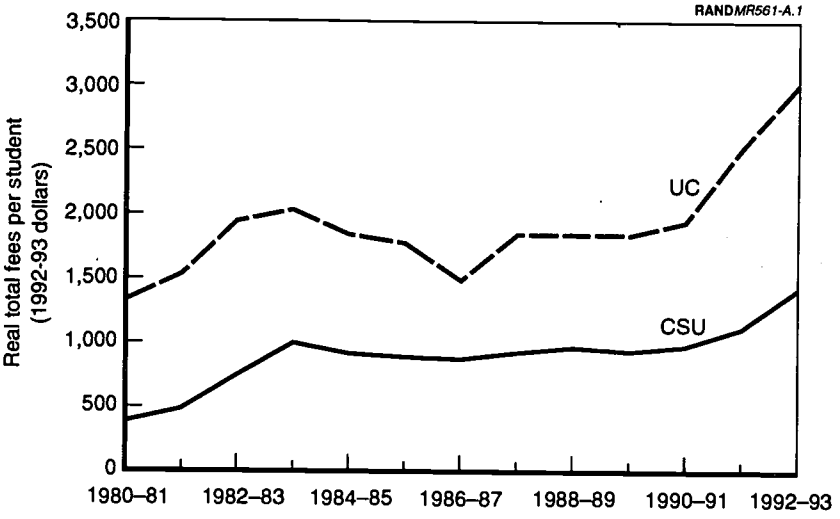

Figure A.1—Real Total Fees[5] per Student in the California State University and the University of California[6] Systems

Comparability of the Baseline Period

Another important assumption of the baseline approach is that the period's economic opportunities must be comparable to those of the future projection period. Some would argue that the state's severe economic recession in the early 1990s was a harbinger of hard times to come, but none would argue that the recession is permanent.[7]

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[5]Total fees include systemwide fees and estimates of campus-based charges for health, student union, parking, and other fees. The nonsystem fees for the California Community College system were estimated using the average nonsystem fee portion of the California State University system costs for that year.

[6]From California Postsecondary Education Commission, *Fiscal Profiles 1992*, CPEC Report 92-9, Display 29.

[7]Most would agree that it has a long-lasting impact on future growth prospects. The state has a long way to climb just to return to prerecession levels of economic output.

Because the model is aggregated across a wide range of subpopulations,[8] the model presumes that the economic alternatives and choices remain the same for each demographic subpopulation used in the model. For example, the model at one point calculates a participation rate of female Hispanics, 18 to 19 year olds in 1989–90. In using this participation rate for the projections, the model presumes that the economic opportunities and the relative returns of the various career choices for this subpopulation will remain the same as it was in 1989–90 over the entire projection period. While this is a big assumption, the projection range of the model is fairly limited (through 2009–10) and there is not enough information available to assume otherwise.

Cross-Price Elasticity of Demand

One important issue not included in this model is an estimate of the cross-price elasticity of demand between the various institutions. For example, suppose someone is currently considering attending the University of California but fees rise rapidly next year and fees at the California State University or the Community College do not rise as quickly. An increased probability exists that this individual will attend one of the other two systems because their relative price is lower. The change in demand for one system because of price changes in another is called the cross-price elasticity of demand. This model does not include this aspect of the analysis. It was omitted because the relevant data was not available.

DEFINING AND UNDERSTANDING THE COMPONENTS OF DEMAND FOR PUBLIC UNDERGRADUATE EDUCATION

In this analysis, the demand for public undergraduate education for each system is modeled separately. The general form of the demand equation is

$$Q_D = Q_0 P^{\varepsilon} \qquad \text{(A.1)}$$

[8]Specifically the model uses gender, ethnicity, and age as drivers.

Q_D is the quantity demanded in each system, Q_0 is the baseline demand for the system, P is the price of education, and ε is the demand price elasticity for the system. The assumptions surrounding each of these values will be discussed below.

The Expected Demand for Public Education, Q_D

The expected demand for public education represents the number of people who would attend public undergraduate education in the system under consideration under the conditions specified in the equation. This is the number of bodies in the classroom who wish to be in the classroom under the conditions specified by the other variables in the equation. For the baseline years, it represents the actual number of students enrolled in the respective systems. For years in which supply exceeds demand, this will be the number of students who actually show up in the system. For years in which demand exceeds supply, this is the number of students who would like to attend. The number enrolled in these years would be the number of seats supplied.

The Baseline Demand, Q_0

The basic assumption of this approach is that the 1980s represented a period in recent history when the public education systems were indeed operating in a manner consistent with the California Master Plan and the state's intent to provide access to undergraduate education in each of the three public segments. The term *baseline demand* refers to the quantity of people who, under the auspices of California's Master Plan, and consistent with the assumption above, are pursuing undergraduate education in California's public education systems. For the baseline year, therefore, it is the number of people who attended the institutions as undergraduates. This model produces a set of participation rates that are calculated at the detail levels along the dimensions of status, gender, and ethnicity and then aggregated to the highest level. A detailed discussion of the theoretical framework underlying baseline demand is included in Appendix B. Appendix C then discusses the methodology used to operationalize this theoretical framework.

The Price of Education, *P*

The price of higher education may be defined in many ways. The level of tuition and fees are one choice for the price of higher education. In order to fully reflect the demand-side issues, however, the price of education can be expanded to reflect the overall cost of education, including books, fees, and living expenses. This first definition of the price of higher education is used in this report.

A further dimension of the price of education includes the opportunity cost of education: the cost of education must also include an estimate of the earnings and income foregone to pursue the education. This additional cost must be offset, however, by the marginal increase in lifetime earnings that the student will enjoy. While this definition is much more complete, it includes yet other dimensions that are very difficult to measure: the average expected earnings for California high school graduates and for students who drop out of higher education at various levels of completion; the perceptions of the value of education; and social value of education, among others. Because of the measurement difficulties and variance associated with the components of this definition of education, this definition is not used.

This model assumes that these several influences on the economics of the choice to pursue higher education are to be constant relative to the baseline period, which in this case is 1989–90. As a result, this model assumes that the opportunities available to the student outside higher education and the relative lifetime returns to those earnings are the same as they were in 1989–90.

Returning to the cost of education, the real total fees[9] for each of the three public institutions are divided by the value of real total fees in 1989–90 to produce an indexed price series. With 1989–90 as the baseline year, the baseline demand equals the quantity demanded in that year and the P^{ε} term in equation (A.1) equals 1, and $P_{1989\text{–}90} = 1.000$. As Table A.1 shows, these fees have risen significantly in the past several years. For years after 1995–96, real total fees are held constant.

[9]The total fees include such costs as health, student union, parking, and other fees in addition to the systemwide registration fees.

Table A.1

Total Price Indices for California Public Institutions (1989–90 = 1.000)

Year	California Community Colleges	California State University	University of California
1980–81[a]	0.383	0.409	0.722
1981–82[a]	0.354	0.522	0.837
1982–83[a]	0.383	0.808	1.068
1983–84[a]	0.930	1.068	1.099
1984–85[a]	0.914	0.964	0.996
1985–86[a]	0.908	0.942	0.964
1986–87[a]	0.954	0.931	0.946
1987–88[a]	0.996	0.989	1.006
1988–89[a]	0.986	1.020	1.004
1989–90[a]	1.000	1.000	1.000
1990–91[a]	1.041	1.041	1.058
1991–92[a]	1.136	1.192	1.398
1992–93[a]	1.728	1.714	1.653
1993–94[a]	2.340	1.809	1.940
1994–95[a]	2.300	1.909	2.063
1995–96[b]	2.460	2.016	2.196
1996–97	2.460	2.016	2.196
1997–98	2.460	2.016	2.196
1998–99	2.460	2.016	2.196
1999–00	2.460	2.016	2.196
2000–01	2.460	2.016	2.196
2001–02	2.460	2.016	2.196
2002–03	2.460	2.016	2.196
2003–04	2.460	2.016	2.196
2004–05	2.460	2.016	2.196
2005–06	2.460	2.016	2.196
2006–07	2.460	2.016	2.196
2007–08	2.460	2.016	2.196
2008–09	2.460	2.016	2.196
2009–10	2.460	2.016	2.196
2010–11	2.460	2.016	2.196

SOURCE: Derived from this analysis. Total fees for 1980–81 to 1991–92 are from CPEC, *Fiscal Profiles 1992*, CPEC Report 92-9, Display 29. Fees for 1992–93 to 1994–95 are from the *Governor's Budget*, various years.

[a]Denotes years for which data are actual amounts.

[b]Fee amounts are those proposed in *1995–96 Governor's Budget.*

The Demand Price Elasticity, ε

There is a certain level of price responsiveness of public undergraduate enrollments to increases in the price of education. For the purposes of this model, the elasticities of demand were calculated when appropriate and estimated when they could not be calculated. A recent meta-analysis of the literature cites demand price elasticities ranging from +.41 to –.74,[10] when adjusted for differing measures and depending on the context of the analysis and how price is defined. This section contains a discussion of the theoretical context.

The descriptions below represent calculations of these elasticities based upon the model and are provided for the reader's information. See the next section for a discussion of how the price and elasticity components were specifically operationalized in the model.

Especially in the case of community colleges, whose funding is largely driven by enrollment, the past several years[11] provide an excellent source of calibration of the demand price elasticity. The demand price elasticity used for the California Community Colleges, –0.1533, was derived by inserting the actual Q_D, baseline demand Q_0, and price into equation (A.1) and solving for ε. Equation (A.2) shows the calculation to derive ε. This calculated value if this coefficient is consistent with those values proposed by the literature for two-year institutions.

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[10]Larry L. Leslie and Paul T. Brinkman, "Student Price Response in Higher Education: The Student Demand Studies," *Journal of Higher Education*, Vol. 58, No. 2, March/April 1987, pp. 181–204. Several of the studies referenced were reviewed for comparability for this study, including Stephen Hoenack and William Weiler, "The Demand for Higher Education and Institutional Enrollment Forecasting," *Economic Inquiry*, Vol. 28, January 1979, pp. 89–113; Michael McPherson and Morton Owen Shapiro, "Does Student Aid Affect College Enrollment? New Evidence on a Persistent Controversy," *American Economic Review*, March 1991, pp. 309–331; and Julia Heath and Howard Tuckman, "The Effects of Tuition Level and Financial Aid on the Demand for Undergraduate and Advanced Terminal Degrees," *Economics of Education Review*, Vol. 6, No. 3, pp. 227–238.

[11]The years 1991–92 to 1993–94 were used to calibrate these elasticities for all three systems. Beyond the desire for consistency, these are years in which *all* components of the demand model are presumed known, except for the price elasticity. Because the model assumes a baseline of 1989–90, the baseline demand quantity Q_0 is assumed to be known for these years. While the model could have been back-cast for these earlier years, variability was considered too high in some of the detailed participation factors, especially for the early 1980s.

$$\varepsilon = \frac{ln\, Q_D - ln\, Q_0}{ln\, P} \qquad \text{(A.2)}$$

A similar exercise was performed for the University of California system because it also has not turned away any students due to capacity constraints.[12] The calculated elasticity, –0.0503, was also within the ranges found in the general literature. It may also be observed that California Community College system students are more sensitive to price than are UC students.

Equation (A.2) is also used to estimate the demand elasticity for the CSU system, calibrated in the same manner as the CCC and UC systems. The resulting elasticity of –0.1971 indicates that CSU students are the most reactive to price changes of the three systems. Because this elasticity also includes some supply effects, it will produce conservative (lower) estimates of the number of students expecting to desire to attend the system under various pricing alternatives.

Implementation of Price and Elasticity

The elasticities listed above, however, are subject to a wide range of problems. First, the number of data points upon which they are based is small. Second, in at least one case (CSU) there are significant supply constraints. Additionally, there is at least anecdotal evidence that nonprice demand-suppressing policies such as reduced outreach and negative publicity occurred.

Price elasticity and price changes are, however, important to the future prospects of modeling higher education in California and cannot be disregarded. Instead of using specific price scenarios, therefore, the model uses the net aggregate impact of recent policy initiatives as an estimate of the proportional suppressing impact of these policies on demand.

[12]Some of these admissions are redirected to later quarters, thereby increasing the overall price of attending the University of California by forcing the student to wait. Because there seems to be a strong bias for students to want to attend school starting in the fall quarter, and possible costs in terms of acclimatization to the university environment, the attractiveness of the University of California as a choice decreases. Subsequently, some of the change attributed to fee increases could actually be a consequence of an increased number of students put on the "waiting list."

Because the price and elasticity are important to future renditions of this research, the infrastructure of the price-elasticity model is left intact. The prices and elasticities, however, are held constant at current levels. This means that the P^{ε} term in Equation (A.1) remains constant at the average of the values for 1991–92 to 1993–94 and is equivalent to calculating this value directly through a simple ratio. The value of ε is calculated based on the theoretical baseline enrollment (Q_0) the observed values of P and expected demand (Q_D). The values, as described above, are then applied to the constant price series into the future.

It is recommended that additional research be conducted to identify the actual elasticities to be used in a fuller implementation of this model. Because the price elasticities themselves are not robust enough to use, scenarios attempting to close the access deficit through price increases are not possible. In an advanced study of these elasticities, the impacts of price increases/decreases and offsetting increases/decreases in financial aid must be considered in the context of an individual's ability to pay and the overall income profile of the entire marketplace. These matters are left to future research.

THE RESULTING PROJECTIONS: EXPECTED DEMAND

Table A.2 shows the resulting projections of expected demand using this model. Readers are referred to Appendices B and C for the details of the baseline demand, which is an input into the model described in this appendix. Note that this table is reported in full-time equivalents and corresponds to the headcount projections presented in Table 3.2.

Table A.2

Projections of Expected Demand for Public Undergraduate Education (full-time equivalents)

Year	California Community Colleges	California State University	University of California	Total
1995–96	1,222,365	266,023	121,722	1,610,110
1996–97	1,250,086	267,632	122,484	1,640,202
1997–98	1,277,448	270,317	123,965	1,671,730
1998–99	1,305,485	274,308	126,332	1,706,125
1999–00	1,334,954	279,652	129,603	1,744,209
2000–01	1,364,523	285,200	132,914	1,782,637
2001–02	1,393,863	291,213	136,228	1,821,304
2002–03	1,423,600	297,256	139,344	1,860,200
2003–04	1,453,361	302,276	141,787	1,897,424
2004–05	1,483,576	307,313	144,263	1,935,152
2005–06	1,513,865	312,052	146,532	1,972,449
2006–07	1,544,086	316,390	148,545	2,009,021
2007–08	1,575,079	321,003	150,754	2,046,836
2008–09	1,607,743	325,938	153,306	2,086,987
2009–10	1,643,413	332,353	157,007	2,132,773
2010–11	1,681,250	339,600	161,278	2,182,128

SOURCE: Derived from this analysis.

Appendix B

MODELING THE BASELINE DEMAND FOR PUBLIC UNDERGRADUATE EDUCATION

The baseline demand for public undergraduate education represents the volume of students who would attend the state's public education institutions if the goals of the California Master Plan for Higher Education (as represented by the baseline year) were fully implemented. In this model, it is the level of demand for public undergraduate education if there are no supply constraints in place and only the price effects are those existent in the baseline period. This appendix details a theoretical explanation of the model and its underlying assumptions. Appendix C provides a discussion of how this theoretical model was operationalized.

THE DETAILED MODEL

The general form of the model assumes a systems approach to mapping the transitions between each of the classes (states). In general, for all classes, a student may either remain in the current class, pass on to the next stage, or drop from the model entirely, as shown in Figure B.1. Similarly, the students in each state are either holdovers from the prior period, new arrivals from the prior class, or arrivals from outside the system.

Equation (B.1) captures this relationship.

$$Class = Advancing\,Cohort + External\,Arrivals + Holdovers \quad \text{(B.1)}$$

In general, the holdovers would be recognized as the group that was in the same class in the prior time period; the advancing cohort represents students who were in the next lowest class the prior year; and

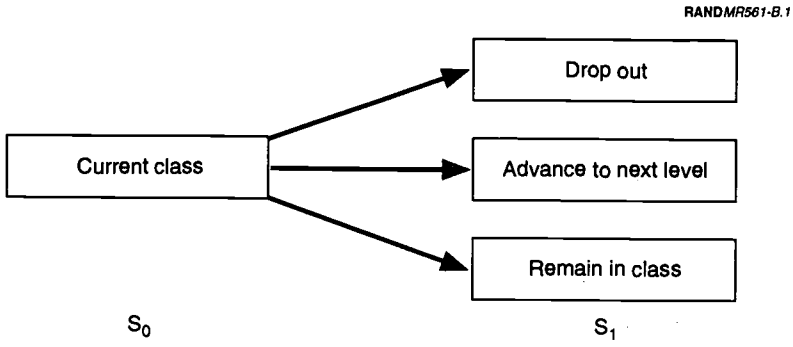

Figure B.1—Student States

external arrivals would be those students who arrive from outside the system itself or transfer students. Equations (B.2) to (B.5) define this more formally for the four undergraduate classes.

Freshmen:

$$F_t = R_t + X_t^F + \rho^F F_{t-1} \tag{B.2}$$

Sophomores:

$$P_t = \alpha^P F_{t-1} + X_t^P + \rho^P P_{t-1} \tag{B.3}$$

Juniors:

$$J_t = \alpha^J P_{t-1} + X_t^J + \rho^J J_{t-1} \tag{B.4}$$

Seniors:

$$S_t = \alpha^S J_{t-1} + X_t^S + \rho^S S_{t-1} \tag{B.5}$$

where the variables are defined as follows:

F_t is the number of freshmen in year t.

P_t is the number of sophomores in year t.

J_t is the number of juniors in year t.

S_t is the number of seniors in year t.

R_t is the number of first-time freshmen in year t.

X_t^C is the number of transfers into class C in year t.

ρ_t^C is the proportion of the class C that remains in class C in year t.

α_t^C is the proportion of the prior year class C–1 that advances to class C in year t.

This represents a fully specified version of the undergraduate enrollment within a system. For freshmen, the number of freshmen is equal to the number of advancing students (from high school—first-time freshmen) plus the number of external entries (transfers) plus a certain share of the prior freshman class who remained in the freshman class. Similarly, the sophomore class is composed of students who advanced from freshman status in the prior year plus transfers plus a certain proportion of sophomores from the prior year who did not advance to junior status and did not drop out. The junior and senior constructs are similar to that of the sophomores.

Unfortunately, the data regarding who stays and who advances, which are necessary for the full implementation of this model, are not available. Instead, the available data include only the number of students in each class in each year. As a result, the model given in equations (B.2) to (B.5) has been modified to become the model shown in (B.6) to (B.9) below.

Freshmen:

$$F_t = R_t + X_t^F + \rho^F F_{t-1} \tag{B.6}$$

Sophomores:

$$P_t = \gamma^P F_{t-1} + X_t^P \tag{B.7}$$

Juniors:

$$J_t + \gamma^J P_{t-1} + X_t^J \tag{B.8}$$

Seniors:

$$S_t = \gamma^S J_{t-1} + X_t^S \qquad \text{(B.9)}$$

where γ_t^C represents a combination of the coefficients α_t^C and ρ_t^C in equations (B.2) to (B.9). Notice that the relationship for freshmen [given in (B.2) and (B.6)] remains the same, while the forms specifying the other classes change. The relationship between γ_t^C in this set of equations and α_t^C and ρ_t^C are given by equation (B.10) below.

$$\gamma_t^C = \alpha_t^C + \rho_t^C \frac{C_{t-1}}{(C-1)_{t-1}} \qquad \text{(B.10)}$$

where C_{t-1} represents the number of students in class C in year $t-1$ and $(C-1)_{t-1}$ represents the number of students in class below C in year $t-1$. Remember that ρ represents the proportion of students who remain in a given class from the prior year. In the special case where $\rho=0$, note that $\gamma=\alpha$; which says that if everyone either advances or drops out, this factor will correspond to the advancement rate. It is also important to note that this aggregate measure responds to changes in the remaining rate (the rate at which people remain in class C) as well as to the ratio of the size of the class and the next lower class in a given year. It would be expected, for example, that ρ is a direct function of the estimated time-to-completion for a degree.[1] As time to completion increases, so will the proportion of each class remaining behind. Another consequence of this relationship is that γ may be greater than one. While α and ρ are, by definition, proportions and must be less than one, γ is a ratio and may be greater than one. In fact, if C_{t-1} is much greater $(C-1)_{t-1}$ and α is close to one, then the ratio can be much greater than one.

Because this ratio is so important, its stability over time is presented in Figures B.2 to B.4. As these figures show, the ratios are generally stable over the period of the model.

[1]This is because, as time-to-completion increases, the number of units completed in a given year on average decreases, and hence the number of students completing enough units to advance will also increase.

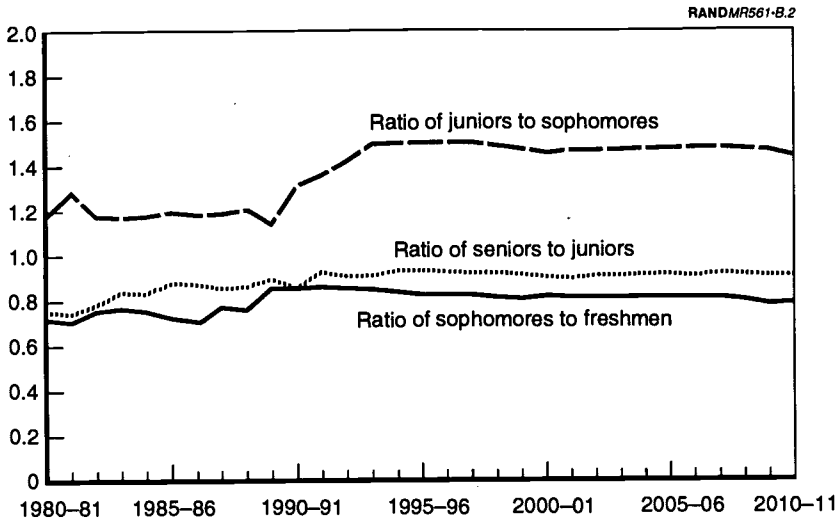

Figure B.2—Ratio of the Number of FTEs in Sequential Classes for the University of California System

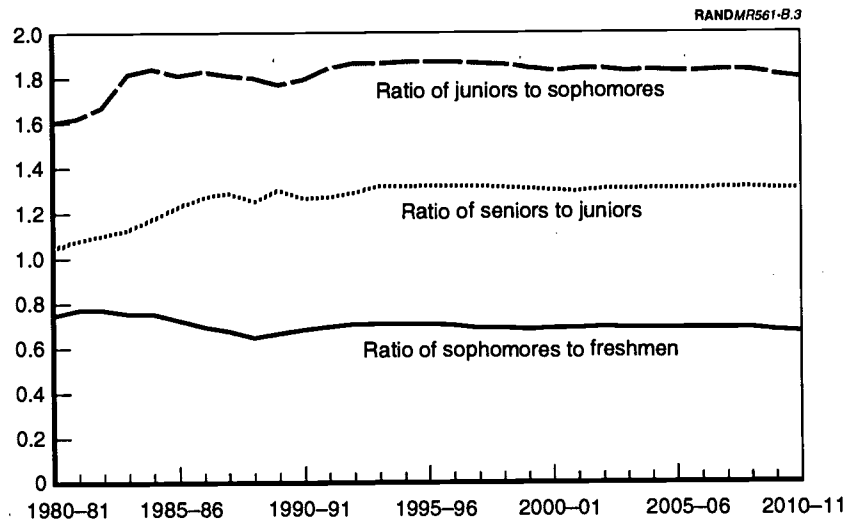

Figure B.3—Ratio of the Number of FTEs in Sequential Classes for the California State University System

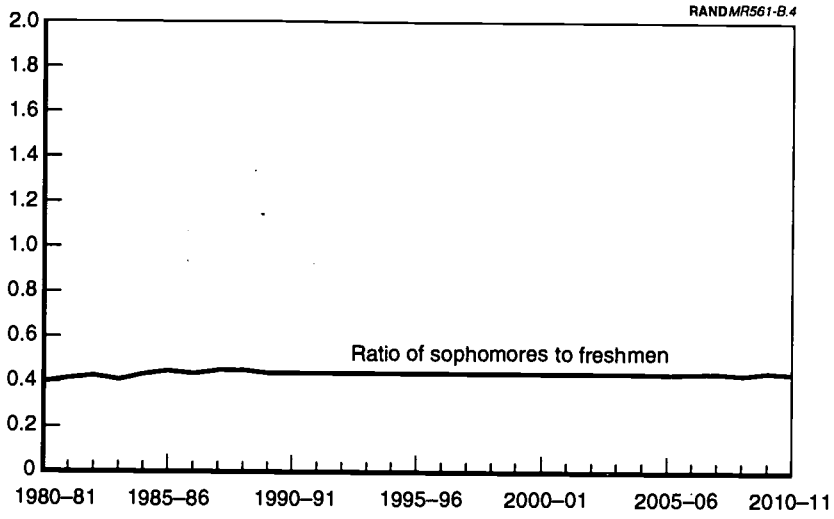

Figure B.4—Ratio of the Number of FTEs in Sequential Classes for the California Community College System

In each figure, the ratios are actuals through 1989–90 and estimates from our model thereafter. In the University of California, Figure B.2, all the class-to-class ratios rose mildly during the early 1980s and then remained relatively flat in the late 1980s. In the 1990s, the series is relatively flat, except for the senior-to-junior ratio. This is the result of the UC's increased success in attracting California Community College students into the system.[2] The California State University and the California Community College figures (Figures B.3 and B.4, respectively) show a similar pattern to the University of California series—mild growth in the early 1980s and a flattening out in the late 1980s.

The actual values for the participation, transition, and transfer factors were estimated from raw summary data provided by the California Postsecondary Education Commission. The detailed mechanics of this estimation process are provided in Appendix C.

[2]This is discussed in more detail in Appendix C.

For the purposes of this analysis, it is assumed that this relationship is relatively constant into the future with respect to the base year (see next section for a discussion of the base year). Another set of issues is the stability of the relationship between α and ρ. For purposes of this analysis, the variations in α are assumed to be proportionately reflected in ρ and the ratio between the two is constant. Because this model uses a base-year approach to assessing future outcomes, it assumes that this ratio remains what it was in the base year.[3] There is some evidence that the time-to-completion overall is increasing over the baseline 1980s, which would mean that an increasing share of the variation in γ may well be explained by changes in ρ rather than α.

SELECTING A SET OF COEFFICIENTS

One of the important assumptions of this model is the set of coefficients (participation and retention rates) used to estimate the future. The coefficients were derived for the years 1980–81 to 1989–90, which represent one possible baseline period discussed in the assumptions above. The model has been estimated using both the average coefficients over the period and those from the last year of this period. Because of a minor trend toward increasing participation rates over the period (this varies by detailed cohort but appears prevalent in the larger groups driving the enrollment levels, namely white students), the coefficients based on the averages produce a *step down* in the estimates for the ensuing years of the model.

For this reason, and the reasons described above, 1989–90 has been chosen as the baseline period of the model. The inherent result is a specific reference point against which to compare the implications of various policy actions, instead of the period of time. Because there also appears to be somewhat of an upward trend over time in the coefficients, this represents a reasonably conservative estimate of the coefficients into the future.[4] As a consequence of this assumption,

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[3]Note that even though we assume that this ratio is constant, we do not have a direct mechanism of ascertaining exactly what that ratio is or the value of either of the coefficients.

[4]This is because our model applies participation rates to Department of Finance population estimates. Higher participation rates produce larger baseline demand levels. Because the trends in some population subgroups were toward increasing par-

the estimated level of baseline demand in the estimated years represents the number of people the system should be expected to enroll, given the economic assumptions and conditions existent in 1989–90. The price parameter will also be driven by the current price relative to the price in 1989–90.

SELECTING THE DIMENSIONS ALONG WHICH TO DIVIDE THE POPULATION

The model used in this analysis is dependent on participation rates of specific population cohorts in the higher education system. This segregation is important because it allows the model to be sensitive to the various demographic shifts in the state's population. For purposes of this model, participation and transition rates were calculated along six dimensions: age,[5] gender,[6] ethnicity,[7] enrollment status,[8] program,[9] and system.[10] These dimensions were selected because they represent standard delineations of the population and they were the primary delineations found in the primary data for this analysis: state public institutional enrollments and state population.

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ticipation rates, our model may well underestimate the baseline demand for these subgroups.

[5]This category was not directly available for all of the information. It was used primarily for the initial enrollment of freshmen into the system.

[6]This category had two possible levels: female and male.

[7]This category had five possible levels: African-American, Asian, Hispanic, white, and other.

[8]This category had two possible levels: full-time and part-time.

[9]This category had two possible levels: regular and noncredit.

[10]This category had three possible levels corresponding to each of the three public systems: the University of California, the California State University, and the California Community Colleges.

Appendix C

IMPLEMENTING THE BASELINE DEMAND MODEL FOR PUBLIC UNDERGRADUATE EDUCATION

This appendix describes the practical issues associated with implementing the theoretical model given in Appendix B. It describes the steps used to move from the raw data sets to the final models and results.

THE RAW DATA

There are two sets of raw data used in this model. The first data set was demographic projections of the state's population, produced by the Department of Finance. The state population includes population projections separated into individual subgroups by gender, ethnicity, and age cohorts. This series was produced after the 1990 census and reflects an official estimate of the state's population from 1970 to 2040. Although the data are available on the county level, this model used only the state totals. The state population projections are given below in Table C.1.

The second set of data came from the California Postsecondary Education Commission. There were four parts to this data set: (1) enrollments by program,[1] class level, full- or part-time status, ethnicity, and gender; (2) enrollments by program, class level, status, ethnicity, gender, and age; (3) first-time freshmen by program, class

[1]Regular or noncredit.

Table C.1

Estimates and Projections of California Population

Year	Population	Year	Population
1980–81[a]	23,782,003	1996–97	33,863,639
1981–82[a]	24,279,565	1997–98	34,524,435
1982–83[a]	24,804,003	1998–99	35,182,776
1983–84[a]	25,335,828	1999–00	35,824,238
1984–85[a]	25,815,852	2000–01	36,443,857
1985–86[a]	26,402,649	2001–02	37,055,570
1986–87[a]	27,052,139	2002–03	37,665,930
1997–88[a]	27,716,977	2003–04	38,252,427
1988–89[a]	28,393,148	2004–05	38,837,978
1989–90[a]	29,142,279	2005–06	39,424,114
1990–91[a]	29,976,003	2006–07	40,011,306
1991–92	30,646,076	2007–08	40,602,861
1992–93	31,300,134	2008–09	41,201,498
1993–94	31,906,302	2009–10	41,800,987
1994–95	32,520,134	2010–11	42,408,137
1995–96	33,188,930		

SOURCE: California Department of Finance, June 1993.

[a]Denotes actual values.

level, status, ethnicity, gender, and source;[2] and (4) transfer students into the systems by program, class level, status, ethnicity, gender, and source institution. These data were provided for each of the public systems of higher education in California and were used to calibrate the participation and transition rates for the model specified in Appendix B.

Cleaning the Data

The institutional enrollment and transfer data provided the CPEC is the result of aggregation of original information provided at the student level by the separate systems. The system information was, in turn, the result of aggregations of the information provided by each system's member institutions. These data are consequently subject to the problems of occasionally inaccurate self-reporting that plague

[2]The source information included details of whether the individual came from a public or private California high school, from other states, or from other countries.

all data collection efforts. After consultation with individuals in each institution, however, these data are believed to be reasonably clean.[3]

The greatest problem plaguing these data was incomplete reporting of information. There were records in all of the systems that indicated "Unknown" (or "Decline To State [DTS]") in response to one or more of the relevant categories. The incidence of this problem was infrequent.[4] While these records represent missing information, the individual cases do represent students attending public institutions in California. To model full enrollment levels, therefore, it was important not to exclude these students.

The data set was cleaned by allocating these students proportionately across all other student group categories at that level. For example, the category segregation for the enrollment data set was, in this order, institution, class level, enrollment status, ethnicity, and gender. If there were ten students included in the group "community college enrollments, freshmen, full-time, Hispanic, unknown gender," and 60 percent of "community college freshmen full-time Hispanics" were male (totaling 155) and 40 percent were female (totaling 103), then six would be allocated to the male subcategory and four to the female subcategory, for a total of 161 males and 107 females. This cleaning technique was implemented from the lowest detail level upward to retain as much of the information in the data as possible.

This distinction could bias the information that goes into the determination of the various coefficients if there were systematic patterns in the missing information. For example, if, at the ethnicity level, white students had a greater predilection to state "Decline to state" as their ethnicity, then all the unknowns should have gone to the white category instead of being proportionately distributed across all the ethnic categories. This would understate the actual number of

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[3]In addition, the identifying information used in this analysis has been routinely collected for some time and is reasonably unambiguous. Follow-up interviews have also shown that the general categories used in the models in this report have been reported and interpreted consistently over time.

[4]Ninety-six percent of the University of California students, 93 percent of the California State University students, and 84 percent of the California Community Colleges students were fully identified in the data.

white students and overstate the number of students in other categories.

Because there is no clear information available regarding possible patterns in the nonresponse rates of the various specific subgroups used in this analysis, the proportionate distribution approach was selected. This makes the best use of the data available.

The data provided by the Department of Finance required no additional cleanup; there were no missing data points.

The Data Sets

The data were organized and segregated into the following detail. The general form of each listed record is: (1) the name of the data set; (2) a description of the data set; and (3) detail categories, in order of detail.

Enrollments by program lists the number of students enrolled in each class of the system. Detail, in descending order, included program, class level, enrollment status, ethnicity, and gender.

Age-delineated enrollments lists the number of students enrolled in each class of the system, and included age detail. Detail, in descending order, was program, class level, enrollment status, ethnicity, gender, and age.

First-time freshmen enrollments lists the number of students enrolling in each system who had never attending college before. Detail, in descending order, included program, enrollment status, ethnicity, gender, and source institution.

Transfer students enrollments lists the number of transfer students into each system, including information on source institution. Detail included, in descending order, program, class level, enrollment status, ethnicity, gender, and source institution.

California state population lists the total number of people in California. The data include the following detail, in descending order: ethnicity, gender, and age.

DEVELOPING THE COMPONENTS OF THE MODEL

There are several sets of coefficients necessary to implement the baseline demand model. The details of the derivation of each are given below.

Derivation of First-Time Freshmen

First-time freshmen may arrive from only one source—the general population outside all systems. First-time freshmen, by definition, are individuals who enroll in the system for the first time. Furthermore, these individuals represent the key link between the general population and higher education enrollments.

In modeling the number of first-time freshmen, indicated as R_t in equations (B.2) and (B.6), a traditional approach has been to estimate the number of incoming students as a share of prior-year high school graduates (or those graduating two years prior). A second, almost equivalent approach, uses the "high school–age population," usually listed as 17 to 19 year olds, as the denominator in the calculation. Both these methodologies will work well for institutions whose primary source pool for undergraduate students is students coming directly or almost directly from high school—the University of California, for example. For the other two institutions, however, this is not necessarily the case. Both the California State University and California Community College systems enroll significant numbers of older students who do not fall into this particular designation. Furthermore, the California Community College system also enrolls students who do not necessarily have their high school diplomas.[5]

An alternative methodology was therefore sought. The selected methodology focuses on age as the primary determinant of an individual's likelihood of attending the various institutions. This analysis estimates an age distribution for first-time freshmen and then devel-

[5]CCC enrolls some students who attend for remedial training in preparation for their high school diploma, students attending vocational education programs, and high school students taking college-level classes concurrent with their high-school enrollment. The University of California and the California State University both have concurrent high-school enrollment students, but in much smaller numbers.

ops participation rates for these students as a proportion of the age-specific general population groups.

Because the specific age breakdown of first-time freshmen was not available, the age distribution of freshmen overall was used, broken down into subgroups by ethnicity and age. This was accomplished by multiplying the percentage of each age category in each ethnicity and gender subgroup [defined in equation (C.1)] times the number of first-time freshmen in that particular ethnicity and gender subgroup. The formulation is given in equation (C.2).

$$a_{t,s,e,g,a} = \frac{N_{t,s,e,g,a}}{\sum_{i=all\ ages} N_{t,s,e,g,i}} \qquad \text{(C.1)}$$

where, for all enrollment status categories s, ethnicity categories e, and gender categories g:

$a_{t,s,e,g,a}$: The percentage of individuals in enrollment group s, ethnicity group e, and gender group g who fall in age group a in year t.

$N_{t,s,e,g,a}$: The number of freshmen in the age-delineated enrollment data set that fall in enrollment group s, ethnicity group e, and gender group g and who fall in age group a in year t.

$$R_{t,s,e,g,a} = a_{t,s,e,g,a} \times FTF_{t,s,e,g,a} \qquad \text{(C.2)}$$

where, for all enrollment status categories s, ethnicity categories e, and gender categories g:

$R_{t,s,e,g,a}$: The number of first-time freshmen in enrollment group s, ethnicity group e, and gender group g that fall in age group a in year t.

$FTF_{t,s,e,g}$: The number of first-time freshmen in enrollment group s, ethnicity group e, and gender group g in the first-time freshmen data set in year t.

This number of first-time freshmen, $R_{t,s,e,g,a}$, is then used to calculate the participation rates of first-time freshman, by age, in the overall

population. This relationship, $r_{t,s,e,g,a}$, will be used to determine the baseline coefficient $r_{base,s,e,g,a}$, which will be used to estimate the flow of first-time freshmen into the various systems in future years, where *base* represents the baseline year(s). The equation for the derivation of $r_{t,s,e,g,a}$, is given in equation (C.3).

$$r_{t,s,e,g,a} = \frac{R_{t,s,e,g,a}}{POP_{t,e,g,a}} \tag{C.3}$$

where, for all enrollment status categories s, ethnicity categories e, and gender categories g:

$r_{t,s,e,g,a}$: The participation rate of first-time freshmen in ethnicity group e and gender group g and age group a in year t.

$POP_{t,e,g,a}$: The number of people in California in ethnicity group e, gender group g and age group a in year t.

This relationship is used to calculate r only for years in which R and POP are known. The values of r are then used to determine a base rate. In this analysis, two values for r_{base} were computed. The first value was the average of the r values for years 1980–81 to 1989–90. The second was the r for 1989–90. In the final model the r from 1989–90 is used as r_{base}. In all years after the base year, the relationship in (C.3) is rearranged into the relationship shown in (C.4) and used to estimate R_t for all prediction years.

$$R_{t,s,e,g,a,} = r_{base,s,e,g,a} \times POP_{t,s,e,g,a} \tag{C.4}$$

$R_{t,s,e,g,a}$ is then aggregated up on the age detail level to produce $R_{t,s,e,g}$. Throughout all of the subsequent models, the detail is retained at the t,s,e,g level.

Transfer Students

The transfer-students model involved a simple calculation of the proportion of students in class C–1 transferring to class C in another institution in year t. This transfer rate is calculated using equation (C.5), where ξ is the rate of transfer of students in class C from the

source institution to the institution *I*, *X* is the number of transfers in year *t* into class *C* from the source institution to destination institution *I*, and *C–1* represents the class before class *C*. In the case of freshmen, the freshmen were used as the base for $(C-1)_{t-1}$.

$$\xi^{C,I}_{t,s,e,g} = \frac{X^{C,I}_{t,s,e,g}}{C^{C-1,I}_{t-1,s,e,g}} \tag{C.5}$$

Once the baseline criteria are selected, the appropriate values of ξ are used to generate an *X* for each year from each of the three public source institutions to each of the three public destination institutions according to equation (C.6).

$$X^{C,I}_{t,s,e,g} = \xi^{C,I}_{base,s,e,g} \times C^{C-1,I}_{t-1,s,e,g} \tag{C.6}$$

Once the numbers of students transferring from one institution to another are known, these amounts are used within the institutions to determine transition rates and overall enrollments as described below. Again the detail is retained at the *t,s,e,g* level.

To account for transfers from non-California public institutions and private institutions, the average number of transfers from these institutions over the period 1980–81 to 1989–90 was used. An alternative approach was to hold the proportion of transfers from these institutions constant as a share of all transfers. Using this approach at the detailed level did not significantly alter the overall results. Furthermore, to the extent that these students represent services to non-California residents, it was felt that serving them was not a policy of the state or the Master Plan.[6]

Participation of Freshmen

Once students have been pulled into the system from the general population, through the derivation of R_t, there are three possible outcomes for them in the next year—they finish their freshman year

[6]This argument ignores the extent to which these individuals remain in California after completing their education and what they contribute to the state.

and become sophomores, they remain freshmen, or they drop out. The number of freshmen who remain freshmen in the next year is represented by the quantity ρF_{t-1} in equation (B.6). To estimate ρ, use the R_t and X_t values derived according to the descriptions above and combine them with the number of freshmen in year t, according to (C.7).

$$\rho^F_{t,s,e,g} = \frac{F_{t,s,e,g} - R_{t,s,e,g} - X^F_{t,s,e,g}}{F_{t-1,s,e,g}} \qquad \text{(C.7)}$$

This value is then applied to future populations to predict F_t according to equation (B.6). As with all other components of the baseline demand model, two versions of these coefficients were generated for the baseline model, using both the average of the coefficients for the years 1980–81 to 1989–90 and the 1989–90 year alone. The final model used the 1989–90 version, as described above.

The Transition Between Classes

Similarly, the transition factors[7] among the sophomore, junior, and senior classes are calculated according to equation (C.8). These factors, called γ, are then inserted into equations (B.7) through (B.9) to estimate the number of students in each class.

$$\gamma^C_{t,s,e,g} = \frac{C_{t,s,e,g} - X^C_{t,s,e,g}}{(C-1)_{t-1,s,e,g}} \qquad \text{(C.8)}$$

PUTTING IT ALL TOGETHER

At this point, estimates of the enrollments in each of the classes—freshmen, sophomores, juniors, and seniors—detailed by sys-

[7]These are factors, not rates. A rate would measure the proportion of students in class C that move on to class $C+1$. Instead, it computes the sum of the effects described in equation (B.10) in Appendix B.

tem, program,[8] enrollment status, ethnicity, and gender have been produced. These detailed groups were then aggregated across gender and age to get estimates of students by system, class level, program, and enrollment status (part-time and full-time). For the system-wide analyses used in this analysis, these amounts were aggregated across classes to have systemwide enrollments by program and status.

These full- and part-time enrollments were then combined into full-time equivalents. This was done by calculating a part-time factor for each system using equation (C.9), where *FTE* is the number of full-time equivalents enrolled, *FT* is the number of full-time students, and *PT* is the number of part-time students. These coefficients were calibrated using the years for which information was available and were consistent over time for all three systems.[9]

$$\phi = \frac{FTE - FT}{PT} \qquad \text{(C.9)}$$

This approach was selected instead of the generic approach of adding an overall factor of one-half or one-third of part-time enrollments to full-time enrollments because of the wide variation in the enrollment behaviors of the students in each system. A system-specific definition allows the full-time equivalent to more closely approximate these diverse behaviors.

This factor was then used in the future projections to convert full- and part-time enrollments into FTEs using equation (C.10).

$$FTE = FT + \phi PT \qquad \text{(C.10)}$$

The resulting time series is the number of undergraduate FTEs in each of the state's public systems who would have attended the system under the conditions existent in the base year without price effects and supply constraints—the baseline demand.

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[8]Because of their unique mission, the California Community Colleges had enrollments other than regular credit enrollments. They also included noncredit enrollments.

[9]The University of California factor varied somewhat but was reasonably stable over the latter portion of the 1980s.

THE RESULTS: BASELINE DEMAND

The resulting baseline demand series is presented in Table C.2. Note that these results are reported in full-time equivalents while the comparable results in Table 3.1 are headcount enrollments.

Table C.2

Projections of Baseline Demand for Public Undergraduate Education (full-time equivalents)

Year	California Community Colleges	California State University	University of California	Total
1995–96	891,677	243,434	117,361	1,252,472
1996–97	911,898	244,905	118,097	1,274,900
1997–98	931,858	247,363	119,524	1,298,745
1998–99	952,310	251,015	121,807	1,325,132
1999–00	973,807	255,905	124,961	1,354,673
2000–01	995,376	260,982	128,153	1,384,511
2001–02	1,016,779	266,484	131,348	1,414,611
2002–03	1,038,472	272,015	134,353	1,444,840
2003–04	1,060,181	276,608	136,708	1,473,497
2004–05	1,082,222	281,218	139,096	1,502,536
2005–06	1,104,317	285,554	141,283	1,531,154
2006–07	1,126,362	289,523	143,224	1,559,109
2007–08	1,148,970	293,745	145,354	1,588,069
2008–09	1,172,798	298,261	147,814	1,618,873
2009–10	1,198,818	304,131	151,383	1,654,332
2010–11	1,226,419	310,762	155,501	1,692,682

SOURCE: Derived from this analysis.

Appendix D

MODELING THE SUPPLY OF PUBLIC UNDERGRADUATE EDUCATION

There are two aspects of the supply of public undergraduate education in California—the number of seats funded on an operational level and the number of seats physically available. The former is the operational definition of supply and the latter is the capital definition. Both dimensions of supply are addressed in this model.

The following models were developed and implemented in real terms using the California Consumer Price Index (CCPI) to deflate historical amounts and an estimated inflation rate of 3 percent to deflate predicted values. The CCPI is converted to a 1992–93 base year by dividing the CCPI time series values by the 1992–93 value.[1] All rates generated and used in the model are real. When necessary for presentation, the real values are converted to nominal amounts using the CCPI.

OPERATIONAL SUPPLY MODEL

The general form of the total operational supply of education for each system is given in equation (D.1) where Q_t^S is the number of undergraduate seats provided by the system, OR_t represents the op-

[1]This calculation does not directly convert the CCPI to a new base year because it does not reflect changes in the "goods basket" that would be associated with such a true conversion. The original CCPI series used a 1982–84 base year period.

erating revenues of the system, and C_t represents the cost per FTE for that system in year t.[2]

$$Q_t^S = u_t \frac{OR_t}{C_t} \tag{D.1}$$

It states that the undergraduate quantity supplied equals the proportion of total seats preserved for undergraduates times the total number of seats provided, which equals the total dollars provided divided by the per-unit cost. The methodologies used to estimate each of these values is presented below.

The actual implementation of this formulation is more complicated, however. The operating revenues (OR_t) in a given year are also a function of the number of students attending and may be rewritten as (D.2), where $Q_t^{Enrolled}$ is the number of students enrolled in the system in year t, $Fees_t$ are the fees per FTE in year t and $Other_t$ is the system's revenues from other sources in year t.

$$Q_t^S = \frac{Q_t^{Enrolled} Fees_t + Other_t}{C_t} \tag{D.2}$$

If Q_t^S is the binding constraint in a given year, then $Q_t^{Enrolled} = Q_t^S$ and equation (D.2) can be solved for Q_t^S, yielding equation (D.3) below.

$$Q_t^S = \frac{Other_t}{C_t - Fees_t} \tag{D.3}$$

Q_t^S in (D.3) represents total enrollment in the system in year t, so this value is then multiplied by u_t, the undergraduate proportion of total enrollments,[3] to arrive at an undergraduate supply projection.

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[2]This model assumes that the costs associated with the production of undergraduate and graduate instruction (or credit and noncredit in the case of community colleges) are equal.

[3]In the case of the California Community Colleges, this proportion is actually the credit (vs. noncredit) proportion of total enrollments. This proportion functions the same for California Community Colleges as the undergraduate proportion does for the UC and CSU.

The Ratio of Undergraduates to Graduates

In this model, the proportion of total enrollments represented by under-graduates[4] is a policy variable. For the general purposes of the model, it is assumed to remain constant over time.[5] For instance, one or more of the systems could choose to increase its share of undergraduate education while decreasing the quantity of graduate education produced, or visa versa.

While this policy lever has been included in the model, for the purposes of this analysis, it is held constant into the future. It was estimated by calculating the past proportion of undergraduate FTEs. For all three systems, these shares were relatively constant during the 1980s. The University of California showed the most change over this period, rising from 71 to 75 percent. The latter value was used.[6] Values of 82 and 86 percent were used for the CCC and CSU systems, respectively.

Total Operating Revenues

The estimation of total operating revenues for each system was an important decision in the process. Much of the work and many of the decisions used in this analysis to develop the model of total resources were based on the California Postsecondary Education Commission's publication *Fiscal Profiles, 1992,* from which some of the information is taken. Other sources, such as the annual *Governor's Budgets* and system-generated publications were also used.

The California Community College System. There are several sources for the operating funds that support the California

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[4]In the case of California Community Colleges, this proportion indicates the share of credit enrollments, not undergraduates.

[5]This is the case for the four-year institutions. In the case of community colleges, a similar distinction could be made between credit and noncredit enrollments.

[6]Graduate enrollments in this calculation included the health sciences student enrollments. The author recognizes that the decision process behind funding these FTEs is different. Even as the state, in the face of increasing population, has need of an increasing pool of trained undergraduate and graduate students, it will also need an increasing quantity of health practitioners and thus, these enrollments are included. The issue of health science enrollments will be revisited in the capital model below.

Community College system. State General Funds account for the largest share, followed by (in decreasing order) property taxes, student fees, lottery funds, other funds, and the State School Fund. Table D.1 presents the history of these funds and the projections for each of these series.

The minimum level of state funding for the CCC system is set, along with K-12 funding, under the provisions of the state constitution as defined by the voter-approved Propositions 98 and 111. Appendix E describes the detailed model for these provisions. The property taxes are projected based upon internal RAND estimates produced in conjunction with a forthcoming RAND report on the state fiscal crisis, and the reader is referred there for the details of this modeling.[7] Lottery revenues are extrapolated from the most recently available datum by the annual growth in per capita personal income. State School Fund revenues and "other funds" were held constant in real terms at their average value over the 1985–86 to 1991–92 period.[8]

Fees revenues are estimated by multiplying the expected number of students (in FTEs) times the average fee revenue per FTE. This quantity is determined by estimating the real total fees[9] and increasing the fees per FTE for the most recent known year annually by the relative increase in fees used in the price model.[10]

The California State University System. The major sources of operating revenues for the CSU system include the state General Fund, fees, federal funds, the Continuing Education Revenue Fund, lottery funds, and other funds. Of these, two do not directly fund general undergraduate education and are consequently omitted

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[7]Stephen J. Carroll, Peter Rydell, Eugene Bryton, and Michael Shires, *Projecting California's Fiscal Future*, Santa Monica, Calif.: RAND, MR-570-IET (1995).

[8]This period was selected because structural changes were made in the rules affecting the State School Fund in 1984–85. Simultaneously, "other funds" increased and remained at the higher level for most of the years following.

[9]Total fees include such things as parking, registration fees, and books, but exclude room and board. See the section on price in Appendix A for a more detailed explanation of the price-index model.

[10]This effectively assumes that the relationship between total fees per student and the fee revenues per FTE remains constant. This has been the case in recent years but was not as strong for the period through 1989–90 when fees for the CCC were nominally constant.

Table D.1

Expected Operating Revenues for the California Community College System (thousands of 1992–93 dollars)

Year	General Funds	Property Taxes	Fees	State School Fund	Lottery Revenues	Other Funds	Total[b]
1980–81[a]	1,874,075	556,981	0	4,512	0	900	2,436,468
1981–82[a]	1,659,927	613,259	0	4,881	0	1,796	2,279,863
1982–83[a]	1,630,134	590,540	0	6,579	0	8,595	2,235,848
1983–84[a]	1,583,866	583,065	0	6,938	0	7,567	2,181,436
1984–85[a]	1,572,891	599,066	91,623	6,938	0	1,432	2,271,950
1985–86[a]	1,600,079	666,052	89,008	4,207	114,335	43,560	2,517,241
1986–87[a]	1,613,139	706,267	86,807	2,510	74,400	1,090	2,484,213
1987–88[a]	1,651,259	749,905	81,868	2,633	120,255	44,626	2,650,546
1988–89[a]	1,739,649	773,935	77,250	2,375	150,317	40,745	2,784,271
1989–90[a]	1,762,971	803,327	73,314	2,367	143,223	33,418	2,818,620
1990–91[a]	1,856,637	846,541	77,335	2,479	103,867	31,288	2,918,147
1991–92[a]	1,766,511	874,507	91,037	2,636	78,547	2,538	2,815,776
1992–93[a]	1,263,000	1,010,367	122,575	1,986	85,479	7,010	2,490,417
1993–94[a]	948,894	1,241,238	181,468	1,108	91,450	25,534	2,489,692
1994–95[a]	1,094,022	1,290,412	168,192	1,108	87,329	25,534	2,666,597
1995–96	1,061,433	1,265,085	261,783	1,108	84,785	25,534	2,699,729
1996–97	1,130,457	1,282,015	229,463	1,108	101,318	25,534	2,769,896
1997–98	1,190,679	1,306,906	232,436	1,108	105,238	25,534	2,861,902
1998–99	1,217,743	1,344,963	233,459	1,108	109,179	25,534	2,931,987
1999–00	1,250,367	1,384,130	234,920	1,108	113,278	25,534	3,009,337
2000–01	1,265,157	1,437,907	235,954	1,108	117,376	25,534	3,083,036
2001–02	1,280,131	1,493,753	237,027	1,108	121,444	25,534	3,158,997
2002–03	1,294,919	1,551,722	238,123	1,108	125,667	25,534	3,237,072
2003–04	1,312,060	1,611,992	239,412	1,108	129,580	25,534	3,319,686
2004–05	1,307,416	1,690,248	240,246	1,108	133,330	25,534	3,397,881
2005–06	1,289,348	1,772,328	240,196	1,108	136,610	25,534	3,465,125
2006–07	1,246,999	1,858,337	238,501	1,108	138,996	25,534	3,509,475
2007–08	1,221,759	1,948,554	238,242	1,108	140,587	25,534	3,575,785
2008–09	1,220,614	2,043,158	239,838	1,108	141,482	25,534	3,671,734
2009–10	1,217,017	2,142,314	241,402	1,108	142,210	25,534	3,769,585
2010–11	1,211,091	2,246,337	242,969	1,108	142,903	25,534	3,869,943

SOURCE: 1980–81 to 1991–92: California Postsecondary Education Commission, *Fiscal Profiles 1992*, CPEC Report 92-9, March 1992, Display 64; 1992–93 to 1993–94: Pete Wilson, *Governor's Budget 1995–96*, 1995, pp. E-1 to E-120; 1995–96 and thereafter from this analysis.

[a]Denotes years for which data are actual amounts.

[b]Totals may vary due to rounding.

from the projections. The Continuing Education Revenue Fund reflects funds that come from extension, concurrent enrollment, and external degree programs and the "other funds" category includes predominantly self-funding enterprises, such as dormitories. Table D.2 shows the time series for these revenues for the CSU system.

State General Fund support of the system is estimated by multiplying the CSU share of General Fund revenues times the General Fund revenues. For years prior to 1993–94, the General Fund revenue support amounts are actuals. For subsequent years, the share is estimated by reducing the most recent actual share available (1993–94) by 5 percent of the 1994–95 share through 2004–05.[11]

In the optimistic scenario, the share is maintained at the 1994–95 level over the entire period. The General Fund revenue amounts are from RAND internal projections. A summary of the General Fund revenues, CSU revenues, and model projections are presented in Table D.3.

Student fees are calculated in the same manner as those in the California Community College system. Lottery funds are projected by the same methodology as well. Federal funds and capital outlay funds[12] are held constant, in real terms, at their average real levels during the period 1980–81 to 1992–93.

The University of California System. Overall operating revenues for the University of California system include state General Fund revenues, General University Funds,[13] student fees, lottery funds,

[11]This choice in the expected scenario is driven by the increased competition for scarce state resources. See the discussion of the supply of public undergraduate education in Chapter Two for a more elaborate discussion of the reasons underlying this adjustment.

[12]This represents the portion of capital outlay funds available for operating expenses.

[13]These represent funds from a variety of sources received by the University of California system for administration of contracts, application fees, and nonresident tuitions. Because the specific uses of these monies are left to the discretion of the system, they may be and are used to supplement the undergraduate teaching enterprise and are consequently included in the operational model.

Table D.2

Expected Operating Revenues for the California State University System (thousands of 1992–93 dollars)

Year	General Funds	Student Fees	Lottery Funds	Federal Funds	Capital Outlay Funds	Total[b]
1980–81[a]	1,631,616	140,760	0	96,747	5,542	1,874,665
1981–82[a]	1,478,510	181,775	0	65,019	8,954	1,734,257
1982–83[a]	1,373,544	253,027	0	88,689	14,063	1,729,323
1983–84[a]	1,386,995	324,330	0	89,382	8,858	1,809,566
1984–85[a]	1,584,246	301,206	0	90,513	1,529	1,977,494
1985–86[a]	1,684,453	291,568	17,026	101,291	10,468	2,104,805
1986–87[a]	1,743,658	311,096	41,972	94,898	7,549	2,199,173
1987–88[a]	1,767,113	333,379	25,261	96,751	–648	2,221,856
1988–89[a]	1,780,785	360,000	43,864	112,464	2,412	2,299,525
1989–90[a]	1,853,618	368,870	62,907	117,083	8,636	2,411,114
1990–91[a]	1,769,448	388,254	52,382	115,488	3,844	2,329,416
1991–92[a]	1,698,742	423,111	27,556	112,138	3,709	2,265,256
1992–93[a]	1,503,445	502,884	47,129	91,195	0	2,144,653
1993–94[a]	1,409,990	520,219	17,649	89,432	5,763	2,043,053
1994–95[a]	1,507,794	540,309	41,599	89,264	5,763	2,184,729
1995–96	1,471,949	643,554	37,263	89,264	5,763	2,247,793
1996–97	1,440,345	544,252	44,529	89,264	5,763	2,124,153
1997–98	1,402,281	520,092	46,252	89,264	5,763	2,063,651
1998–99	1,349,190	491,840	47,984	89,264	5,763	1,984,041
1999–00	1,296,644	464,825	49,786	89,264	5,763	1,906,281
2000–01	1,234,143	435,660	51,587	89,264	5,763	1,816,417
2001–02	1,167,617	406,334	53,374	89,264	5,763	1,722,353
2002–03	1,096,097	376,619	55,230	89,264	5,763	1,622,973
2003–04	1,020,870	346,887	56,950	89,264	5,763	1,519,734
2004–05	942,927	317,473	58,598	89,264	5,763	1,414,024
2005–06	958,264	315,557	60,040	89,264	5,763	1,428,887
2006–07	973,620	313,508	61,089	89,264	5,763	1,443,242
2007–08	987,476	310,934	61,788	89,264	5,763	1,455,225
2008–09	1,000,871	308,157	62,181	89,264	5,763	1,466,235
2009–10	1,013,540	305,180	62,501	89,264	5,763	1,476,248
2010–11	1,025,602	302,064	62,806	89,264	5,763	1,485,498

SOURCE: 1980–81 to 1991–92: California Postsecondary Education Commission, *Fiscal Profiles 1992*, CPEC Report 92-9, March 1992, Display 61; 1992–93 to 1993–94: Pete Wilson, *Governor's Budget 1995–96*, 1995, pp. E-1 to E-120; 1995–96 and thereafter from this analysis.

[a]Denotes years for which data are actual amounts.

[b]Totals may vary due to rounding.

Table D.3

Assumptions Supporting Alternative Scenarios for General Fund Support of the California State University System (thousands of 1992–93 dollars, unless otherwise indicated)

Year	General Fund Revenues	Expected Share	Expected CSU General Fund Revenues	Optimistic Share	Optimistic CSU General Fund Revenues
1980–81[a]	32,601,511	5.00%	1,631,616	5.00%	1,631,616
1981–82[a]	32,427,149	4.56%	1,478,510	4.56%	1,478,510
1982–83[a]	32,143,183	4.27%	1,373,544	4.27%	1,373,544
1983–84[a]	34,762,330	3.99%	1,386,995	3.99%	1,386,995
1984–85[a]	36,782,528	4.31%	1,584,246	4.31%	1,584,246
1985–86[a]	37,573,619	4.48%	1,684,453	4.48%	1,684,453
1986–87[a]	42,151,977	4.14%	1,743,658	4.14%	1,743,658
1987–88[a]	40,401,098	4.37%	1,767,113	4.37%	1,767,113
1988–89[a]	43,757,676	4.07%	1,780,785	4.07%	1,780,785
1989–90[a]	43,681,826	4.24%	1,853,618	4.24%	1,853,618
1990–91[a]	40,895,658	4.33%	1,769,448	4.33%	1,769,448
1991–92[a]	43,527,439	3.90%	1,698,742	3.90%	1,698,742
1992–93[a]	40,946,452	3.67%	1,503,445	3.67%	1,503,445
1993–94[a]	38,927,601	3.62%	1,409,990	3.62%	1,409,990
1994–95[a]	39,921,402	3.78%	1,507,794	3.78%	1,507,794
1995–96	41,023,522	3.59%	1,471,949	3.78%	1,549,420
1996–97	42,372,856	3.40%	1,440,345	3.78%	1,600,383
1997–98	43,679,709	3.21%	1,402,281	3.78%	1,649,742
1998–99	44,652,612	3.02%	1,349,190	3.78%	1,686,488
1999–00	45,774,437	2.83%	1,296,644	3.78%	1,728,858
2000–01	46,680,048	2.64%	1,234,143	3.78%	1,763,062
2001–02	47,560,978	2.45%	1,167,617	3.78%	1,796,334
2002–03	48,368,364	2.27%	1,096,097	3.78%	1,826,828
2003–04	49,144,101	2.08%	1,020,870	3.78%	1,856,127
2004–05	49,931,154	1.89%	942,927	3.78%	1,885,853
2005–06	50,743,337	1.89%	958,264	3.78%	1,916,529
2006–07	51,556,445	1.89%	973,620	3.78%	1,947,239
2007–08	52,290,216	1.89%	987,476	3.78%	1,974,953
2008–09	52,999,497	1.89%	1,000,871	3.78%	2,001,742
2009–10	53,670,389	1.89%	1,013,540	3.78%	2,027,081
2010–11	54,309,112	1.89%	1,025,602	3.78%	2,051,205

SOURCE: General Fund Revenues: *Governor's Budget*, various years to 1993–94 and RAND projections thereafter. CSU Shares of General Fund Revenues: this analysis. CSU General Fund Revenue Support: California Postsecondary Education Commission, *Fiscal Profiles 1992*, CPEC Report 92-9, March 1992, Display 61 for 1980–81 to 1991–92; Pete Wilson, *Governor's Budget 1994–95*, 1994, pp. E-1 to E-120 for 1992–93; Pete Wilson, *Governor's Budget 1995–96*, 1995, pp. E-1 to E-120 for 1993–94 to 1994–95; this analysis for 1995–96 and thereafter.

[a]Denotes years for which data are actual amounts.

University Special Funds, extramural funds, and other funds. Of these sources, two have been omitted from this model—University Special Funds and extramural funds. University Special Funds are revenues from such activities as hospitals, the direct sale of educational activities and services, extension courses, and other auxiliary activities and, as such, are not directly related to providing resources to teach undergraduate students. Extramural funds are predominantly federal research dollars and the Department of Energy contract for the UC's management of its laboratories.

The expected real revenue streams for the other sources are presented in Table D.4. State General Fund support is estimated in the future using the same methodologies employed in the California State University system estimates. Student fees are also calculated in the same manner as the CSU and CCC systems. Lottery funds are extrapolated from 1993–94 levels at the same rate as those in the California Community College system model. Because they had shown a marked increase in the early 1990s and then remained at that level, General University Funds are held constant at the average level of the years 1991–92 to 1993–94. The other funds category included two one-time transfers of capital funds to operating accounts (1983–84 and 1989–90). Because these are the only two instances, and, as will be seen in the capital model, there are not significant excess capital resources available, it is assumed that there will be no additional revenues from this source in the future.

As in the case of the California State University system, the main source of operating funds is the state General Fund. In the expected resources scenario, the UC share of General Fund revenues is expected to drop by 50 percent (5 percent of the 1994–95 share per year) over the next ten years. Table D.5 presents the expected General Fund revenue stream, the projected shares of state General Fund revenues under each of the scenarios, and the expected state support of the University of California under the two scenarios.

The Operating Cost per Student

Because the total operating budget of the system is divided by this factor to estimate the total number of FTEs, this is also an important issue for calculating the cost of producing students. The operating

Table D.4

Expected Operating Revenues for the University of California System (thousands of 1992–93 dollars)

	General Funds	Student Fees	Lottery Funds	University General Funds	Other Funds	Total[b]
1980–81[a]	1,841,610	166,697	0	113,485	0	2,121,792
1981–82[a]	1,697,590	185,695	0	144,267	0	2,027,552
1982–83[a]	1,703,688	219,726	0	130,717	0	2,054,131
1983–84[a]	1,620,639	246,675	0	141,177	94,609	2,103,100
1984–85[a]	2,019,790	231,607	0	123,504	0	2,374,901
1985–86[a]	2,197,407	226,043	23,096	160,530	0	2,607,076
1986–87[a]	2,318,056	226,621	16,388	126,333	0	2,687,398
1987–88[a]	2,345,627	241,631	25,023	157,549	0	2,769,830
1988–89[a]	2,332,826	249,329	30,769	190,084	0	2,803,008
1989–90[a]	2,340,993	259,112	27,174	194,655	64,481	2,886,415
1990–91[a]	2,285,636	267,163	19,885	178,087	0	2,750,771
1991–92[a]	2,180,759	355,510	15,037	245,512	0	2,796,818
1992–93[a]	1,919,476	465,115	16,285	246,452	0	2,647,328
1993–94[a]	1,741,006	504,761	14,950	216,606	0	2,477,322
1994–95[a]	1,721,087	542,804	15,029	228,696	0	2,507,616
1995–96	1,680,171	589,117	14,591	228,696	0	2,512,576
1996–97	1,644,096	493,683	17,436	228,696	0	2,383,912
1997–98	1,600,647	474,191	18,111	228,696	0	2,321,646
1998–99	1,540,047	450,926	18,789	228,696	0	2,238,459
1999–00	1,480,067	428,508	19,495	228,696	0	2,156,766
2000–01	1,408,725	403,980	20,200	228,696	0	2,061,602
2001–02	1,332,788	379,085	20,900	228,696	0	1,961,469
2002–03	1,251,151	353,603	21,626	228,696	0	1,855,077
2003–04	1,165,282	327,903	22,300	228,696	0	1,744,181
2004–05	1,076,313	302,275	22,945	228,696	0	1,630,229
2005–06	1,093,820	301,243	23,510	228,696	0	1,647,270
2006–07	1,111,348	300,147	23,920	228,696	0	1,664,112
2007–08	1,127,165	298,619	24,194	228,696	0	1,678,674
2008–09	1,142,454	296,936	24,348	228,696	0	1,692,434
2009–10	1,156,916	295,061	24,474	228,696	0	1,705,146
2010–11	1,170,684	293,037	24,593	228,696	0	1,717,010

SOURCE: 1980–81 to 1991–92: California Postsecondary Education Commission, *Fiscal Profiles 1992*, CPEC Report 92-9, March 1992, Display 59; 1992–93 to 1993–94: Pete Wilson, *Governor's Budget 1994–95*, 1994, pp. E-1 to E-120; 1994–95 and thereafter from this analysis.

[a]Denotes years for which data are actual amounts.

[b]Totals may vary due to rounding.

Table D.5

Assumptions Supporting Alternative Scenarios for General Fund Support of the University of California System (thousands of 1992–93 dollars, unless otherwise indicated)

Year	General Fund Revenues	Expected Share	Expected UC General Fund Revenues	Optimistic Share	Optimistic UC General Fund Revenues
1980–81[a]	32,601,511	5.65%	1,841,610	5.65%	1,841,610
1981–82[a]	32,427,149	5.24%	1,697,590	5.24%	1,697,590
1982–83[a]	32,143,183	5.30%	1,703,688	5.30%	1,703,688
1983–84[a]	34,762,330	4.66%	1,620,639	4.66%	1,620,639
1984–85[a]	36,782,528	5.49%	2,019,790	5.49%	2,019,790
1985–86[a]	37,573,619	5.85%	2,197,407	5.85%	2,197,407
1986–87[a]	42,151,977	5.50%	2,318,056	5.50%	2,318,056
1987–88[a]	40,401,098	5.81%	2,345,627	5.81%	2,345,627
1988–89[a]	43,757,676	5.33%	2,332,826	5.33%	2,332,826
1989–90[a]	43,681,826	5.36%	2,340,993	5.36%	2,340,993
1990–91[a]	40,895,658	5.59%	2,285,636	5.59%	2,285,636
1991–92[a]	43,527,439	5.01%	2,180,759	5.01%	2,180,759
1992–93[a]	40,946,452	4.69%	1,919,476	4.69%	1,919,476
1993–94[a]	38,927,601	4.47%	1,741,006	4.47%	1,741,006
1994–95	39,921,402	4.31%	1,721,087	4.31%	1,721,087
1995–96	41,023,522	4.10%	1,680,171	4.31%	1,768,601
1996–97	42,372,856	3.88%	1,644,096	4.31%	1,826,774
1997–98	43,679,709	3.66%	1,600,647	4.31%	1,883,115
1998–99	44,652,612	3.45%	1,540,047	4.31%	1,925,058
1999–00	45,774,437	3.23%	1,480,067	4.31%	1,973,422
2000–01	46,680,048	3.02%	1,408,725	4.31%	2,012,465
2001–02	47,560,978	2.80%	1,332,788	4.31%	2,050,443
2002–03	48,368,364	2.59%	1,251,151	4.31%	2,085,251
2003–04	49,144,101	2.37%	1,165,282	4.31%	2,118,695
2004–05	49,931,154	2.16%	1,076,313	4.31%	2,152,626
2005–06	50,743,337	2.16%	1,093,820	4.31%	2,187,641
2006–07	51,556,445	2.16%	1,111,348	4.31%	2,222,695
2007–08	52,290,216	2.16%	1,127,165	4.31%	2,254,330
2008–09	52,999,497	2.16%	1,142,454	4.31%	2,284,908
2009–10	53,670,389	2.16%	1,156,916	4.31%	2,313,832
2010–11	54,309,112	2.16%	1,170,684	4.31%	2,341,368

SOURCE: General Fund Revenues: *Governor's Budget*, various years to 1993–94 and RAND projections thereafter. CSU Shares of General Fund Revenues: this analysis. CSU General Fund Revenue Support: California Postsecondary Education Commission, *Fiscal Profiles 1992*, CPEC Report 92-9, March 1992, Display 59 for 1980–81 to 1991–92; Pete Wilson, *Governor's Budget 1994–95*, 1994, pp. E-1 to E-120 for 1992–93; Pete Wilson, *Governor's Budget 1995–96*, 1995, pp. E-1 to E-120 for 1993–94 and 1994–95; this analysis for 1995–96 and thereafter.

[a]Denotes years for which data are actual amounts.

costs per student used in this model are presented in Table D.6 below.

For each system, an estimate of this amount for the years in which actual data are available was developed by dividing the total resources estimated above by the total number of FTEs (both undergraduate and graduate) in the institution in that year. This amount was then increased by the average annual growth amount for the period 1980 to 1989. The resulting annual real-cost growth rates were 1.4 percent for the University of California system, 1.7 percent for the California State University system, and 2.0 percent for the California Community College system. The cost values used are presented in Table D.6.

This measure is consistent with other information on real-price increases in the higher education sector. For example, the Higher Education Price Index, which measures the year-to-year changes in the prices of goods consumed by the higher education sector, outgrew the California Consumer Price Index by approximately 1.2 percent per year. Because this is a national price measure and it is known that prices in California generally outstrip the national prices (e.g., the CCPI outstrips the national Consumer Price Index), the average annual growth rates used here for the three systems seem reasonable.

Because the measure treats the cost of all FTEs the same, it presumes that the operating cost of producing undergraduate student units is equal to the operating cost of producing graduate student units. It is likely that graduate students cost more than undergraduates do because of smaller class sizes, greater laboratory costs, the necessity of more direct faculty involvement, and so on. However, these graduate students generally receive significant support from extramural sources of revenues, such as research grants. Because these extramural funds are intentionally omitted from the model, the decision to hold these two operating cost factors constant is reasonable.

It is critical to understand that this definition of *cost per student* does not represent a real measure of the direct cost of producing an FTE of instruction within the system, but rather the overall expenditures per FTE. The definition is intentionally broad, and the spending amount used produces a range of products, including

Table D.6

Real Operating Costs per FTE Assumptions (1992–93 dollars)

Year	California Community Colleges	California State University	University of California
1980–81[a]	2,850	7,843	16,824
1981–82[a]	2,585	7,228	15,836
1982–83[a]	2,621	7,164	15,844
1983–84[a]	2,797	7,478	16,076
1984–85[a]	3,002	8,146	17,762
1985–86[a]	3,360	8,472	19,040
1986–87[a]	3,192	8,700	18,955
1987–88[a]	3,324	8,604	18,974
1988–89[a]	3,321	8,598	18,632
1989–90[a]	3,190	9,018	18,882
1990–91[a]	3,457	8,364	17,656
1991–92[a]	3,256	8,388	18,619
1992–93[a]	2,685	8,301	17,160
1993–94[a]	2,738	8,439	17,398
1994–95	2,793	8,580	17,640
1995–96	2,849	8,723	17,886
1996–97	2,906	8,868	18,135
1997–98	2,964	9,015	18,387
1998–99	3,023	9,166	18,643
1999–00	3,084	9,318	18,902
2000–01	3,146	9,473	19,165
2001–02	3,208	9,631	19,432
2002–03	3,273	9,791	19,702
2003–04	3,338	9,954	19,976
2004–05	3,405	10,120	20,254
2005–06	3,473	10,288	20,536
2006–07	3,542	10,460	20,822
2007–08	3,613	10,634	21,111
2008–09	3,685	10,811	21,405
2009–10	3,759	10,991	21,703
2010–11	3,834	11,174	22,005

SOURCE: Values for actual years derived by dividing total revenues by total FTEs. Estimated values are estimated by extrapolating last known amounts by rates described below.

[a]Denotes years for which revenue and FTE data are actual amounts.

student support services, public service, research, and a range of other community resources. This model presumes, however, that the institution will wish to continue to provide these services in quantities proportionately comparable to the level of production of these services currently provided. A more detailed rendition of the cost variable is left for future research.

CAPITAL SUPPLY MODEL

Another dimension of the supply of higher education is the amount of space available for students to occupy. To model this dimension, a simplified model of the costs of developing new physical capacity was developed. It divides the total annual cost into two components: (1) the cost of renovation and repairs and (2) the cost of new capacity. The former represents the maintenance of the current physical plant. The latter represents the costs associated with expanding that plant to accommodate the demand for public undergraduate education.

An important caveat to the discussion of capital capacity in this report is that this analysis focuses on the capital costs that are associated with the provision of undergraduate education over the next 15 years. This study has narrowly defined the issues around the 15 years, but the trends that shape the conclusions in this analysis are expected to continue well into the next century, and the systems must consider this expectation when setting up their capital plans.

Renovation and Repair Costs

The estimates of future costs of maintaining the current physical plant are based upon the CPEC publication *Prospects for Long-Range Capital Planning in California Public Higher Education: A Preliminary Review.*[14] In this report, CPEC prepares a summary of the future capital needs of the three public systems. Because this model estimates the future demand for new capacity, it was necessary to identify the difference between the renovation and repair

[14]CPEC, *Prospects for Long-Range Capital Planning in California Public Higher Education: A Preliminary Review,* CPEC Report 92-4, 1992.

costs and the costs of new capacity.[15] This was done by combining the expected real annual capital requirements of the three systems stated in the document with the estimated proportion of these expenditures associated with renovation and repairs.

The expected average real annual capital requirement for the University of California was listed at $493.5 million (constant 1992–93 dollars).[16] The discussion further states that renovation will account for "about 58 percent of the capital outlay budget."[17] Multiplying these two amounts together, an estimate of $286.2 million (constant 1992–93 dollars) per year in renovation costs results. This amount is used into the future for the renovation and repair portion of the total capital costs.[18]

Similar assessments of the information for the California State University and the California Community College systems produced estimates of real annual total capital needs of $462.5 million[19] and $430.9 million,[20] respectively. Combining this with renovation shares of 45 percent[21] and 46 percent,[22] respectively, yielded real annual renovation costs of $208.1 million for CSU and $198.0 million for CCC. These amounts are used in the repair and renovation estimates in the model.

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[15]In this way, we could adapt the capital costs to reflect the new capacities projected in our study.

[16]CPEC, *Prospects for Long-Range Capital Planning in California Public Higher Education: A Preliminary Review,* CPEC Report 92-4, 1994, Display 4, page 4. The $493.5 million total was derived by adding the needed state amount of $393.5 million to the $100.0 million expected from nonstate sources. The use of the total amount is appropriate in this case because it is very difficult to attract funds from private donors for repairs and renovations. Most of the capital funding raised from nonstate sources is used in the construction of new facilities.

[17]*Ibid.*, p. 3.

[18]In a more elaborate model, one may wish to link this amount to the total size and age of the overall capital base. This is left to future steps in this research.

[19]*Ibid.*, p. 5.

[20]*Ibid.*, p. 6.

[21]*Ibid.*, p. 6.

[22]*Ibid.*, pp. 5–6. The actual share was calculated based on the information presented in Displays 6 and 7 on page 6.

New Capacity Costs

The model first ascertains how much new capacity is needed this year by looking four years into the future[23] and estimating the amount by which demand will outstrip the current expected capital capacity for that year, as described in equation (D.4), where Q^D is the quantity of space demanded and Q^K is the physical capacity of the institution.

$$Q_t^{New} = MAX\left[\left(Q_{t+4}^D - Q_{t+4}^K\right), 0\right] \quad \text{(D.4)}$$

If new capacity is necessary, then its cost is estimated according to the relationship given in equation (D.5), where K_t is the total cost of the new capacity and M^C is the marginal cost per FTE of new capital capacity in system C.

$$K_t = Q_t^{New} \times M^C \quad \text{(D.5)}$$

The values for the marginal cost of new capital capacity were derived from display 1 of the CPEC report. The startup and buildout sizes and costs of new capacity in each system were combined to produce estimates of the capital cost per FTE of new facilities. For the CSU and CCC systems, this calculation produced values of $26,615 and $15,894 (constant 1992–93), respectively.[24] The University of California cost was revised to reflect the expected private contributions. This adjustment was derived by calculating the expected state share of the balance of the total $493.5 million average annual capital outlay, after removing the renovation and repair portion. The resulting real state capital cost per FTE in the UC system is $59,238 (1992–93 constant dollars).

The model also assumes a minimum new capacity increment of 1,000 FTEs for planning purposes and the following initial capacities

[23]This lag time is put into place to allow the systems to plan and build the new capacity.

[24]Display 1 is in 1990 dollars.

for the systems—UC: 157,000 FTEs;[25] CSU: 280,000 FTEs; and CCC: 950,000 FTEs. These amounts were obtained from the data available and from conversations with numerous experts, both within and without the systems.

It is important to recognize that these new construction costs include full-fledged campuses and may well include a range of services and facilities that do not fall directly under the instructional mission. This approach is consistent with the model's goal of holding the composition and structure of the system intact.

At this point, the model assumes that the system issues bonds and begins payment in that year. For purposes of this analysis, the bonds are amortized over 20 years at an annual real interest rate of 3 percent. The annual cost of this new capital is accumulated over the time horizon of the model. The model also estimates the total real and nominal costs of the new construction bond issues.

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[25]This includes health sciences enrollments. Even though these enrollments are managed and funded somewhat differently from all other enrollments, they represent important products of the University of California. Because this is the only point in the model where the "Total FTEs" (including graduates and health sciences enrollments) are used, they were included. This assumes that the state will wish to produce a proportionately higher quantity of these individuals in response to the same forces that drive the enrollment expansion mapped in the overall model.

Appendix E

MODELING PROPOSITION 98

The first major task in the simulation of K-14 finance is to model the provisions of the California Constitution and Education Code, which are defined by Propositions 98 and 111.[1] Proposition 98 provides a minimum floor for the funding levels of K-14 education. It does this through a series of calculations that are specified in the law. It calls for the calculation of two quantities, the larger of which must be funded. Each of these calculations is called a *test.* Proposition 111 added two additional tests, termed *Tests 3A and 3B,* which take effect in bad economic times.

Conceptually, Proposition 98 creates a *baseline* level of funding for K-14 education in California. Without the advent of bad economic times, the state education spending floor remains on this baseline, which is defined by Tests 1 and 2 of the California State Constitution, Section 8, Subdivision (b).

When the state encounters bad times, however, Test 3 of the same section takes over and allows the state to spend less than the baseline amounts. When this happens, the shortfall between what is actually spent and the baseline is called the *maintenance factor.* When the bad times pass, a clause then takes effect that causes the state to re-

[1]The initial version of this model was designed for RAND's analysis of the California Voucher Initiative, Proposition 174, which appeared on the California ballot in November 1993. In that version of this model, the emphasis was on K-12 finance only. The model is expanded here to include the entire range of K-14 education. Much of the documentation in this appendix may also be found in Appendix D of the RAND Report, *The Effects of the California Voucher Initiative on Public Expenditures for Education* (Shires, et al.), RAND, MR-364-LE, 1994, pp. 69–78.

turn to the baseline and repay the maintenance factor. This process is called *restoration.*

It is important to remember that the goal of this analysis is to estimate the future prospects for K-14 finance in California. Because the Proposition 98/111 calculation uses a deflator different from the California Consumer Price Index,[2] all calculations are done in nominal dollars and the results are then converted to constant dollars using the CCPI to assure comparability.

Historically, the split between K-12 and community colleges has been approximately 90-10 and, absent any choices by the state to act otherwise, it will presumably remain so over the balance of this decade. The specific details regarding the implementation of this assumption in this model are presented below.

VARIABLES AND CONVENTIONS

The mathematical forms of this model and its underlying equations are presented in this appendix. To facilitate understanding, the following variables will be used throughout this appendix. All terms are nominal for the purposes of executing the simulation model. Results are subsequently deflated by the appropriate inflation rate for reporting in this analysis. [3]

t:	This is an index for the given year.
α:	This coefficient represents the required minimum proportion of the state's General Fund revenues that must go to K-14 education under Proposition 98 under Test 1.
$A1_t$:	This is the Test 1 calculated amount used for calculating the actual Proposition 98 minimum funding guarantee.

[2]It uses the change in per-capita personal income as an inflation index.

[3]The symbols and abbreviations used in this appendix relate to the calculations in this appendix only and do not correspond directly to those used in any other appendix. For example, J_t in Appendix B refers to the number of juniors enrolled in year t. For the purposes of this appendix alone, it refers to the California *per-capita* personal income in year t.

$A2_t$: This is the Test 2 calculated amount used for calculating the actual Proposition 98 minimum funding guarantee.

$A3_t$: This is the Test 3 calculated amount used for calculating the actual Proposition 98 minimum funding guarantee.

$A3a_t$: This is the Test 3a calculated amount used for calculating the actual Proposition 98 minimum funding guarantee.

$A3b_t$: This is the Test 3b calculated amount used for calculating the actual Proposition 98 minimum funding guarantee.

B_t: This is the state and local commitment to education in year t. It equals the K-14 portion of state General Fund and those local property taxes allocated for K-14 education.

E_t: This is the total K-12 average daily attendance (ADA) enrollment in public schools in year t.

G_t: This is the state General Fund in year t.

H_t: This is the per-capita state General Fund in year t, arrived at by dividing G_t by P_t.

I_t: This is the total personal income in California in year t.

J_t: This is the per-capita state personal income in year t, derived by dividing I_t by P_t.

N_t: This is the "hypothetical baseline" in year t. The hypothetical baseline is a value used in calculating the restoration of the maintenance factor in post-Test 3 (see below) or post-suspension years.[4] It is equal to the level of the minimum funding guarantee in year t if the suspension or Test 3 had never occurred in a prior year.

$N1_t$: This is the Test 1 calculated amount used for calculating the baseline.

[4]The state has the option of suspending the Proposition 98 funding requirements in a given year.

$N2_t$: This is the Test 2 calculated amount used for calculating the baseline.

$N3_t$: This is the cap by which the Test 2 baseline amount is allowed to grow after a Test 1 year.

R_t: This is the amount of the maintenance factor to be restored in a year t (see below for discussion of restoration of maintenance factors).

S_t: This is the state General Fund budget for K-14 education in year t also equal to $(B_t - X_t)$.

X_t: This is the portion of local property taxes allocated to K-14 education in year t.

In addition, the calculations to derive the Proposition 98/111 guarantee amount associated with each of the three tests will be calculated. The result of the Test 1 calculation is designated A1, the result of Test 2 is A2, the result of Test 3a is A3a, and the result of the Test 3b calculation is A3b.

The first stage in this analysis is to calculate the baseline floor for K-14 spending. Two terms with similar but very specific meanings will be used in this appendix: *baselines* and *budgets*. The baseline represents the hypothetical level of spending that would occur for K-14 without interruptions caused by poor economic years and suspensions.[5] The budget represents the *actual* spending in a given year. If a Test 3 year never occurs, then the two are equal.

THE BASELINE

The first step in the analysis is to calculate the baseline amounts for K-14 education over the next decade. In spirit, this baseline is what the education budget would have been if the General Fund had grown enough to support the Test 1-Test 2 amounts. The specific language guiding the calculations for the baseline amounts for Tests 1 and 2 is provided in California Constitution Article XVI, Section 8, Subdivision (b), Paragraphs (1) and (2), respectively. The baseline

[5]Most of the provisions of Proposition 98 may be suspended for one year. This analysis does not consider the effects of suspensions of these provisions.

amount in any year is given by the greater of Test 1 and 2 amounts as they are specified in Section 8. The details of these two amounts are presented below.

Test 1

Test 1 requires that a minimum proportion of the California General Fund be allocated to K-14 education. The total[6] baseline amount allocated to K-14 education under this scenario is then given in Equation (E.1).

$$N1_t = \alpha G_t + X_t \tag{E.1}$$

For K-14 education, the share of the General Fund α was 40.737 percent in 1988–89 to 1991–92, 37.719 percent in 1992–93, and 34.004 percent in 1993–94 and thereafter.[7] The changes are the result of adjusting to the increased use of local property taxes to fund education.

Test 2

The Test 2 amount is defined by the language in Article XVI, Section (8)(b)(2). It requires that real per-pupil expenditures[8] this year at least equal the prior year's expenditures. Equation (E.2) presents that calculation.

$$N2_t = N_{t-1}\left(\frac{E_t}{E_{t-1}}\right)\left(\frac{J_t}{J_{t-1}}\right) \tag{E.2}$$

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[6]The state commitment to K-14 refers to the total state General Fund commitment plus total local property tax proceeds allocated to K-14 education. The explanation for this as a unit of analysis is included in the introduction to Chapter Four.

[7]This amount was determined as the "percentage of General Fund revenues appropriated for school districts and community college districts, respectively in fiscal year 1986–87." [State Constitution, Article XVI, Section 8 (b) (1)]

[8]The provisions of the law require that the enrollment growth factor used here is the change in *K-12 enrollments*, not K-14 enrollments.

Note that, in general, this year's Test 2 amount is a function of last year's baseline amount (N_{t-1}), not the prior year's baseline Test 2 amount, $N2_{t-1}$. If, in the prior year, N_t was determined by Test 1 ($N1>N2$) and Test 1 represented extraordinary growth levels, then the potential would exist for a significant "ratcheting up" of the baseline amount. The state took this into account in implementing Proposition 98 and included a 1.5 percent growth cap on Test 1 in a given year.[9] This cap is implemented in Equation (E.3).[10]

$$N3_t = (0.015)G_{t-1} \qquad \text{(E.3)}$$

Putting these all together produces Equation (E.4) for the final determination of the baseline amount. This equation says that the hypothetical baseline amount in year t equals at least the Test 2 amount plus other amounts. If Test 1 is greater than Test 2, the equation adds either the difference between the Test 1 and Test 2 amount (resulting in the full Test 1 amount) or the 1.5 percent cap on baseline growth, whichever is smaller. If Test 1 is smaller than Test 2, then it adds zero to the Test 2 total, resulting in the Test 2 amount.

$$N_t = N2 + \min\left\{\max\left[\ (N1_t - N2_t), 0, \ \right] N3_t\right\} \qquad \text{(E.4)}$$

It is important to remember that this baseline amount is the hypothetical amount that K-14 education would receive in a world where the General Fund always grows faster than inflation. With this baseline in hand, one can now turn to the actual amounts guaranteed to K-14 education.

THE BUDGET FOR K-14 EDUCATION

The next step, determining the minimum budget for K-14 education, follows a methodology similar in many respects to the baseline. The difference is that it also allows for low-growth years through the introduction of Test 3 calculations. In a given year, one of the three

[9]See Subdivision (c) of Section 8, Article XVI.

[10]Remember that this calculation is for the hypothetical baseline amount. The actual Proposition 98 guarantee in a year may exceed this cap because of Test 1.

tests specified in Section 8, Subdivision (b) will apply. The approach used here is to calculate all three amounts and then ascertain which amount actually applies.

The Test 1 Amount

The budget may be represented by a linear function of the General Fund as in the Test 1 calculation above. Equation (E.5) shows the linear relationship between the General Fund and the Test 1 budget amount.

$$A1_t = aG_t + X_t \tag{E.5}$$

The Test 2 Amount

Similarly, the Test 2 budget might be last year's budget increased by enrollment growth[11] and inflation (per-capita personal income) growth (the Test 2 amount), as given in equation (E.6).

$$A2_t = B_{t-1}\left(\frac{E_t}{E_{t-1}}\right)\left(\frac{J_t}{J_{t-1}}\right) \tag{E.6}$$

It is important to point out that B_{t-1}, last year's state and local spending on K-14 education, in this equation represents the prior year's actual spending—the budget—and not the baseline. In periods of state economic prosperity, $A2_t$ is subject to the same growth constraints as $N2_t$ and therefore B_{t-1} cannot exceed N_{t-1}.

The Test 3 Amount

In low General Fund revenue growth years, the budget is determined by Test 3. Under one provision of this test, the budget is last year's budget increased by enrollment growth and General Fund (per-capita) growth plus one-half of one percent (the "Test 3a" amount),

[11]There is a constraint that, in years of declining enrollment, the enrollment adjustment cannot serve to reduce the funding amount *unless* there were also enrollment decreases in the prior *two* years. This applies in both Tests 2 and 3a.

as described in Section (8)(b)(3). It is given mathematically in Equation (E.7). Note that B_{t-1} in the equations in this section represent the actual spending—the budget—from the prior year.

$$A3a_t = B_{t-1}\left(\frac{E_t}{E_{t-1}}\right)\left[\left(\frac{H_t}{H_{t-1}}\right)+0.005\right] \tag{E.7}$$

Test 3 is further constrained by Section 41203.5 of the Education Code, which requires that K-14 education, on a per-pupil basis, do no worse than noneducation categories within the General Fund, on a per-capita basis.[12] This is "Test 3b." Another way of stating this is that current year's budget might be last year's budget increased by enrollment growth and the growth in noneducation spending from the General Fund. This is given in Equation (E.8).

$$A3b_t = B_{t-1}\left(\frac{E_t}{E_{t-1}}\right)\left(\frac{\left(G_t - S_t\right)/P_t}{\left(G_{t-1} - S_{t-1}\right)/P_{t-1}}\right) \tag{E.8}$$

Recognizing that $S_t = B_t - X_t$ and $S_{t-1} = B_{t-1} - X_{t-1}$ in general, and that B_t=$A3b_t$ in this formula, one can solve for $A3b_t$, defining an intermediate variable, Z_t, to make the final formula more compact. This is done in equations (E.9) and (E.10) below. Explanation will be limited to the fact that they represent the algebraic solutions of Equation (E.8), solving for $A3b_t$.

$$Z_t = \left(\frac{P_{t-1}}{P_t}\right)\left(\frac{1}{G_{t-1} - B_{t-1} + X_{t-1}}\right) \tag{E.9}$$

$$A3b_t = \frac{B_{t-1}\left(\frac{E_t}{E_{t-1}}\right) Z_t\left(G_t + X_t\right)}{1 + Z_t B_{t-1}\left(\frac{E_t}{E_{t-1}}\right)} \tag{E.10}$$

[12]Because we are assuming that community college budgets and enrollments will move similarly to K-12, we can execute this test using only K-12 numbers.

The final Test 3 amount is equal to the greater of $A3a_t$ or $A3b_t$, as long as it does not exceed $A2_t$. In equation form, one gets:

$$A3_t = \min\left[\max\left(A3a_t, A3b_t\right), A2_t\right] \quad \text{(E.11)}$$

Moreover, if one is in a Test 3 world, then the budget is below the baseline. The difference between the two is called the maintenance factor. Because the model keeps the baseline from year to year, the difference between the baseline and the budget is always the maintenance factor. A final footnote in the description of these tests is the role of maintenance factors.

Maintenance Factors

Maintenance factors serve to keep a running record of where K-14 education should be under Proposition 98 (the baseline) and where it is after the addition of the low-growth provisions included in Proposition 111 (the budget). In years in which the General Fund grows faster than inflation, a portion of this shortfall (the maintenance factor) is restored to the minimum K-14 education budget until it gets back to baseline levels of funding. This restoration takes place in any year in which the per-capita General Fund outgrows inflation (per-capita personal income) and a maintenance factor exists ($A2_t<N2_t$). In these years, one-half of the difference in growth rates between the per-capita General Fund and inflation, times the General Fund is required to be allocated to K-14 education in addition to the Test 1 or Test 2 amount. Equation (E.12) describes this relationship mathematically, where R_t is the amount to be restored to the budget in year t.

$$R_t = \max\left[\min\left\{0.5\left(\left(\frac{H_t}{H_{t-1}}\right)-\left(\frac{J_t}{J_{t-1}}\right)\right)G_t, N2_t - A2_t\right\}, 0\right] \quad \text{(E.12)}$$

All the tests and their related pieces have now been covered and it is time to see how they interact in a given year.

SELECTING THE CORRECT BUDGET AMOUNT

From the preceding part of the analysis, three amounts have been generated, one from each test—$A1_t$, $A2_t$, and $A3_t$. Which of these possibilities actually happens in a given year is governed by the following logic. The test that determines which equation to use compares growth in the General Fund per capita with growth in personal income per capita. If the General Fund growth is large by this test, then the budget equals the larger of amount $A1_t$ versus amount $A2_t$ plus the restoration R_t. If the General Fund growth is small by this test, then the budget equals the amount $A3_t$, represented in equations (E.13) through (E.15).

$$\text{If } \left(\frac{H_t}{H_{t-1}}\right) > \left(\frac{J_t}{J_{t-1}}\right) - 0.005 \qquad \text{(E.13)}$$

$$\text{Then } B_t = \max\left(A1_t,\ A2_t + R_t\right) \qquad \text{(E.14)}$$

$$\text{Else } B_t = A3_t \qquad \text{(E.15)}$$

One of the crucial aspects of California's K-14 finance structure is that it is dynamic—that is to say, each year is dependent on what happens in the prior year. This means that changes in any given year, such as those associated with the voucher initiative, may have effects on the baseline and budget numbers across all succeeding years. This is why it is necessary to develop a full dynamic simulation model, as done here, to assess the prospects for K-14 education under different scenarios.

ALLOCATING THE RESOURCES

The total Proposition 98/111 minimum budget must then be allocated between K-12 and community colleges.[13] A straight 90-10 split, K-12 to community colleges, was used to allocate the total minimum

[13]The actual allocation is significantly more complicated, as K-12 districts take on a range of shapes and sizes. For this model, they are taken in aggregate.

budget between the two segments. The historical average has been very close to this amount over the five—plus years that Proposition 98 has been in force. Property taxes were then netted from this amount to derive the state General Fund support amount for community colleges listed in Table D.1.

INPUTS INTO THE MODEL

The calculations of the minimum budget allocation for K-14 is dependent on several inputs—the state General Fund SAL revenues (see Table D.3),[14] K-12 (see Table E.1) and community college (see Table D.1) property taxes, the state population (see Table C.1), state personal income (see Table E.1), K-12 Average Daily Attendance (ADA) enrollments[15] (see Table E.1), and community college FTE enrollments (see Table 2.3). While the last set of information is developed in the context of this model, all of the other information for this model was obtained from other sources. Table E.1 presents a summary of the values used for each series not found elsewhere in this report.

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[14]These are state revenues under the "State Appropriations Limit" imposed by voters through the Gann Initiative.

[15]ADA enrollments in K-12 education are equivalent to FTE enrollments in higher education. A different term is simply used to represent the same concept.

Table E.1

Inputs into Proposition 98/111 Minimum K-14 Finance Model

Year	K-12 Property Taxes ($millions)	K-12 ADA Enrollments (thousands)	General Fund SAL Revenues ($billions)	California Personal Income ($billions)
1987–88[a]	3,772	4,395	32.5	495.3
1988–89[a]	4,097	4,518	35.9	532.4
1989–90[a]	4,487	4,681	37.5	573.3
1990–91[a]	4,950	4,860	37.0	617.7
1991–92[a]	5,239	5,016	40.8	634.9
1992–93[a]	6,399	5,102	39.5	667.3
1993–94[a]	8,245	5,166	38.9	683.0
1994–95	8,651	5,245	41.2	711.8
1995–96	8,899	5,382	43.6	751.8
1996–97	9,236	5,526	46.4	793.4
1997–98	9,698	5,662	49.2	836.4
1998–99	10,280	5,784	51.8	881.9
1999–00	10,897	5,909	54.7	928.3
2000–01	11,660	6,041	57.5	976.2
2001–02	12,476	6,180	60.3	1,025.6
2002–03	13,349	6,329	63.2	1,075.9
2003–04	14,283	6,489	66.1	1,127.6
2004–05	15,426	6,638	69.2	1,181.7
2005–06	16,660	6,762	72.4	1,238.8
2006–07	17,993	6,840	75.8	1,298.4
2007–08	19,432	6,878	79.2	1,358.6
2008–09	20,987	6,882	82.7	1,420.9
2009–10	22,666	6,877	86.2	1,484.9
2010–11	24,479	6,871	89.9	1,550.8

SOURCE: All Projections through 1995–96: Office of the Legislative Analyst. All Projections 1996–97 to 2010–11: RAND internal projections. See Carroll, et al., *California Fiscal Future*, MR-570-IET, 1995, for details on the methodologies used to develop these series.

[a]Denotes years for which data are actual amounts.

Appendix F

MODELING THE VARIOUS DEFICIT-CLOSING SCENARIOS

In this appendix, the details of the methodologies used to assess the findings reported in Chapter Four are explained. Several alternatives to closing the access deficits described in Chapter Three are also discussed. The scenarios presented were (1) buying out the access deficits; (2) raising tuition to close the deficit; (3) increasing productivity to close the deficit; (4) letting all students in; and (5) implementing a three-year degree. No numeric results were presented in conjunction with the universal access option (number four above) and so no detailed description is provided in this appendix.

FUNDING THE ACCESS DEFICITS

The methodology associated with this scenario presumes that the quantity supplied will equal the appropriate demand level. For purposes of addressing the access deficits, the quantity supplied Q_S was set to the baseline demand level Q_0. In analyzing the operating shortfalls, this quantity supplied Q_S was to the expected Q_D under the particular demand scenario in question. Given a level of Q_S, the annual cost of expanding the capital capacity, K_t, was calculated using the methodologies described in equations (D.2) and (D.3), setting the desired capital capacity levels in year t equal to baseline demand, Q_0 in the access deficit scenarios and Q_D in the operating shortfall scenarios. Equation (D.1) was re-written to solve for the need for operating revenues OR_t as shown in equation (F.1) below, using the same naming conventions as in Appendix D.

$$OR_t = \frac{Q_t^s \times C_t}{u_t} \qquad \text{(F.1)}$$

The total revenues required by the system (for both operating and capital capacity), were then calculated as the sum of K_t and OR_t. This total revenue was used to ascertain the amount of support necessary to meet the specified demand level.

In the case where these revenues are construed to come from General Fund revenues, the total General Fund revenues to the systems were the difference between the total required revenue amount and revenues from all other sources. Because, as described in Chapter Four, it is necessary to set the price level back to 1989–90 levels to close the access deficit, it is important to note that expected revenues from one source—fees—declines, thereby increasing the amount of revenues from other sources—such as the General Fund—necessary to close the gap. The share of General Fund revenue calculations were derived by dividing this amount by expected total General Fund revenues in that year.

INCREASING PRODUCTIVITY TO CLOSE THE DEFICIT

This scenario, which estimates the cost per FTE as defined in the supply model, is necessary to meet the specified demand level. As in the case of "funding the access deficits" scenario above, the quantity supplied, Q_S, was set equal to the appropriate demand level. The capital cost was also netted from total revenues (effectively holding capital productivity constant) before the productivity calculation below was made. The necessary cost per FTE was calculated by manipulating equation (D.1) again, this time producing equation (F.2) below.

$$C_t = u_t \frac{OR_t}{Q_t^s} \qquad \text{(F.2)}$$

This relationship was used to derive a new level of C_t for each year. This value was compared to the original values for presentation in the text.

Appendix G

RESULTS OF ANALYSIS FOR TOTAL PUBLIC ENROLLMENTS

The thrust of the analysis in the main body of this dissertation has been the prospects for undergraduate education in California. Because the models in this analysis assume that the proportion of relevant undergraduate populations is a constant share of total enrollments (still in FTE terms), comparable results for each of the findings in this report could be presented in total enrollment terms. This appendix presents selected findings of this report in total enrollment terms, *for informational purposes only.* No discussion of the implications of these total numbers is provided. Tables G.1 and G.2 below map the references for the major undergraduate results provided to the appropriate tables and figures in this Appendix. The complete set of tables is presented, followed by the complete set of figures.

Table G.1

Map of Selected Tables in Report to Their Counterparts in This Appendix

Chapter Table Reference	Corresponding Appendix G Table
3.1	G.3
3.2	G.4
3.4	G.5

Table G.2

Map of Selected Figures in Report to Their Counterparts in This Appendix

Chapter Figure Reference	Corresponding Appendix G Figure
3.1	G.1
3.2	G.2

TABLES

Table G.3

Projections of Baseline Demand for Total Public Education (students)

Year	California Community Colleges	California State University	University of California	Total
1995–96	1,711,351	350,798	169,804	2,231,953
1996–97	1,750,161	352,919	170,868	2,273,948
1997–98	1,788,469	356,460	172,934	2,317,863
1998–99	1,827,722	361,723	176,236	2,365,681
1999–00	1,868,979	368,770	180,799	2,418,548
2000–01	1,910,377	376,085	185,419	2,471,881
2001–02	1,951,454	384,015	190,041	2,525,510
2002–03	1,993,087	391,984	194,389	2,579,460
2003–04	2,034,753	398,603	197,796	2,631,152
2004–05	2,077,056	405,246	201,250	2,683,552
2005–06	2,119,461	411,495	204,416	2,735,372
2006–07	2,161,771	417,215	207,224	2,786,210
2007–08	2,205,162	423,298	210,305	2,838,765
2008–09	2,250,893	429,806	213,865	2,894,564
2009–10	2,300,832	438,265	219,029	2,958,126
2010–11	2,353,806	447,821	224,987	3,026,614

SOURCE: Derived from this analysis.

Table G.4

Projections of Expected Demand for Total Public Education (students)

Year	California Community Colleges	California State University	University of California	Total
1995–96	1,490,709	309,524	162,696	1,962,929
1996–97	1,524,516	311,395	163,715	1,999,626
1997–98	1,557,884	314,520	165,694	2,038,098
1998–99	1,592,077	319,164	168,858	2,080,099
1999–00	1,628,015	325,381	173,230	2,126,626
2000–01	1,664,075	331,836	177,657	2,173,568
2001–02	1,699,857	338,832	182,085	2,220,774
2002–03	1,736,122	345,864	186,251	2,268,237
2003–04	1,772,416	351,704	189,515	2,313,635
2004–05	1,809,264	357,566	192,825	2,359,655
2005–06	1,846,203	363,079	195,858	2,405,140
2006–07	1,883,057	368,126	198,549	2,449,732
2007–08	1,920,854	373,493	201,501	2,495,848
2008–09	1,960,689	379,236	204,912	2,544,837
2009–10	2,004,190	386,699	209,860	2,600,749
2010–11	2,050,334	395,131	215,568	2,661,033

SOURCE: Derived from this analysis.

Table G.5

Projections of Expected Operating Supply for Total Public Education (in FTEs)

Year	California Community Colleges	California State University	University of California	Total
1995–96	1,472,665	308,021	147,348	1,928,034
1996–97	1,500,068	296,669	142,297	1,939,034
1997–98	1,519,504	283,499	136,679	1,939,682
1998–99	1,526,192	268,099	129,973	1,924,264
1999–00	1,535,740	253,374	123,511	1,912,625
2000–01	1,542,501	237,476	116,441	1,896,418
2001–02	1,549,515	221,491	109,266	1,880,272
2002–03	1,556,678	205,293	101,921	1,863,892
2003–04	1,565,104	189,086	94,513	1,848,703
2004–05	1,570,559	173,053	87,126	1,830,738
2005–06	1,570,235	172,008	86,829	1,829,072
2006–07	1,559,150	170,891	86,513	1,816,554
2007–08	1,557,460	169,489	86,073	1,813,022
2008–09	1,567,894	167,975	85,587	1,821,456
2009–10	1,578,115	166,352	85,047	1,829,514
2010–11	1,588,362	164,654	84,463	1,837,479

SOURCE: Derived from this analysis.

FIGURES

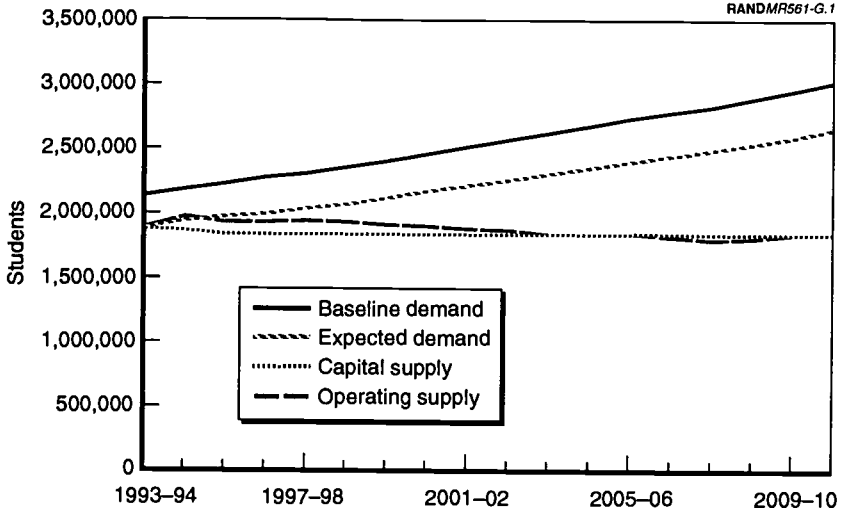

Figure G.1—Demand and Supply of Total Public Education in the Expected Supply Scenario

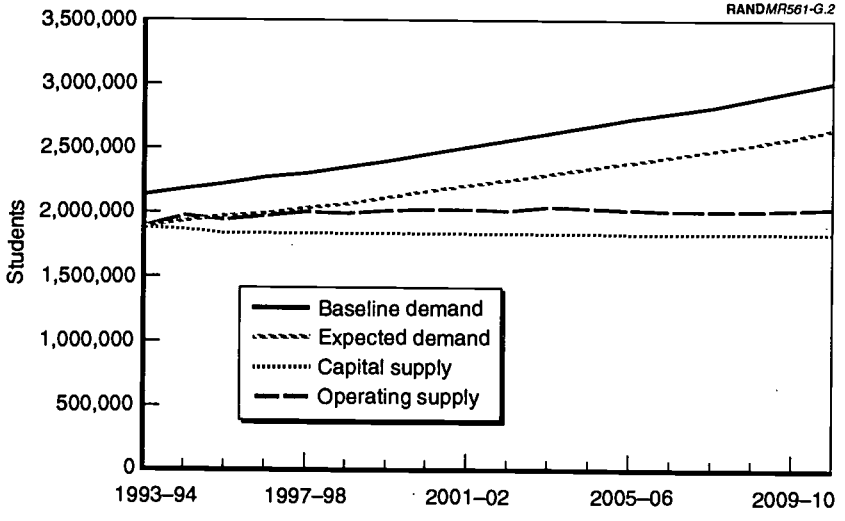

Figure G.2—Demand and Supply of Total Public Education in the Optimistic Supply Scenario

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The Future of Public Undergraduate Education in California

In 1960, California's Master Plan for Higher Education set an ambitious goal: access to higher education for every Californian who could benefit from it. As a result, the state's higher education sector flourished and, in turn, fueled the state's economy and the growth of its high technology and aerospace industries. But the state's recent recession and the pattern of reduced public funding and increased fees have undercut the aims of the Master Plan and put its goals nearly out of reach. Enrollments in 1994–1995 were 11 percent below what they would have been if participation had remained at prerecessionary levels.

Now that California is pulling out of the recession, will access return to the levels envisioned in the Master Plan? Not according to Michael Shires' research: "The state's population is expected to grow by about 10 million people over the next 15 years. At the same time, the demands on the state's discretionary resources are expected to grow significantly." The result will be an increasing "access deficit"—that is, a shortfall between the number of higher education seats demanded and the number supplied. Today, access is at 89 percent of prerecessionary levels. If current trends continue, by 2010–2011, it will drop to 56 percent, and more than 1,000,000 prospective students will be denied access. Grim as the projections seem, the author makes several suggestions for closing the access deficit, including recommendations for revising the Master Plan itself and for developing a new strategy for the public higher education sector.

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