DOCUMENT RESUME

ED 306 827 HE 022 489

AUTHOR Caldwell, Roger L.; Brown, Kenneth
TITLE Enrollment at Arizona Universities: Forecasts to the Year 2000.
INSTITUTION Arizona Board of Regents, Phoenix.
PUB DATE Nov 88
NOTE 54p.; In "The Arizona Board of Regents' Task Force on Excellence, Efficiency and Competitiveness. Final Report and Working Papers." Volume Two. For Volumes One and Two, see HE 022 446-447. For individual working papers, see HE 022 448-480 and HE 022 482-501.
PUB TYPE Reports - Research/Technical (143)

EDRS PRICE MF01/PC03 Plus Postage.
DESCRIPTORS Competition; Educational Quality; Efficiency; *Enrollment Projections; *Enrollment Trends; Excellence in Education; Foreign Students; Higher Education; Minority Groups; National Surveys; Out of State Students; *Prediction; Public Colleges; State Surveys; *State Universities; Statewide Planning
IDENTIFIERS *Arizona; Arizona State University; Arizona Task Force on Excellence Efficiency Compet; Northern Arizona University; University of Arizona

ABSTRACT

One of the working papers in the final report of the Arizona Board of Regents' Task Force on Excellence, Efficiency and Competiveness, this document discusses the national and state level for making judgments about future enrollment options for Arizona's universities. Relevant national and statewide trends are identified. Future challenges include increasing the proportion of minority students in higher education and planning for alternative ways to address the potential student demand for higher education. A discussion includes: state enrollment possibilities; historical trends and driving forces of change; previous studies; special concerns for Arizona; assumptions for enrollment analysis; uncertainties for enrollment forecasting; enrollment scenarios for 1988-2000; selected forecasts; implications for Arizona universities; role of minority, out of state, and foreign students; and alternative growth options. Arizona's universities will fare better than many universities during the next 5- to 7-year period of national decline in high school graduates. The real costs of increased enrollment are not adequately provided by additional state funding. Three recommendations include: ABOR should alter the form of its report on student enrollment to better identify various types of enrollments, and new educational delivery systems should be investigated to slow the demand for on-campus enrollment growth. Four appendices provide: enrollment management; national and state historical trend data; future needs of the state report; and revisited enrollment forecasts. Many tables and figures are included. Contains 22 references. (SM)

ENROLLMENT AT ARIZONA UNIVERSITIES: FORECASTS TO THE YEAR 2000

ROGER L. CALDWELL AND KENNETH BROWN

PREFACE

Information contained in this working paper is to provide background on the national and state level for making judgements about future enrollment options for the Arizona universities. While a limited amount of information is presented for each of the three universities, most consists of the total of the universities. Accordingly, some of the trends may not apply to an individual campus and the actual changes within one campus will differ from the others.

It is very difficult to make enrollment forecasts to the year 2000 for Arizona. This working paper addressed this difficulty by identifying relevant trends, both nationally and within the state, listing appropriate assumptions, and identifying several possible enrollment futures.

The report provides several tables and figures in the main body, with detailed reference materials presented in the appendices. Where references are made to a table or figure in the appendix, the number will be preceded by the appendix letter.

Roger L. Caldwell has been a member of the University of Arizona for 20 years, where he is a Professor of Soil and Water Science. He has served in several administrative positions relating to general environment, energy conservation, computing and academic planning. He has taught in the fields of plant diseases and pesticides, environment, and scientific communication methods. He has served on several state and local governmental committees relating to economic development, transportation and environmental concerns.

Kenneth Brown is a Research Associate at the Center for the Study of Higher Education at the University of Arizona.

The following abbreviations are found in the report:

ABOR	Arizona Board of Regents
NCHEMS	National Center for Higher Education Management Systems
WICHE	Western Interstate Commission on Higher Education
ASU	Arizona State University
NAU	Northern Arizona University
UA	University of Arizona

SUMMARY

The Arizona universities have grown relatively rapidly compared to some other universities, but have not grown significantly over the last 15 years. Over the period 1970 to 1985, the average annual growth rate (not compounded) was 1.8 percent for credit hours taken, 1.4 percent for full time student enrollment, and 2.5 percent head count student enrollment. However, high school graduation trends suggest Arizona will be faced with a level to declining freshman student enrollment period beginning in fall 1989 followed by a significant growth period beginning in fall 1992. How we react to these changing times in an efficient and effective manner will require careful enrollment management techniques.

Higher education throughout the country grew rapidly from about 1955 to about 1975, followed by a general up and down drift for the last decade; Arizona is not unlike the national trends in this behavior. The large shifts in higher education were due to 1) greater percent of the 18-24 year old population attending college, 2) greater percentage of women attending college, and 3) demographic trends which caused the baby boom age to coincide with college going years (boomers achieved age 18 in the early 1960s). Smaller trends relate to a slowly increasing part-time student population and in the case of Arizona, a declining percentage of the state population attending college. This latter observation is likely due to relative increased migration of professionally educated persons and a growing very young and older population.

In the next decade the strongest impact on enrollment trends will be the demographic effects of the baby boom (including in-state changes and interstate migration) and its echo and the ethnic composition of the population. Using estimates developed in other studies, it appears that a relative enrollment high in Arizona will be experienced in the fall of 1989 and a relative enrollment low in the fall of 1992. Other states seem likely to be more severely affected, with a sharper and more sustained decrease. Other variables are likely to have a lesser effect (such as increasing part time students, retraining graduates for new careers or using telecommunications for distance education). For Arizona the impacts of the declining 18-24 year old population over the next five to seven years (depending on which state you are evaluating) will be minimal but significant. The challenges will include:

- Increasing the proportion of minority students enrolled in higher education to approximate the proportion graduating from high school,

- Applying enrollment management methods to maintain a quality educational experience while continuing to provide access to qualified Arizona students,

- Planning for alternative ways to address the anticipated student demand for higher education.

The opportunity exists for developing solutions to these challenges. The decline in traditional-age freshmen students will allow time to better understand and adjust to the realities of the demographic trends, the changing Arizona universities, and the future needs of the state. Some of the implications of this change are:

- Competition for both undergraduate and graduate students with other states is likely to increase. The states of most likely impact are those which send or receive students with Arizona: California, Illinois, Colorado, New Mexico, New York, Michigan, Texas, Kansas, and Utah;

- The anticipated increases in minorities in the school and college age groups will require increased recruitment efforts and resource expenditures on the part of Arizona's universities;

- Planning for the next five year period (1988-1993) will be much different than the following five year period (1994-2000) and will require greater management involvement than in the past;
- Institutional resistance to change as well as the impacts of new

educational or communications technology are hard to estimate but may be significant;

- Increases in enrollment levels will undoubtedly produce a number of solutions, however, these are likely to be more successful in combination that individually.

Estimates for the Arizona universities headcount enrollment changes from 1985 to 2000 vary considerably. Previous estimates ranged from 33 to 48 thousand; a broader set of assumptions developed in this working paper gives a range of 23 to 80 thousand. For planning purposes, we have selected a range of 20 to 30 thousand. However, an important conclusion of this working paper is that there are many assumptions involved in these forecasts; some are under the control of the universities and some are not.

INTRODUCTION

BACKGROUND AND PURPOSE

Enrollment forecasts for the Arizona universities to the year 2000 are important for several reasons:

1) the Arizona universities are approaching enrollment levels where quality, efficiency, and student experience at each university should be reevaluated,

2) the national high school graduating class size will decline for several years (and Arizona's to a lesser extent) and then increase in the late 1990s, and

3) questions are being asked about additional branch campuses or off-campus sites for the state. Two aspects of future enrollment conditions in particular that require special understanding are:

- Increasing percentage of minorities in the general population;

- Impacts of the baby boom population shift on interstate migration (general population and college-age) and high school graduation rates.

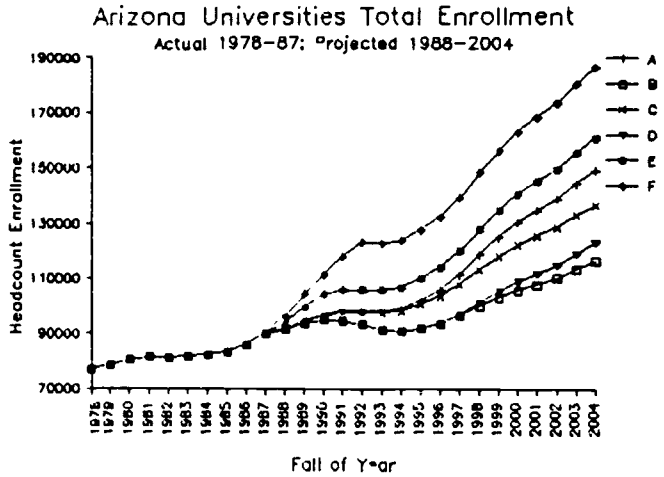
The analysis and understanding of these issues are the purposes of an enrollment management plan. As the Arizona universities continue to define their missions and types of institutions, the quality and number of students will be an important consideration. As possible shifts in the numbers of traditional-age students occur, the universities would like to prevent sharp swings in enrollment. As high school graduation numbers decrease nationally over the next five to seven years, there will be new competition among the nation's universities. As the number of minority children increase, especially in Arizona, new demands will force the educational system to enhance access to the university and to retain the students once they are on campus.

The purposes of this working paper are to review historical enrollments, to provide a range of probable enrollment forecasts, and to identify the critical variables for enrollment related university planning. Since the strategic planning process for the Arizona university system and the individual campuses is in process, the enrollment management comments presented here are not presented within the context of other planning perspectives.[1]

ARIZONA ENROLLMENT POSSIBILITIES

Enrollments in Arizona's public universities and community colleges grew rapidly in the mid 1960s to the mid 1970s, and have exhibited a steady but slow growth trend during the last decade. Forecasts of future enrollment in the Arizona universities provide a wide range of options. There are a number of components of the forecasting process that are under university control, and a number that are not. As an example of the ranges we might consider, six forecasts are presented in Figure 1. These same six forecasts will be discussed in more detail in the section on Enrollment Scenarios for Year 2000:

Figure 1. Arizona Enrollment Futures*



A = base model of historic trends; B = lower in-migration, lowered high school progression rates, and graduate enrollment cap; C = graduate enrollment cap at 23,000; D = lower high school progression rate; E = university retention increased 10 percent; F = off-campus enrollment increase to 25 percent of on-campus.

HISTORICAL TRENDS AND DRIVING FORCES OF CHANGE

HISTORICAL TRENDS

There has been frequent mention of how universities will be increasing the percentage of the nontraditional students (e.g., older, part-time, distant) and retraining existing college graduates as the job markets shift and require new skills. There is also mention of the importance of increasing the higher education of citizens so they can cope with the demands of high technology and the increasingly complex society as employees and as members of the general population. Finally, there is mention of increasing the percentage of high school graduates within the overall population.

It is difficult to estimate how these "changes" in increased numbers of part-time students, and increased high school and university graduates will take place. Historically, within the nation as a whole, there have not been large changes in the last decade or so in any of the commonly stated variables (e.g., headcount or FTE enrollment, student credit hours). There are still some increases occurring in part-time enrollment in higher education. It has increased from 32.2 percent in 1970 to 38.8 percent in 1975 to 42.2 percent in 1985 (Table B1 and B2). Nationally, in the last 25 years (1960 to 1985) high school graduates as a percent of the 17 year old population has changed from 69.5 to 76.9 to 71.4 to 73.3 percent (Table B5). The years of college completed by the 25-35 year old population has not changed much from 1980 to 1985 (Table B3) and the percentage of female students has essentially leveled at 53.2 percent female (or at least the growth rate has slowed

substantially), but the percentage of females that are full time is less (56.1 percent) than for males (63.6) with the overall average of part time at 59.6 percent in 1985 (Table B2). National and Arizona enrollment growth over the last 15 years is shown in Table 1.

Table 1. Growth Enrollments for Higher Education (in thousands)

Year	Enrollment National 2-Yr	4-Yr	Enrollment National Female	Male	No. Inst National 2-Yr	4-Yr	Enrollment Arizona 2 Yr	4-Yr
1970	1.630	6.290	3 284	4.637	891	1.665	43.316	68.791
1975	2.588	7.143	4 410	5.321	1.128	1.898	90 691	82.351
1980	4.526	7.571	6.223	5.874	1.274	1.957	113.710	89.064
1985	4.531	7.716	6.429	5.818	1.311	2.029	117.484	91.287

Includes public and private institutions. Sources: National Center for Education Statistics, Valley National Bank of Arizona.

The enrollment in higher-education institutions as a percent of the 18-24 year old population or of the high school graduating class has been relatively constant (in 1985 at 27.8 percent of 18-24 year old population and 33.7 percent of the high school graduates), see Table B6. In fact, if current trends continue, the increasing percentage of minorities in the high school age group will actually cause the high school graduation numbers to drop (due to the higher drop-out rate for minorities). The inertia of society is such that we might not expect major changes in these trends in the next 12 years, but on the other hand, there are new forces that might make major changes.[2] This uncertainty contributes to the complexity of attempting long-term enrollment forecasting.

Arizona universities are not only attractive to in-state students but out-of-state students as well. For example, Arizona is the state with the highest ratio of students entering to students leaving the state for higher education, at a ratio of 3.1 compared to the national average of 1.2 (Table B4). Arizona also has the highest proportion of native first-time college students enrolled on its campuses (with 97 percent followed by California at 95 percent and Texas at 94 percent). Arizona in-migration for university students is primarily from six states (with Fall 1984 numbers): California (1,641), Illinois (797), Colorado (566), New Mexico (487), New York (478), and Michigan (378). Arizona out-migration to other state's universities is primarily to five states (with Fall 1984 numbers): California (1,276), Kansas (374), Texas (348), Utah (344), and New Mexico (261), see Bartram and Gebel (1988).

Overall Arizona population (all ages) in-migration in 1984-85 is primarily from: California, Illinois, New Mexico, Texas, and Colorado. Overall Arizona population out-migration is primarily to (1984-85): California, New Mexico, Texas, Colorado. These migration patterns change by year, and in the last 5 years (FY 81-85) California, Ohio, Michigan, and New York net migrations have been decreasing, while Washington, and Illincis have been increasing and the net loss to Texas has been decreasing (Bartram and Gebel 1988).

Arizona has 94 percent of its higher education enrollment in public institutions, compared to 78 percent for the nation. This proportion is also higher than other western states (e.g., CA, CO, OR, UT, WA). Arizona students in higher education at full-time status are only 46 percent compared to 58 percent nationally. This is similar to California at 44 percent but lower than other western states (e.g., CO, OR, UT, WA).

Therefore, the states of primary interest for the university enrollment and state population changes in Arizona are: California, Illinois, Colorado, New Mexico, New York, Michigan, Texas, Kansas, and Utah. The projected high school graduates to the year 2004 for these states are shown in Appendix D.

The growth rate of total university headcount enrollment slowed somewhat in Arizona over the period 1975 to 1985 (Table 2 and Figure 2). Actual headcount increases in undergraduate have been getting smaller, while graduate growth was very small over the period and actually declined from 1975 to 1980.

Table 2. Arizona Undergraduate and Graduate Enrollments*

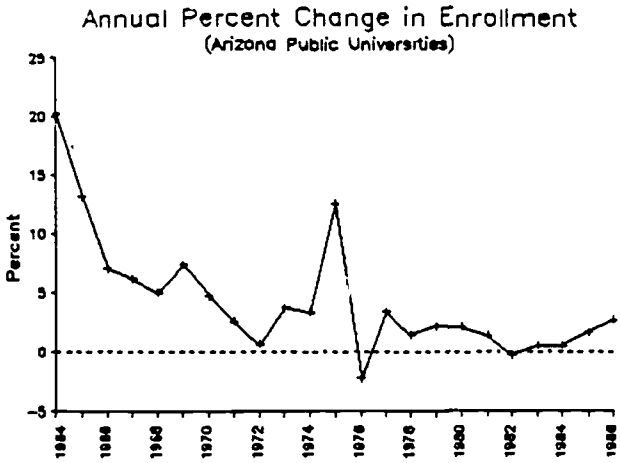
Year	Headcount			SCH	Total FTE
	Total	Undergrad	Graduate		
1970	60,218	47,001	13,411	759,092	54,064
1975	75,065	55,281	19,784	880,532	62,407
1980	80,408	61,565	18,843	922,220	64,722
1985	83,547	63,611	20,236	935,783	65,707

---

* Total includes ASU, ASUW (separate category for FY 85), NAU, UA on-campus), FTE calculated using old method.

The overall growth rate of the Arizona universities showed a generally declining trend during the 20 year period from 1964 to 1984, however, this trend seems to have been reversed over the last three years, as shown in Figure 2.

Figure 2. Percent Annual Change in Arizona Universities Enrollment*



The ratio of Arizona high school graduates to university enrollment has been slowly increasing over the last 25 years (Figure B1), but this trend is confounded by the growth of community college enrollments (and in-migration or out-migration of high school age students) (Figure B2). The ratio of Arizona population to high school graduates had been increasing, with a marked acceleration since 1979 (Figure B3). The university total headcount enrollment per 1000 population increased to the early 1970s and has been declining since that time (Figure B4). The ratio of community college enrollment to university enrollment increased rapidly from the early 1960s to 1975 with a change to a slow increase since that time (Figure B5). These changes indicate the rapid growth to the early to mid 1970s with relatively little change until the last three to four years. Graduate enrollment at the universities as a percentage of the total enrollment grew until about 1975, and has remained relatively stable since that year (Figure

B6). These changes not only reflect a national change but also indicate the maturing of higher education in Arizona (community colleges and universities). Although enrollments in Arizona community colleges and universities have been increasing rather slowly for over a decade, demographic changes projected to occur over the next 12 years indicate that we cannot rely on simple extrapolation of recent trends in estimating future enrollments. The age distribution of students at the Arizona universities is such that the high school graduating class is an important indicator of university enrollments. For example, at all three universities, the 18-24 year-old on-campus (including full- and part-time) undergraduate group accounts for 76-84 percent of the total undergraduate population (see Table B7).

DRIVING FORCES

There are several changes that have accounted for enrollment patterns in the last 15 years (1970 - 1985). These include:

1. The national growth in four-year college enrollment was 23 percent compared to a 178 percent increase in community college enrollments. The Arizona growth rate for universities was 39 percent and for community colleges was 171 percent. The growth rates of these two sectors, both nationally and in Arizona, have been more comparable in the last five years.

2. The percentage of women in higher education has increased 96 percent compared to a 25 percent increase for men (with more women than men currently enrolled). This accounts for a greater percentage growth in enrollment than if the population had been more equally represented through the 15 year period.

3. The baby boom (those born in late 1940s through early 1960s) accounted for a large number of people in the 20-39 age group.

Several of these changes in the last period of major enrollment increases will not be repeated during the next period of enrollment increase (late 1990s). The single most important factor in the next enrollment increase (and the preceding decline) is the age distribution of children of the baby boom cohort.

Since the high school age population is a strong predictor of future university enrollments, at least for the types of universities we have in Arizona, some knowledge of the likely distribution of that population over the next 15 years is necessary in order to give some understanding of potential future enrollment issues. The WICHE forecasts for the nation are shown in Figure 3.

Figure 3. National WICHE High School Graduate Forecast.

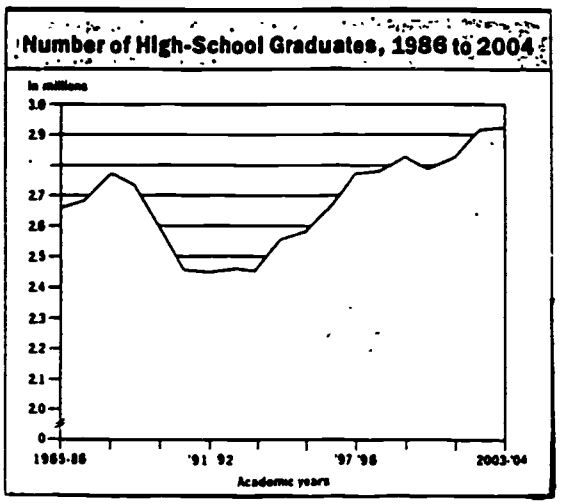
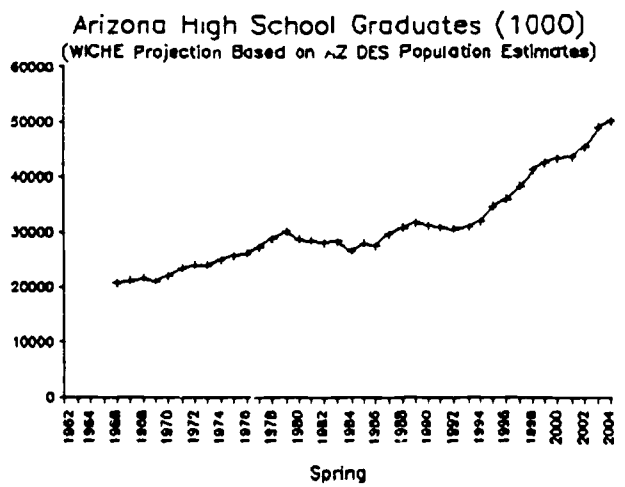


Figure 4. Arizona High School Graduates: Historic and Projection



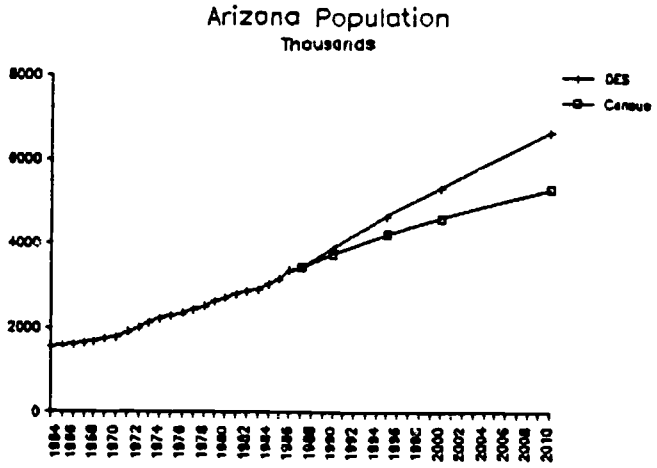
Arizona high school graduates increased to about 1979, declined until about 1985, and are projected to peak again about 1989. This will be followed by a small decline and a rapid increase to the year 2000 and beyond. This change in high school graduates can also been seen relative to the overall population. The ratio of Arizona population to high school graduates was relatively constant from 1966 to 1979, when the ratio changed markedly to a higher population per high school graduate (see Figure B3).[3]

PREVIOUS STUDIES

ARIZONA POPULATION FORECASTS

It is getting increasingly difficult to forecast Arizona population for more than a few years. The state is "maturing" in that it is moving from a rapid growth state to one whose GROWTH RATE is decreasing simply due to the size of the base population. In addition, the significant in- and out-migration rates for Arizona (where for every 4 people entering the state 3 leave in a given year), and the baby boom portion of the population is beginning to shift out of high migration age ranges. While it seems reasonable to expect the growth rate will slow, it is difficult to make reliable forecasts given the uncertainty in migration rates. As an example, the Arizona Department of Economic Security forecasts a year 2000 Arizona population of 5.3 million, where the U.S Bureau of Census does not expect this level to be reached until the year 2010 (instead forecasting 4.6 million for the year 2000). This difference is shown in Figure 5.[4]

Figure 5. Arizona Population History and Forecasts



ABOR FUTURE NEEDS OF THE STATE TASK FORCE ON EDUCATION AND PUBLIC EXPECTATIONS

This ABOR subcommittee developed the still current enrollment forecasts for the Arizona universities to the year 2000. A full set of these data (three forecasts for each university) and the institution specific assumptions are in Appendix C and the summary estimates are listed in the enrollment scenarios section below (note these reports were published in 1986 but still provide the most recent official estimates for the universities).

1. All university participants agreed to use a cohort-survival computer based forecasting model (this follows the number of students promoted through each of the grades). The basic data are developed from enrollments in primary and secondary schools, community colleges, private schools, and in- and out-of-state migration. This model and the results were approved by the senior management of each Arizona university.

2. Three projections were developed: most likely, optimistic and pessimistic. Each university identified and used different assumptions for projections, but used the same basic model described above.

3. The major (all universities combined) conclusions for the most likely projection were:

a. The period of greatest increase will be 1995-2000, accounting for a 20 percent growth in headcount enrollments;

b. The period of smallest increase will be 1985-1990, accounting for 7.9 percent growth in headcount;

c. Enrollment will increase from 1985 to the year 2000 by about 46 percent for undergraduate and 47 percent for graduate, but will vary widely by institution (ASU 32 percent increase in undergraduate and 40 percent graduate; ASUW increase of 1,422 percent overall; NAU 42 percent increase in undergraduate and 60 percent in graduate; UA 29 percent in undergraduate and a 1 percent decrease in graduate);[5]

d. Nonresident enrollment will increase to 25 percent of headcount enrollment;

e. Off-campus headcount enrollment will increase 63.5 percent but varies widely by university (ASU: 108 percent, NAU: -20 percent, UA: 106 percent).

WESTERN INTERSTATE COMMISSION ON HIGHER EDUCATION (WICHE)

Early in 1988 WICHE published its third report on high school graduates (Figure 3). The report this year provides estimates of high school graduates for each state through the year 2004. For Arizona, the previous WICHE (1984) forecast was low (due to underestimating state growth); the current forecast is likely to be high because of incorporating the average of in-state migration rates of the higher years as a constant migration rate. Plane (1988) has indexed and modeled the WICHE high school graduation data for first-time college enrollment (Table 3).[8] Arizona, California, and Utah are generally enrollment growth states and New York, Illinois, and Michigan are generally enrollment loss states from the peak year (1988 or 1989) to 2000. Comparing Arizona and Illinois will show the differences in significant enrollment growth and declining enrollment states. Arizona first time university enrollment will reach its peak in fall 1989, dip to 1992, and by the year 2000 be 1.32 times the 1989 peak (a 32 percent increase). However, Illinois will peak a year earlier in 1988, decline to 1992, but not recover by the year 2000, when the high school enrollment will be 0.86 that of the 1988 peak (a 14 percent decrease).

Table 3. Projections of First-time University Students by Selected States

State	Fall 1979 Index	Fall Peak 1980s Year	Peak Index Total	Fall Trough 1990s Year	Trough Index Total	Fall 2000	Ratio 2000 to Peak Yr
AZ	110	1989	112	1992	107	148	1 32
CA	109	1988	107	1991	97	139	1 30
CO	115	1988	107	1992	93	120	1 12
KS	124	1989	105	1992	94	114	1 09
UT	104	1989	115	1990	111	155	1 35
NM	115	1988	101	1992	98	124	1 23
MI	121	1988	104	1994	84	91	0 88
TX	105	1989	111	1992	105	125	1 13
IL	121	1988	103	1992	90	89	0 86
NY	124	1988	102	1994	84	91	0 89

Index based on 100 for fall 1986 States listed are most relevant for

SPECIAL CONCERNS FOR ARIZONA

One of the most important variables is the future population growth rate of Arizona. Closely related is the in- and out-migration of school age students (at all grade levels) and the percentage of high school students electing to enter a university. See figures D2-D3 for forecasts of high school graduates for these states most important in this consideration. It seems reasonably clear that the overall population growth rate for Arizona in the next 15 years will be less than that of the previous 15 years (however, the absolute value of population increase will still be significant). It seems probable that the interstate competition for university-age students in the next 15 years will also increase. Arizona is a somewhat atypical state with respect to student flows, in that the migration of students into the state far exceeds the movement of students out of the state (see Table B4). Arizona higher education has a much greater ratio of out-of-state students to in-state students; this will increase the importance of out-of-state enrollments and other state competition in the 1990s.

The Arizona universities total enrollments as a percentage of total Arizona population increased until about 1970, declined and then increased again to 1975, and has since steadily declined (Figure B3). This decline is likely related to:

1) increased proportion of Arizona in-migrants with professional education attained elsewhere,

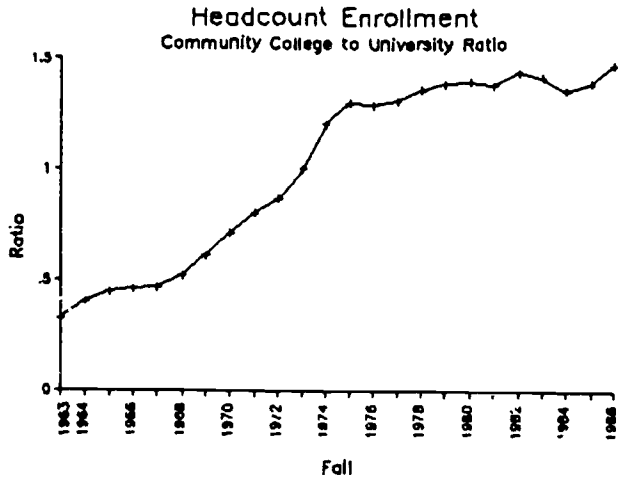
2) increased proportion of Arizona population consisting of young (less than 4) and elderly (over 65), and 3) the impact of the community college

system on university enrollments (Figure B5),

4) declines in the number of 18-24 year olds in the population.

The Arizona community colleges began significant growth in the 1960s and have influenced university growth. Beginning in 1975 the combined enrollment at the community colleges exceeded the combined enrollment of the universities (Figure B5).

Figure B5. Headcount Enrollment



The method of calculating enrollments is also an important element in developing forecasts. For example, all students will require some student services (whether off-campus, on-campus, part-time) but the instructional demand will be related to the actual student credit hours taken by the students. Table 4 indicates the ranges in headcount, depending on the definition. It is VERY important to identify separately the on- and off-campus headcount enrollments, as it is primarily the on-campus students that have major effects for the on-campus institutional character. However, many data are reported on the basis of "all students" when making institutional comparisons. This is a limitation of this working paper but for comparative purposes it is necessary.

Table 4. Headcount Enrollments in Arizona Universities, Fall 1987*

Type	ASU	ASUW	NAU	UA
On-campus Credit	39,802		11,317	32,505
Off-campus Credit	2,255	2,979	2,028	318
On-campus non-credit	-	-	-	1,462
Off-campus non-credit	-	-	-	382
Correspondence	-	-	177	1,875
Total	42,057	2,979	13,622	36,542

* Numbers are corrected for concurrent enrollments at ASU and ASUW. The ASU and NAU figures involve a different categorization of the credit/non-credit enrollments than UA, accounting for the variation in manner of presentation. Credit is defined as "degree" credit. The individual universities are listed here to emphasize the variation in reporting formats

There are several special concerns for Arizona that complicate long-term enrollment forecasts. These are:

1. The variation in future population growth rate of the state because of the current approximately two-thirds population growth due to net in-migration shifting to a greater percentage of native born.

2. The diverging growth rates of numbers of high school graduates in some states that either provide or take Arizona high school students, and the resulting competition between these states and Arizona for students.

3. The increasing percentage of minorities in the K-12 school years, coupled with changing high school graduation rates for minorities (recently improving but still lower than for non-minorities).

4. The impacts of increased retention of already enrolled students. Approximately 35-40 percent of the freshmen class does not continue to a given school the following year; even small increases in this rate could have significant affects on university total enrollments.

5. The degree to which part-time or off-campus instruction occurs and the impact of communication technologies on effectively reducing the number of on-campus students will have consequences for both calculating or estimating the total enrollment.

6. The amount of competition which might occur with the private educational market (e.g., University of Phoenix) if the public universities do not adequately address the needs of the those type of students, they will select alternative institutions.

ASSUMPTIONS FOR ENROLLMENT ANALYSIS

This analysis of enrollment trends was one to develop a range of plausible estimates for the universities as a whole, to learn more about the circumstances that may face the Arizona universities as we move to the 21st century. Accordingly, there are two major limitations to the forecast:

1) it combines all three universities in one analysis, although some campuses will change much more than others and specific assumptions may vary widely by campus; and

2) only a few of the many possible variables were used. This was done to simplify the analysis and to show the possible range of enrollments and shape of the growth curve for the Arizona universities. This simplification was done to allow development of a broad understanding of the possible range of enrollments and to reduce the concerns of each campus relating to which assumptions are most relevant to that particular campus.

THESE GENERAL HYPOTHESES ARE:[7]

1. There will be four rates of high school graduation: a) current graduation rate (WICHE defined), b) a reduced rate based on the increasing percentage of minorities and adjusted for the historic graduation rate for make-up of minorities, and c) each of these rates further adjusted by a slowed interstate migration rate adjusted for the current age distribution.

2. Retention rates after entry to the university are given at two levels: a) current retention, and b) a 10 percent increase in retention rate.

3. Distribution of students between undergraduate and graduate is given at two rates: a) graduate as a percentage of current undergraduate held constant, and b) graduate as a constant number regardless of percentage.

4. Relationship of off-campus students to on-campus students is given at two rates: a) five-year average percentage for each campus, and b) increasing off-campus enrollment to 25 percent of total student headcount.

Many of these variables are under control of the universities (e.g., increased student support services to help retention), some are demographically controlled (e.g., high

school graduation rates and interstate migration), some are due to student demand (e.g., part time students), and some are affected by state and federal initiatives (e.g., availability of financial aid). These assumptions are examples of those critical to the future enrollment levels.

UNCERTAINTIES SURROUNDING ENROLLMENT FORECASTING

There are some major uncertainties that make it unlikely that enrollment forecasting will be simple, causing the need for multiple forecasts incorporating various assumptions. In addition to the items listed in "Special Concerns for Arizona" above, some of the uncertainties for Arizona universities are:

1. Enrollment impacts of ASUW on state-wide higher education enrollments and on other universities, particularly ASU and NAU.

2. Effects of the economic cycle on the state budget, competition of the universities and state agencies for a share of the state budget, and the impact of federal and private funding on university activities.

3. Development of additional campuses of the Arizona community College system will likely produce reductions in university freshmen enrollments and subsequent increases in upper division enroliments (or reduce freshmen enrollments while holding upper division enroilments relatively constant).

4. Actions taken by universities in those states most likely to be effected by decreasing numbers of high school graduates to keep students in their home state or recruit more heavily in Arizona.

5. Impact of changes in tuition rates and financial aid for Arizona universities relative to those of other states.

ENROLLMENT SCENARIOS FOR PERIOD 1988-2000

Although the last 10 years has not been a period of significant enrollment growth for higher education in Arizona, increases in the number of high school graduates expected to start in the early 1990s and continue through the end of the century seem likely to produce significant increases in enrollment starting in the mid-1990s. It seems unlikely that this projected grov vill be as large as that experienced in the 1960s, since the components of 1960s growth, e.g., the baby boom cohort, increased higher education participation rates (especially among women), and avoidance of military service, have been largely played out or are no longer operative. Enrollment growth in the late 1990s, unlike that of the 1960s, seems likely to be singularly fueled by the projected increase in the college age cohort. Although other trends may have an impact on enrollment growth in the 1960s, e.g., the increase in the proportion of part-time students and technological innovation in education, these are operating at slower rates and likely to have less impact on growth than did the other components of growth in the 1960s. Another identifiable trend, which may moderate growth in 1990s, is the increasing percentage of minorities in the college age cohort. Thus, it is necessary to examine a number of enrollment scenarios rather than relying too heavily on past experiences or simple extrapolations.

It is very important to recognize that major uncertainties exist when trying to forecast 10 or 12 years into the future. A major war, changing economic conditions or a major natural disaster, among others, could occur and have substantial effects on university enrollments. Nevertheless, for contingency planning purposes, it is necessary to develop forecasts that control for a number of identifiable conditions.

SELECTED FORECASTS

Several forecasts of enrollment for Arizona universities over the period 1985 through 2000 are displayed in Table 5 and Figure 6 (a reduced version appeared earlier as Figure 1). Considering all projections in Table 5, enrollment increases for Arizona universities over the period 1987-2000 are projected to range from approximately 16,000 to 73,000. Note that the Future Needs of the State projections fall in the mid range of the nine projections (also note that these were estimated in 1986). Although no formal probabilistic analysis was done, it is the subjective assessment of the authors that the two highest and the two lowest projections have low probability of occurrence and that the highest two of these four have the lowest probabilities. The range of enrollment increase most likely to occur over the years 1987 through 2000, based on subjective criteria, is 20,000 to 30,000 headcount. The upper end of this range is supported by Plane (1988) whose analysis of indexed migration rates and university enrollments suggests an increase of 30,000 students in Arizona over the period 1987-2000. Example D in Table 5 provides support for the lower end of the most likely range, although the authors feel that the impacts of the migration and minority assumptions are more severe in this model than they will be in actuality. In addition, the pessimistic projection (made in 1986) of the Future Needs of the State report falls in the preferred range. Thus, for the Arizona university system, we conclude that headcount enrollment increases in the range of 20,000 to 30,000 have a high probability of being realized and should be used for planning purposes.

Table 5. Selected Enrollment Forecasts 1985 to 2000

Example	1985	1990	1995	2000	1985-2000 Increase
Projection A	90 098	95.904	1.2.138	130 449	40.351
Projection B	90.098	95.114	91.831	105.718	15.620
Projection C	90 098	96.701	100 681	122.213	32.115
Projection D	90.098	95.114	91.831	108.761	18.663
Projection E	90.098	102.719	110.054	140 558	50.460
Projection F	90.098	111.440	127.673	163.361	72.963
Optimistic*	90.098	99.774	112.455	131.406	41.308
Pessimistic*	90.098	86.339	99.168	117.018	26.920
Most Likely*	90.098	92.630	105.113	123.911	33.813

* Projections developed in 1986 by Future Needs of State Task Force on Education and Public Expectations. the terms "optimistic, pessimistic, most likely" are the terms used in the original report See Appendix D for detailed discussion The base year is 1987 because is most recent data. the base year for the Future Needs of the State study was 1986 The

---

* Projections developed in 1986 by Future Needs of State Task Force on Education and Public Expectations; the terms "optimistic, pessimistic, most likely" are the terms used in the original report. See Appendix D for detailed discussion. The base year is 1987 because it rpovides the most recent data; the base year for the Future Needs of the State study was 1986. The headcount for that 1985 base year was 83,547.

IMPLICATIONS FOR ARIZONA UNIVERSITIES

1. Competition for both undergraduate and graduate students with other states is likely to increase;

2. The anticipated increases in minorities in the school and college age groups will require increased recruitment efforts and resource expenditures on the part of Arizona's universities;

3. Planning for the next five year period (1988-1993) will be much different than the following six year period (1994-2000) and will require greater management involvement than in the past;

4. Institutional resistance to change as well as the impact of new educational or communications technologies are hard to estimate but may be significant;

5. Increases in enrollment levels will undoubtedly produce a number of solutions, however, these are likely to be more successful in combination that individually.

CONFLICTING VIEWS ON ENROLLMENT GROWTH

During the course of developing this working paper, we found several viewpoints regarding enrollment that are inconsistent with generally accepted facts. Several of these are listed below as view and fact:

VIEW 1: ENROLLMENT GROWTH IS NEEDED TO INCREASE THE BUDGET OR PROGRAMS AVAILABLE

Without a growing student enrollment a university will not be able to improve its programs.

FACT 1: MOST BUDGET INCREASES COME FROM PROGRAM CHANGES NOT ENROLLMENT INCREASES

The major budget categories are: continuation (providing for inflation and capital renewal), capital planning, enrollment growth, and program changes. It is the latter category, program changes, that accounts for most of the non-inflation related budget growth in Arizona's universities. In the last five years (FY 85-89) for the combined enrollment increase budgets and program change budgets, program change accounted for 92% of the FTE (including faculty and staff) and 97% of the total budget. Several universities in other states have reduced enrollment while increasing quality, and a study of 439 public institutions show that states neither reward enrollment growth nor

punish enrollment decline by adding or subtracting commensurate with enrollment changes (Leslie and Ramey 1986).

VIEW 2: INCREASES IN ENROLLMENT ONLY CREATE MARGINAL COSTS BUT PROVIDE FULL FUNDING

As additional students are added, the primary structures are already in place and therefore only small increases in costs occur.

FACT 2: ADDITIONAL COSTS ARE STEP FUNCTIONS AND REQUIRE ADDITIONAL INFRASTRUCTURE

As additional students cause a demand for additional services, new library space, or more classrooms, these facilities need to be built; this additional space then allows for some increase until a new level of support is required. The increases in "infrastructure" requests in program changes in the last two years alone are an indicator of this continual support need. During FY 88 and FY 89 [add more here to show actual amounts of infrastructure requests and the percent of total request). This has particularly been a problem for ASU due to its greater growth rate, and the need for additional space exists at all universities.

VIEW 3: OUT-OF-STATE STUDENTS PROVIDE ADDITIONAL BUDGET SUPPORT

The out-of-state student allows greater support than in-state students due to tuition payments in addition to fees.

FACT 3: BOTH IN-STATE AND OUT-OF-STATE STUDENTS ARE SUBSIDIZED BY THE STATE

The out-of-state student pays non-resident tuition in addition to the fees paid for all students. The total of tuition and fees is set at 85% of the cost of instruction; the cost of instruction includes all the instruction and student services, a portion of academic support and institutional support but not capital. Accordingly, the out-of-state student pays some amount less than the stated 85% of the cost of instruction; this difference is made up by the state. This is further complicated by the university retaining a portion of tuition (original intent in 1980) and fees (for some universities) in local accounts for revenue bond debt service; the remainder is deposited with the State Treasurer. These funds on deposit with the Treasurer are then considered when the legislature appropriates the university budgets.

VIEW 4. REDUCING OUT-OF-STATE NUMBERS WILL INCREASE STATE EDUCATION COSTS

This issue initially occurred during discussions of possible enrollment caps while at the same time increasing the number of in-state minority students. For example, if the total number of students remains constant and out-of-state students were to decrease, the state will have to pay an amount equal to the tuition payments by out-of-state students for the overall budget to remain constant. There are other considerations of out-of-state students that do not affect the university budget or cost structures. For example, the increased benefits by having additional funds expended in Arizona or the increased costs in providing services for more people.

These non-university issues are not addressed here.

FACT 4. SIMPLE COMPARISONS OBSCURE A COMPLEX ENVIRONMENT

Because of the number of out-of-state students, it would likely require a substantial increase of in-state students for the total number of students to remain constant. The fees paid by the student would presumably remain unaffected (if the process were slowly transformed and the state responded by continuing its current level of support for in-state students. If the educational need for in-state students were not met by reducing out-of-state students), the total state costs would be substantially higher than by substituting in-state for out-of-state students (see view/fact 3).

VIEW 5. WHILE THERE PROBABLY IS AN "OPTIMUM" SIZE OF AN INSTITUTION, THERE IS NO APPARENT REASON TO LIMIT GROWTH

Since the major investments already exist, additional growth is more in line with its costs.

FACT 5. IT IS NOT CLEAR WHAT AN OPTIMUM CAMPUS SIZE IS BUT THERE ARE LIMITS TO GROWTH EFFICIENCIES

While most economies of scale slow rapidly after a few thousand students, there are other less obvious indicators for institutional size. Around 13,000-20,000 there is a change and above that you either do not find economies of scale or there are diseconomies of scale. In addition, the non-economic issues suggest very large institutions are not the best for overall educational performance. For the Arizona universities, an additional concern relates to available space for future growth while maintaining the setting of a university campus (for a more detailed discussion of "optimum size" see the section titled "Is There an Optimum Size for a University?).

VIEW 6. MANY OUT-OF-STATE STUDENTS REMAIN IN ARIZONA AFTER GRADUATION

The state economy is enhanced by having out-of-state students become acquainted with Arizona and remain here to contribute to the general economy after graduation.

FACT 6. MANY OUT-OF-STATE (AND IN-STATE) STUDENTS PROBABLY LEAVE ARIZONA AFTER GRADUATION

This is a difficult subject to find clarifying data. The Task Force did a survey of alumni (analyzed by American Council on Testing). While these results are representative of the university graduates, additional work should be done to better understand this issue. The preliminary results on 1117 alumni graduating in xxx indicate that 66 percent of the formerly in-state residents still live in Arizona, and 77 percent of the formerly out-of-state residents currently live out of state.

DISCUSSION

FORECASTING IS DIFFICULT

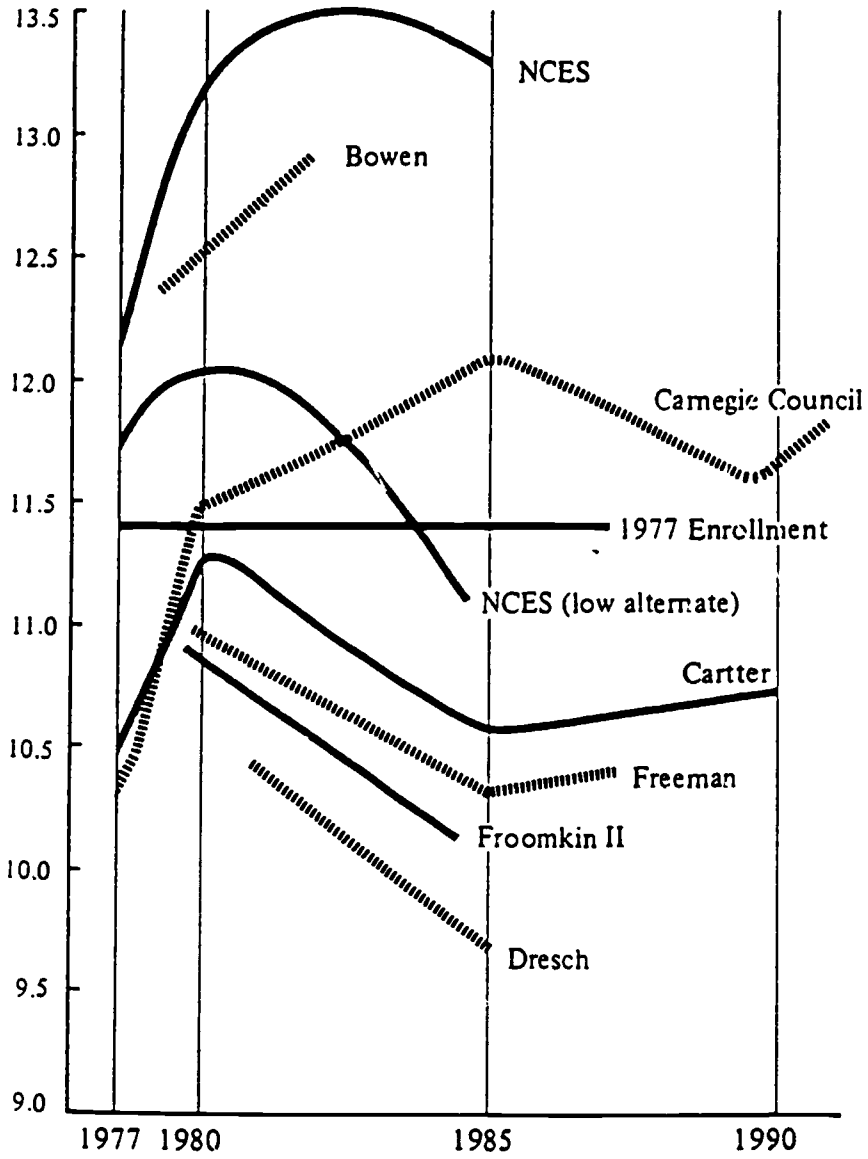
It is not easy to forecast university enrollments for more than a year ahead with any accuracy. For example, Centra (1980) analyzed a number of projections of total post-secondary enrollments for the 1980s (see Figure 7); these

projections were made in 1977. As the figure indicates, large differences in projections can occur due to the variety of assumptions used, emphasis placed on underlying trends, and the perspectives of the analyst. There are a number of other examples that could be developed using institutional or systems wide estimates of university enrollments that would show equally discrepant results. Thus, it is always necessary to exercise a reasonable amount of caution when examining or discussing enrollment projections, especially those for as far as 10 or 12 years into the future. Forecasts must be realistic and the impacts of trends or assumptions must be reasonable.

Other considerations to be kept in mind when institutional projections are analyzed are noted by Kemerer and others (1982). They note that universities tend to place greater emphasis on admissions than on retention, senior university officials tend to be more optimistic regarding enrollments in public settings than they are in private, and universities in general are not adequately preparing for possible enrollment problems. They further note that it is important to maintain a focus on long term institutional viability rather than on quick fix solutions. Although this book was published in 1982, there is still considerable value to these statements.

Figure 7. Arizona Enrollment Futures (Expanded Scale)

Projections for Total Enrollment in Postsecondary Education to 1990
(in millions, relative to actual 1977 total enrollment of 11.4 million)



Note: The lines for Bowen, Freeman, Dresch, and Froomkin's second scenario are not based on actual figures but instead are an approximate illustration of their views. *Source:* Centra, 1980, Fig. 2.

ROLE OF MINORITIES, OUT-OF-STATE, AND FOREIGN STUDENTS

Because the relative proportion of minorities in the Arizona population will increase in the future, it is relevant to ask how that will affect overall enrollment and university size. Some statements regarding the universities and increases in minority students include:

- A relative slowing of in-state migration and the relative increase of minority youth will increase the relative number of minorities in the university admissions pool and may not affect the overall university enrollments.

- Each university should adopt minority recruitment and other minority program based on its geographical location, program availability, and type of student.

- Retention and transfer status of minorities is as relevant as admissions for the objective of increasing degree completion.

- Admission standards should be applied equally to all students, but special actions may be required for minorities because of different academic preparation or financial needs. These actions will require resources.

Current out-of-state enrollments at Arizona universities are in the range of 18-25 percent (depending on the method of calculation and the university), but freshman out-of-state enrollments range from 28-43 percent. Anticipated increases in minority students can be accounted for even with enrollment limitations if the increases are off-set by reductions in out-of-state students (Table B8). In addition, as the competition increases between states for a more limited pool of high school graduates in the early 1990s, major changes in out-of-state students may occur, causing additional risks of higher than average enrollments in this category. As this competitive situation develops, the relative amounts of in-state registration fees and out-of-state tuition may become an important item in the decision of which state a student might select. The Arizona rates and those of some comparative institutions are found in Table B10.

The foreign student enrollments at the Arizona universities are within the range of similar types of institutions in other states (Table B9). With the increasing internationalization of the economy, it is an advantage to have an appropriate number of foreign students, although they are usually concentrated in several highly technical fields.

IS THERE AN OPTIMUM SIZE FOR A UNIVERSITY?

This is not a question with a direct answer. There are many factors that make inter-institutional comparisons difficult (e.g., on-campus vs off-campus, part-time vs full-time, evening vs day). There are various opinions, anecdotal examples, and limited formal study. However, it is an important question for Arizona and there are some available data to help understand the basic concept.

Brinkman and Leslie (1986) have noted that there are "optimum" sizes for universities, but they are hard to define in economic terms. On the basis of their own study and summarizing the literature, they concluded that in the 13,000 to 18,000 range there is a transformation of the institution. Above

that you don't really gain through economies of larger scale. There are also few institutions in the really large university class, where ASU ranks number 6 in headcount and second highest in part-time students of the largest (headcount) ten universities. Many of the very large enrollment campuses have substantial land areas and can maintain the learning setting better than the more compact Arizona universities. Institutional size is heavily skewed to the very small college. Comparing fall 1986 enrollments, only 10 percent of the institutions are 10,000 headcount or above; only 3 percent are over 20,000, and less than two percent are over 30,000 (30 institutions).[8] The top 10 universities (all are public) are listed in Table 6.

Table 6. Ten Public Universities with Greatest Head Count Enrollment (Fall 1986)

University	Headcount	FTE	Percent Part-time
U Minnesota	63,067	44,573	44 0
Ohio State	53,199	46,770	18 1
U Texas, Austin	47,838	43,392	13 9
U Wisconsin	45,050	40,155	16 7
Michigan State	42,746	37,251	19 3
Arizona State	40,529	30,658	36 5
U Maryland	38,679	32,118	25 4
U Illinois	35,997	33,905	8 7
Penn State	35,699	32,813	12 1
Texas A&M	35,675	32,820	12.0

Source: NCHEMS. Universities with branch campuses have only the main campus listed.

Arizona universities cannot accommodate the likely 20,000 - 30,000 headcount increases in the next 12 years and also maintain the quality of their educational settings approximately as they are today.[9] Other universities have decided to downsize in the last few years and several have had enrollment limits for a number of years (e.g., University of California at Berkeley and Los Angeles).[10]

There is no clear breakpoint where institutions move from small to medium to large to very large. However, Brinkman and Leslie (1986) on purely economic considerations reinforce what seems to be a feeling that as you move through about the 15,000 level, the institutional character changes; NAU is presently at 11,417 total on-campus headcount but is 13,445 total (1987).

The next break is more difficult to define. Brinkman found after about 15,000 the economies of scale are no longer significant, and in some cases begin to be diseconomies of scale. The character of the campus begins to change when the very large student body develops. There is some anecdotal evidence to suggest this level is in the 30,000 range, and is partially supported by those choosing to cap or downsize focus on the 30,000 number as a general target.[11]

In our Task Force staff interviews, we found that there is some concern ASU may already be too large, NAU is approaching a critical size that will change its character if exceeded, and UA is about right at its current size. Furthermore, NAU has publicly indicated this concern and interest in remaining the type of institution it is currently, but the other two universities have not made public statements regrading overall enrollment caps or optimum sizes. It should be noted that there are de facto enrollment limitations at all Arizona universities in the form of entrance requirements for individual colleges within the university.[12]

There are several universities of wide reputation that provide useful comparisons in terms of enrollment size (Table 7).

Table 7. Enrollment of Selected Universities*

University	Total Headcount	Percent Part-time	Percent Graduate
Arizona State	40,223	33.9	13.5
U Arizona	30,460	26.4	22.0
Northern Arizona U	-	-	-
U Calif,Los Angeles	34,751	7.9	23.0
U Washington	34,368	22.5	20.9
San Diego State	32,494	34.7	11.2
U Houston	31,114	49.3	18.7
U Calif, Berkeley	30,009	8.9	25.9
U New Mexico	25,690	44.4	14.8
San Jose State	25,081	40.3	10.7
U Utah	24,911	33.0	12.9
U Colorado	22,191	11.1	16.7
U North Carolina	21,812	15.9	20.3

---

* From top 100 universities in enrollment for Fall 1983 from National Center for Education Statistics (more recent statistics for full comparison were not easily available).

ALTERNATIVE GROWTH OPTIONS

The Arizona universities are all in the "large" category (top 10 percent in the country in headcount enrollment). In the Future Needs of the State Report enrollment projections (1986 report), ASU estimated a year 2000 most likely headcount of 50,651; this would likely place ASU as the third largest campus in the country. Thus, overall campus size is an important issue facing the Arizona universities in the next decade or so. An example of how the expected 20,000-30,000 headcount enrollments will likely be distributed in the state is shown in Table 8.

Table 8. Primary Arizona Growth Areas (in 1000)*

Year	Maricopa #	Maricopa %	Pima #	Pima %	Enrollment Increases Maricopa % of 20-30,000	Enrollment Increases Pima % of 20-30,000
1985	1,838	57.5	624	19.5		
1990	2,262	58.1	735	18.9		
1995	2,792	60.1	853	18.4		
2000	3,252	61.0	974	18.2	12.2-18.3	3.6-5.5

---

* Note these estimates are from AZ Department of Economic Security. The Statewide population growth for 2000 is 700,000 greater than the US Bureau of Census, so these estimates are intended to show percent distribution rather than absolute values. The Maricopa/Pima percent of 20-30,000 is the estimated increased size of the university enrollments for 1985-2000.

The expected year 2000 increase in Maricopa County enrollment of 12,200 to 18,300 is probably too great for any one campus.[13] However, the role of the community colleges (including recently or planned campuses) and on-campus vs off-campus enrollments will have a significant effect on these estimates.

In summary, the options included in this limited evaluation and the conclusion for each are:

1. INCREASE ENROLLMENTS AT MAIN CAMPUS.

This seems to be a realistic option only for NAU since ASU is already approaching a maximum and U of A is currently at an optimum size. This option should only be implemented after careful planning efforts by the Arizona Board of Regents identify maximum enrollment targets for each university and assess the likely impacts of enrollment increases on student life (broadly defined) and the surrounding communities.

2. DIVERT MORE FRESHMAN STUDENTS TO COMMUNITY COLLEGES.

This is in effect done in Maricopa County, causing ASU to have a larger upper division than lower division, and for ASUW to be designated as an upper division campus. While this could be implemented in the case of UA and NAU, it would change the character of these institutions significantly.

3. DEVELOP OFF-CAMPUS CENTERS OF LIMITED SIZE IN MULTIPLE LOCATIONS.

Relatively small off-campus centers could be expanded in the Phoenix area and initiated in the Tucson area. However, these types of centers usually have limited programs and are designed to accommodate part-time students and, thus, they are unlikely to relieve pressures on the main campuses to provide places for students desiring full-time study.

4. ESTABLISH A SECOND TIER OF UNIVERSITIES.

Other state universities have done this with mixed success. The resource demands on the state for a possible additional governing board and the likely political demand for multiple campuses (geographically dispersed) would undoubtedly be enormous. Perhaps this is the least desirable of the options.

5. ESTABLISH A FOURTH UNIVERSITY UNDER THE REGENTS

This could be done anywhere in the state for a residential campus. The demands, however, are more likely to be for a campus located in the Phoenix metropolitan area. A university offering the full range of programs would duplicate expensive programs and cause major resource expenditures.

6. USE OF ELECTRONIC TECHNOLOGY FOR OFF-CAMPUS INSTRUCTION.

It is difficult to estimate the impact of this option. It seems clear that many courses could be taught in this manner, but this technology is unlikely to be widely implemented within the 12-year period under discussion; to effect any major diversions of "traditional" university students into an "electronic campus" will take time. However, an increasing number of students are anticipated to be "non-traditional."

7. DEVELOP COOPERATIVE AGREEMENTS WITH OTHER STATES TO EDUCATE ARIZONA RESIDENTS.

It is possible that states with excess higher education capacity, due to a decline int he number of high school graduates, may find it attractive to negotiate WICHE-like cooperative agreements to accept students from states, such as Arizona, with excess student demand. Such agreements have been negotiated in the past under the auspices of WICHE but have dealt mainly with high cost, low demand programs such as dentistry and veterinary medicine. It might be possible for Arizona to negotiate agreements for undergraduate education that would be more cost affective than building new facilities to handle increased demand.

8. BUILD SELECTED BRANCH CAMPUSES OF EXISTING UNIVERSITIES. A branch campus structure (modeled after ASUW) would maintain the major management structure of the main campus and undoubtedly focus on selective programs. This approach would allow additional campuses to be built with fewer resources than other options.

While several of these options should be pursued simultaneously, consideration needs to be given to the option(s) that will provide the type and quality of education for the estimated 20-30,000 new students likely to matriculate at

Arizona universities between 1988 and 2000.

CONCLUSIONS

1. The Arizona universities will fare better than many universities during the next 5-7 year period of national decline in high school graduates. However, with changing demographic conditions in Arizona and national economic uncertainty, care still needs to be taken to avoid the simple straight line projections of future enrollment.

2. The real costs of increased enrollment are not adequately provided by additional state funding. Such enrollment does provide a sense of "good feeling" about the desirability of the university and provides faculty members to compensate for the increased teaching responsibilities of increased enrollment, but is requires additional funding over that supplies in the "enrollment" gain formula funding (e.g., through program changes).

3. Although the range of possible enrollments for Arizona universities is rather large, only a small number of the variables contributing to the variability can be controlled by the institutions. Other variables, e.g., changing student demand as well as national and state demographic trends, are not amenable to institutional control and seem likely to produce an enrollment growth of approximately 20 to 30 thousand students over the period 1988 to 2000.

4. The proportion of out-of-state students should be further evaluated relative to the potential vulnerability of overall enrollments if increased interstate competition should occur in the mid 1990s.

5. Off-campus enrollment and part-time enrollment patterns confuse enrollment forecasting. There is no clearly understood process to fully identify student services or academic program costs for off-campus vs on-campus students. As trends are likely to continue for both of these categories, the apparent headcount enrollment may increase markedly. Enrollment reporting forms should be changed where necessary to clearly identify off-campus, on-campus full-time, and on-campus part-time enrollments by institution in order to allow for development of dependable and realistic enrollment forecasts.

6. The issue of optimum campus size and the number of branch campuses is highly relevant at this time and needs additional study.

7. There are two time periods for consideration in enrollment planning. The next 5-7 years (1988-1995) is a period of high uncertainty and requires special monitoring; the last five years of this century (1995-2000) are more clearly a period of continuous growth, but will be affected by what occurs in the earlier period. The strategic planning processes should take into consideration the different strategies necessary to deal with these two distinct periods.

8. While the universities have considered the relative mix of undergraduate to graduate, on-campus to off-campus, and full-time to part-time students, there is no clearly identified series of goals on how to operationalize those interests. Additional studies are needed to better understand the relative student mix and total size of the universities.

9. The relative impact of electronic communications capabilities in the next 12 years to alter the traditional teaching approach and student location will affect the enrollment maxima of the universities. But while many of the these effects can be listed, they are difficult to quantify.

RECOMMENDATIONS

- THE ARIZONA BOARD OF REGENTS SHOULD ALTER THE FORM OF ITS REPORT ON STUDENT ENROLLMENT SO THAT VARIOUS TYPES OF ENROLLMENTS ARE CLEARLY IDENTIFIED.

Since data on part-time, full-time, on-campus, and off-campus enrollments are critical for enrollment forecasting, it is necessary to separate them for analysis. Furthermore, enrollments for main campuses, branch campuses, major off-campus centers, and an aggregate of other off-campus offerings should be reported separately, and duplicated and unduplicated headcount as well as FTE data should be reported for each entity. Enrollment data reported in this manner would allow the Board of Regents to more closely monitor enrollment growth at the various campuses and to make better informed decisions regarding campus size and operation.

- EACH UNIVERSITY SHOULD DEVELOP A SET OF AT LEAST THREE ENROLLMENT PROJECTIONS THAT TAKE INTO CONSIDERATION ANTICIPATED ENVIRONMENTAL CONDITIONS OVER THE PLANNING PERIOD AND THE UNIVERSITY'S BOARD APPROVED ROLE, SCOPE, AND MISSION.

These projections should be part of the Board of Regents strategic planning process, and the projection methodology should be approved by Board staff and the assumptions used should be clearly identified. The enrollment forecasts should be more completely developed along the lines of some of the uncertainties listed in this working paper. It is not too soon to determine the types of institutions necessary to meet year 2000 student demands. The shape of the enrollment curve is such that we have about 7-10 years before major enrollment increases are likely; given the development process for major campus facilities (including possible branch campuses), this allows time to fully debate the options and take action in advance of forced change.

- NEW EDUCATIONAL DELIVERY SYSTEMS SHOULD BE INVESTIGATED TO SLOW THE DEMAND FOR ON-CAMPUS ENROLLMENT GROWTH.

Given the high percentage of part-time students and the increasing demands for off-campus education, the use of alternative educational delivery systems should be actively pursued (e.g., delivery by telecommunications technology).

REFERENCES

Bartram, Jack, and Melinda Gebel. 1988. Arizona Environmental Scan. Task Force on Excellence, Efficiency, and Competitiveness. Arizona Board of Regents.

Brinkman, Paul T. and Larry L. Leslie. 1986. Economies of Scale in Higher Education: Sixty Years of Research. The Review of Higher Education 10(1) 1:28.

Centra, John A. 1980. Collete Enrollment in the 1980s: Projections and Possibilities. Journal of Higher Education 51:18-39.

Charney, Alberta H., David A. Plane, and Gary C. Woodard. 1988. Uses and Abuses of Population Estimation: The Case of Arizona. Arizona Review 36 (1) 20:34.

Fincher, Cameron. 1986. Budgeting Myths and Fictions: The Implications for Evaluation, in, Larry Leslie and Richard Anderson, Reader in Higher Education (Association for Study of Higher Education), Ginn Press.

Hardy, Cynthia. 1988. Turnaround Strategies in Universities. Planning for Higher Education 16(1):9-23.

Hossler, Don. 1986. Managing College Enrollments. New Directions for Higher Education No. 53. Jossy Bass Publishers, San Francisco.

Hossler, Don and Frank Kemerer. 1986. Managing College Enrollments. New Directions for Higher Education 14(1):5-14.

Keane, John G. 1985. Higher Education: Some Trends Stressing the Need for Strategic Focus. Continuum Spring 1985 88-100.

Kemerer, Frank R., J. Victor Baldridge, and Kenneth C. Green. 1982. Strategies for Effective Enrollment Management. American Association of State Colleges and Universities, Washington D.C. 198 p.

Leslie, Larry, and Garey W. Ramey. 1986. State Appropriations and Enrollments: Does Enrollment Growth Still Pay? Journal of Higher Education 57:1-19.

Olsgaard, John N. 1987. The Impact of a Distance Education Program on Enrollment Patterns. Journal of Education for Library and Information Science 27(4):272-279.

Pailthorp, Keith P. 1987. Population and Enrollment Trends in Arizona and Environs: Past, Present, & Future. Presented to Student Financial Aid Task Force, October 23, 1987.

Plane, David A. 1988. Geographic Dimensions of the Competition for College and University Enrollments: The Repercussions of Changing U.S. Age Composition, 1978 to 2001. In Press (The Social Science Journal).

Rex, Tom. 1988. Population Estimates and Projections. Arizona State University Center for Business Research, February 1988

U.S. Department of Education. 1987. Digest of Education Statistics.

U.S. Department of Education. 1988 1986 Minority Enrollment at 3200 Institutions of Higher Learning (as reported in the Chronicle of Higher Education, July 8, 1988, page A20.

U.S. Department of Commerce. 1987. Statistical Abstract of the United States: 1988.

Valley National Bank. 1987. Arizona Statistical Review.

Western Interstate Commission for Higher Education. 1988. High School Graduates: Projections by State, 1986 to 2004. 46 p.

Wing, Paul and Glenwood L. Rowse. 1986. Coping with Competition for Students in a Period of Decline. Planning for Higher Education 12(1):6-15.

Zammuto, Raymond F. Geographic Proximity and Enrollment Competition. 1985. National Center for Higher Education Management Systems. 98 p. ERIC Document ED 270 028.

APPENDICES

Appendix A. Enrollment Management

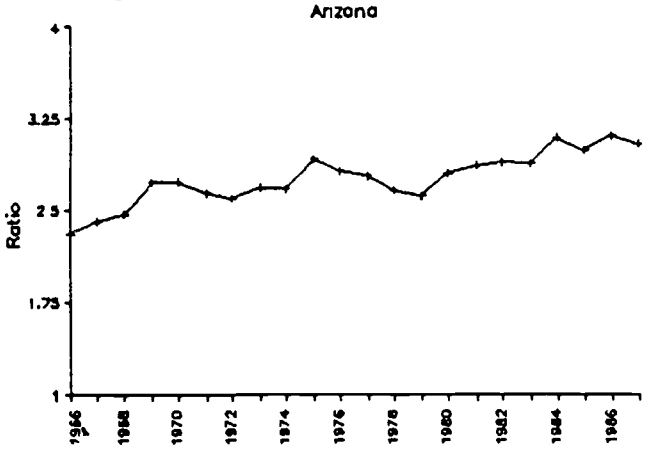
Enrollment management entails more than just recruiting students. Indeed, if properly constituted, enrollment management involves university administrators, faculty, staff, students, and alumni in a carefully coordinated set of interrelated programs culminating in the realization of the university's goals as specified in its mission statement. Programs critical to effective enrollment management are marketing, recruiting, advising, academic assistance, financial assistance, orientation, retention, recreation, and student and alumni research.

In addition to the instructional and recreational aspects of student life on campus, enrollment management also considers the cultural and environmental experiences of students. Thus, enrollment management is concerned with the "total" educational experience of the student and not just the academic side. How universities structure their enrollment management programs over the next decade will largely determine the quality of student life on their campuses and have an impact on the interinstitutional competition for students.

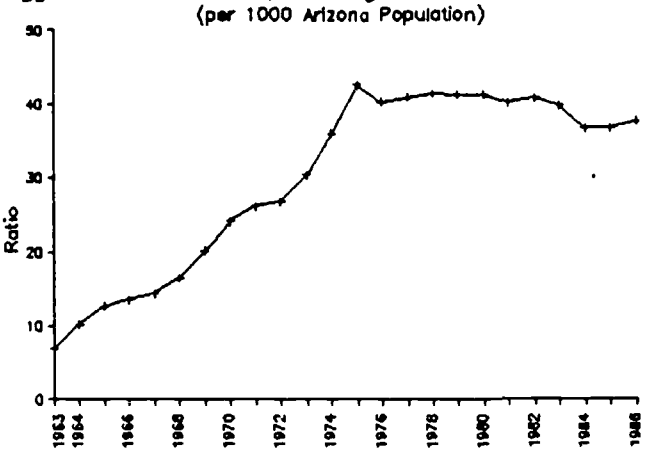
Appendix B. National and State Historical Trend Data

This appendix contains a variety of trends relating to higher education nationally and in Arizona. The results are summarized in the main body of the report and the details are placed here for reference

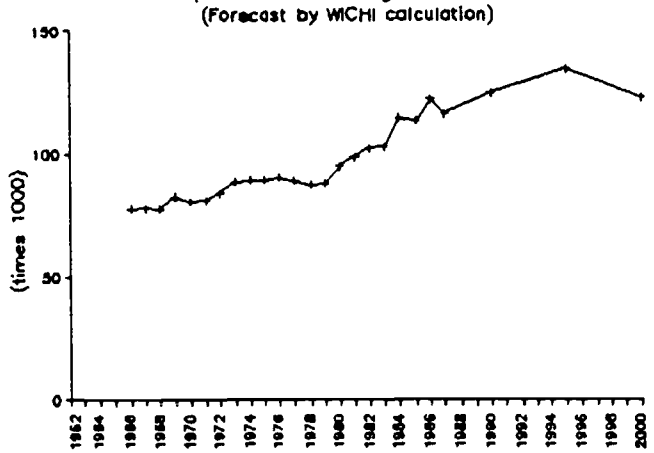
B1 Ratio High School Graduates to University Enroll



B2 Community College Enrollment
(per 1000 Arizona Population)

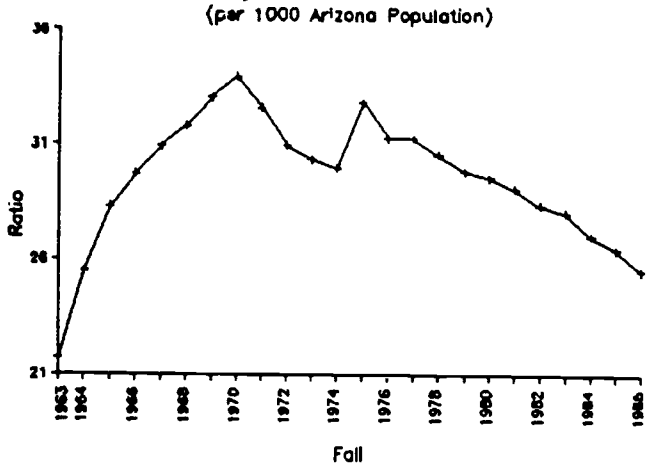


B3 Ratio AZ Population to High School Graduates
(Forecast by WICHI calculation)



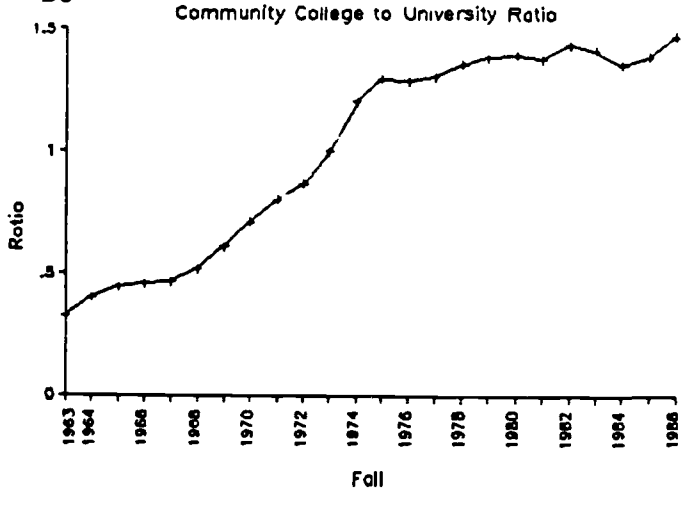
B4 University Headcount Enrollment

(per 1000 Arizona Population)



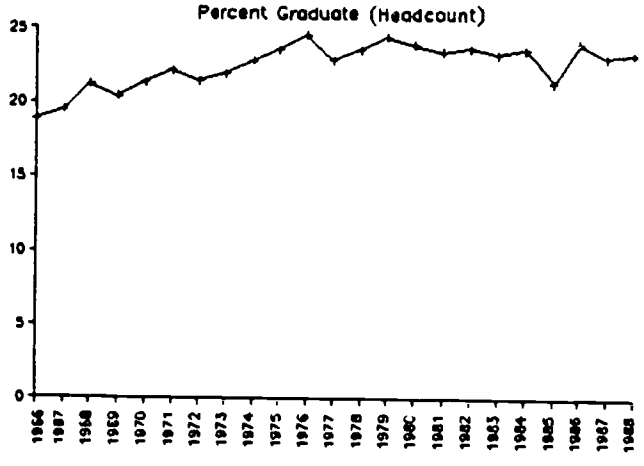
B5 Headcount Enrollment

Community College to University Ratio



B6 Enrollments of Arizona Universities

Percent Graduate (Headcount)



Appendix C. Future Needs of the State Report

The Future Needs of the State Work Group developed a report on enrollment projections through the year 2000 in 1986. Three levels were projected through the year 2000, based on most likely, optimistic, or pessimistic scenarios. The assumptions were different for each campus and the results were reviewed by senior management at each university. Three figures from that report are reproduced here: Figure C1 Higher Education Enrollment in Arizona; Figure C2 Public University Enrollment by type of estimate, and Figure C3 Public University Enrollment by University. Three tables are also reproduced here: Table C1 Projected Public University FTE Enrollments,[14] and Table C2 Projected Enrollments for Most Likely Assumptions. In addition, all assumptions for each university are reproduced.

Figure C1. Public University Enrollment 1985-2000 (FTE)

Figure C2. Public University Enrollment by Type of Estimate

Figure C3. Public University Enrollment by University

Table C1. Projected Higher Education Enrollment in Arizona

Table C2. Projected Enrollments Using Three Assumptions.

Table C3. Listing of Individual University Assumptions.

Table C1. Projected Higher Education Enrollment in Arizona

PROJECTED ARIZONA PUBLIC UNIVERSITY ENROLLMENTS
Full-Time Equivalent Students

1985 Actual, 1990-2000 Projected

	Actual 1985	1990	1995	2000
UNIVERSITY OF ARIZONA				
Optimistic	25,411	27,774	28,344	33,283
Most Likely	25,411	26,633	26,899	31,595
Pessimistic	25,411	25,695	25,834	30,293
ARIZONA STATE UNIVERSITY				
Optimistic	29,646	31,495	36,042	41,774
Most Likely	29,646	30,290	34,194	39,508
Pessimistic	29,646	28,576	31,504	35,743
ASU-WEST				
Optimistic	695	5,007	10,019	10,913
Most Likely	695	3,148	7,827	10,579
Pessimistic	695	2,794	7,191	10,332
NORTHERN ARIZONA UNIVERSITY				
Optimistic	10,319	12,086	12,478	16,371
Most Likely	10,319	11,242	11,600	14,861
Pessimistic	10,319	10,399	10,721	13,736
UNIVERSITY SYSTEM TOTAL				
Optimistic	66,071	76,362	86,883	102,341
Most Likely	66,071	71,313	80,520	96,543
Pessimistic	66,071	67,464	75,250	90,104

TABLE III-A

PROJECTED ARIZONA PUBLIC UNIVERSITY ENROLLMENTS
Using "Most Likely" Assumptions

Headcount and FTE Students by Undergraduate and Graduate Levels
1995 Actual, 1990-2000 Projected

	Actual 1985		1990		1995		2000	
	Headcount	FTE	Headcount	FTE	Headcount	FTE	Headcount	FTE
UNIVERSITY OF ARIZONA								
Undergraduate	23,111	21,232	24,429	22,563	24,717	22,829	29,991	27,525
Graduate	7,263	4,179	7,153	4,070	7,158	4,070	7,158	4,070
TOTAL	30,374	25,411	31,587	26,633	31,875	26,899	36,959	31,595
ARIZONA STATE UNIVERSITY*								
Undergraduate	29,043	25,239	29,514	25,722	33,098	28,911	38,011	33,332
Graduate	8,986	4,407	9,320	4,568	10,740	5,283	12,640	6,176
TOTAL	38,029	29,646	38,834	30,290	43,833	34,194	50,651	39,508
ASU WEST								
Undergraduate	1,305	412	6,806	2,361	12,087	5,870	14,043	7,934
Graduate	1,224	283	1,909	787	3,390	1,957	4,681	2,645
TOTAL	2,529	695	8,715	3,148	15,477	7,827	18,724	10,579
NORTHERN ARIZONA UNIVERSITY								
Undergraduate	9,852	9,089	10,175	9,526	10,499	9,829	13,773	12,894
Graduate	2,763	1,230	3,319	1,716	3,424	1,771	3,804	1,967
TOTAL	12,615	10,319	13,494	11,242	13,923	11,600	17,577	14,861
UNIVERSITY SYSTEM TOTAL								
Undergraduate	63,311	55,972	70,924	60,172	80,401	67,439	95,828	81,685
Graduate	20,236	10,099	21,706	11,141	24,712	13,081	28,283	14,858
TOTAL	83,547	66,071	92,630	71,313	105,113	80,520	123,911	96,543

* Headcount for ASU main campus does not include students concurrently enrolled at main campus and ASU West.

Table C2. Projected enrollments Using Three Assumptions.

1117

Table C3. Listing of Individual University Assumptions.

UNIVERSITY OF ARIZONA

Assumptions for the Most Likely Enrollment Projections

I. New Freshmen

A. Pima County high school graduates will matriculate at the U of A at the same weighted-average rate (24.94%) as they have over the past five years.

B. High school graduates of all other Arizona counties will matriculate at the same weighted-average rate (5.83%) as they have over the past five years.

C. The number of out-of-state freshmen will increase slightly over the weighted-average level of the past five years.

II. Other Undergraduate Students

A. Year-to-year retention rates will increase over those experienced in the past five years.

B. Grade level weighted-average transfer-in rates will remain the same as over the past five years.

III. Graduate Students

A. The number of graduate students will remain at the same weighted-average level as over the past five years.

B. Research funds to support graduate students will decrease from the average level experienced over the past five years.

IV. Demographic and Other

A. Student financial aid funds will decrease moderately over the projection period.

B. Continuing education enrollment will increase as the number of 30 to 54 year-olds increases over the next 15 years.

C. Tuition prices will increase at a rate not greater than that experienced over the past five years.

D. Recruitment efforts will increase, especially those targeted on minority groups.

E. The number of 18 year-olds will increase at the rate predicted by the Arizona Department of Economic Security.

F. Enrollment of students from other states will increase slightly from that experienced, on average, over the past five years.

Higher Education Enrollment

State of Arizona

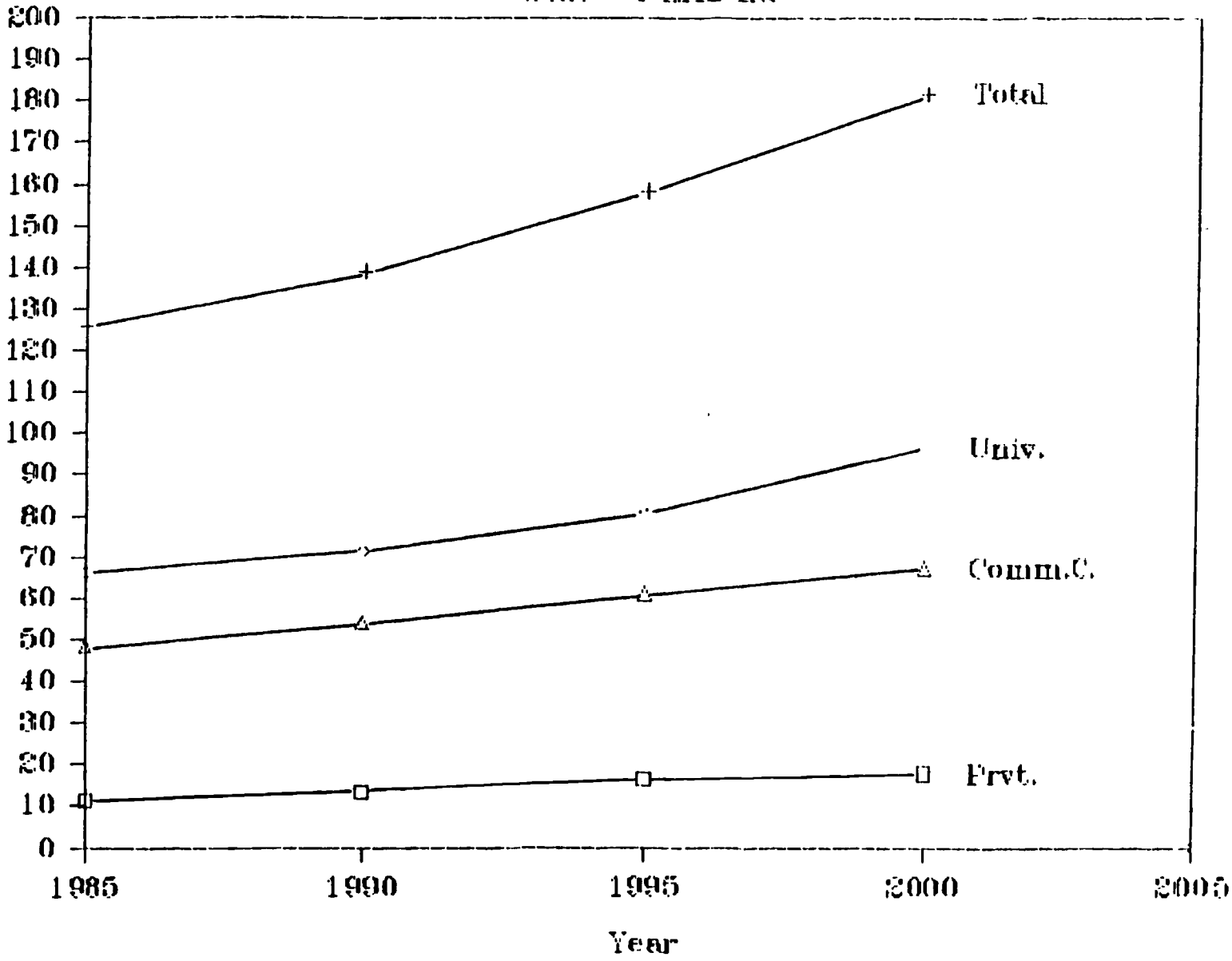


Figure C1. Public University Enrollment 1985-2000 (FTE)

1119

CHART 1

Public University Enrollment

State of Arizona

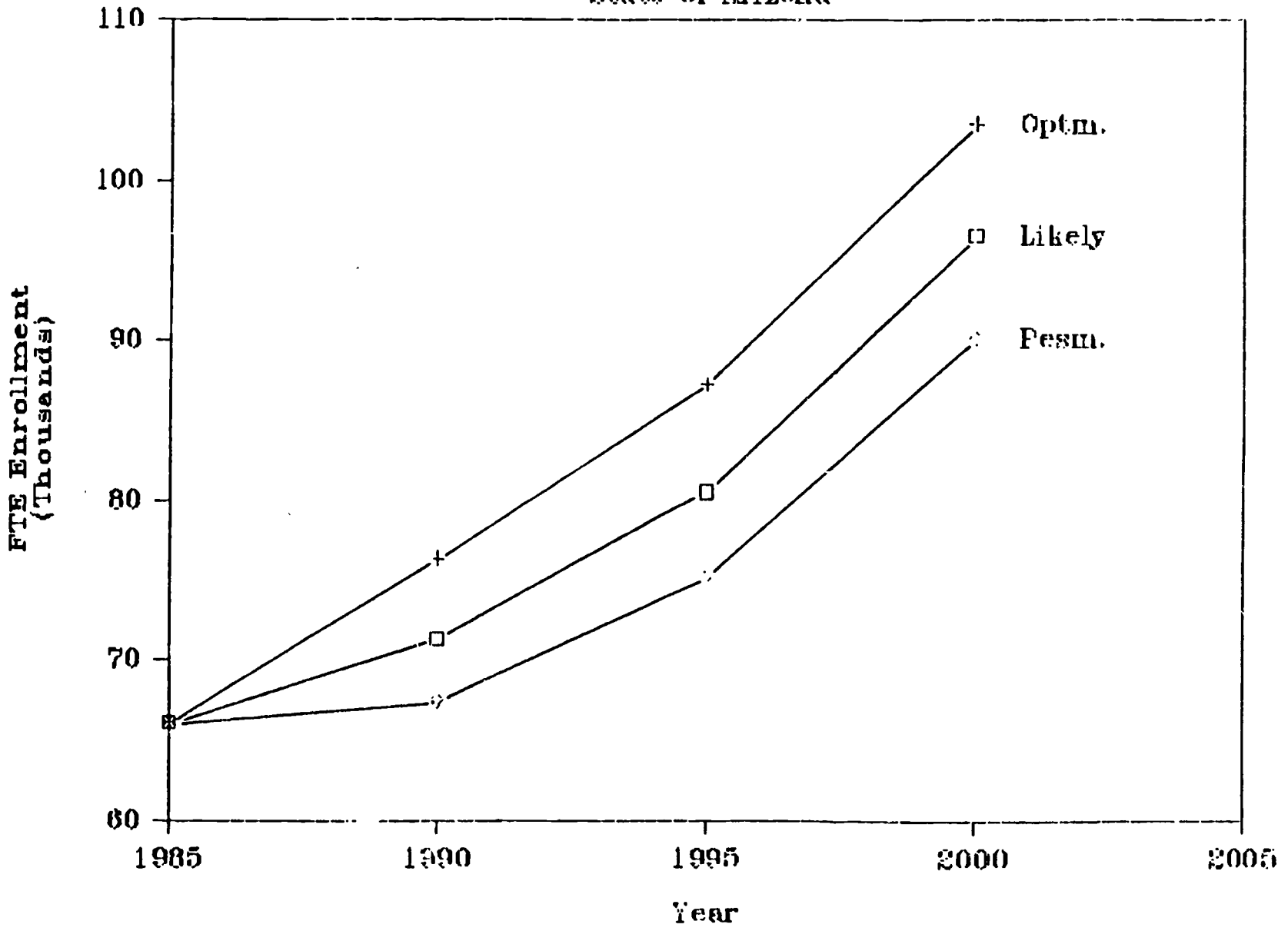


CHART 2

Figure C2. Public University Enrollment by Type of Estimate

1120

Higher Education Enrollment

State of Arizona

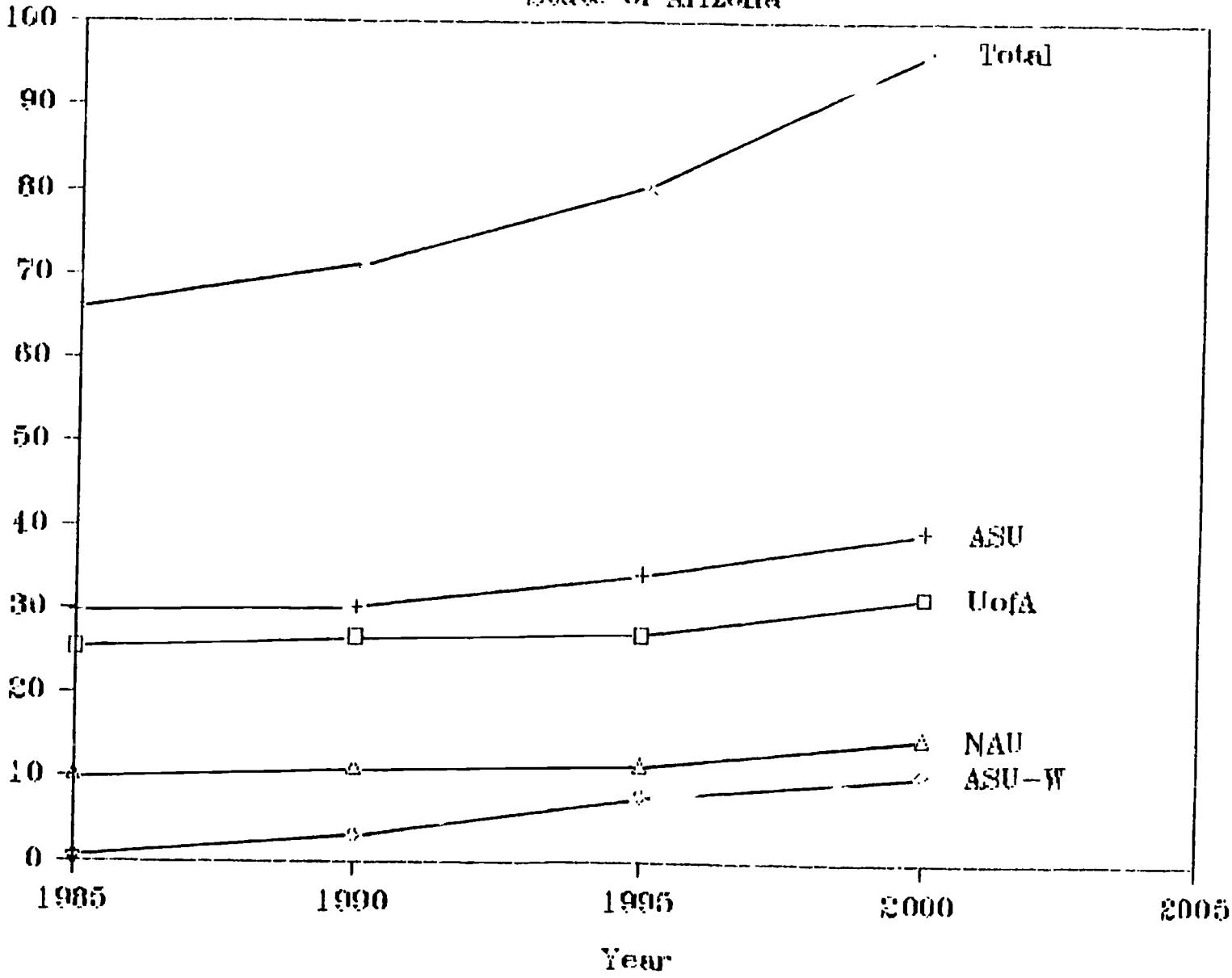


Figure C3. Public University Enrollment by University

Appendix D. Revisited Enrollment Forecasts

The overall enrollment forecasts are shown in Figure D1 (this is an expanded version of Figure 1) and include six sets of assumptions (presented in Table D1). The high school graduation trends in those states where students either leave or come to Arizona for higher education are shown in Table D2 and D3. These states are California, Colorado, New York, Illinois, Texas, Michigan, Kansas, New Mexico, and Utah.

Table D1. Assumptions for WICHE Based Arizona Forecast (1988)

The Base Model. See the model labeled "Market Share Model A." The columns of interest are labeled Total AZ Grades, three university's undergraduate enrollment, High school Grade 5 Year Weighted Average (most recent year weighted 1.5 and most remote year weighted 0.5 all others weighted 1.0), (2)/(3a) which is the ratio of UG enroll to weighted HS grades, 3 Us GR Enroll, (4)/(2) which is the ratio of graduate HC to undergrad HC, and the rightmost column which contains the projected total enrollment. All entries through 1987 are actual numbers. The number used to generate the undergrad projection is in column "(2)/(3a)," this is a 2 year weighted average wit most recent year weighted 2.0; for 1988 the figure is 2.414445. This ratio is multiplied by weighted HS graduates to produce the total undergraduate enrollment (see column "3 Us UG Enroll"). The graduate/undergraduate ratio is produced similarly (see column "(4)/(2)"); this ratio is multiplied by undergraduate enrollment to produce projected graduate HC (see column "(4)" for the 1988 and subsequent years. Total projected enrollments are obviously the sum of the undergraduate and graduate columns.

Market Share Model A -- This model used the WICHE HS graduate projections as a base and the ratios as described in the paragraph above to produce its projections. This is the base model.

Note: only changes from the base model will be noted in the descriptions that follow.

Market Share Model B -- Three changes were made in this model. First, high school graduate projections were based on grade-to-grade promotion percentages from the period 1974 through 1977, a period of recession in Arizona. Second, graduation rates were further adjusted for the promotion rates of Hispanics and Indians to account for

the increases in the number of these racial/ethnic groups in the school populations in the future (see attached sheet for calculations). Third and last, graduate enrollment was capped at 23,000; it was allowed to increase naturally until it reached the cap in 1997.

Market Share Model C -- The only change, from the base model, was to cap graduate enrollment at 23,000; this limit was reached in 1990.

Market Share Model D -- This model incorporated the 1974-1977 percentages and the Hispanics/Indian adjustment. All other parameters were not changed.

Market Share Model E -- The only change in this model was the adjustment for the 10 percent increase in retention.

Market Share Model F -- The change to this model was the adjustment for the 25 percent increase in headcount for off-campus enrollment.

Additional information is given in three figures:

Figure D1. Arizona Universities Total Enrollment

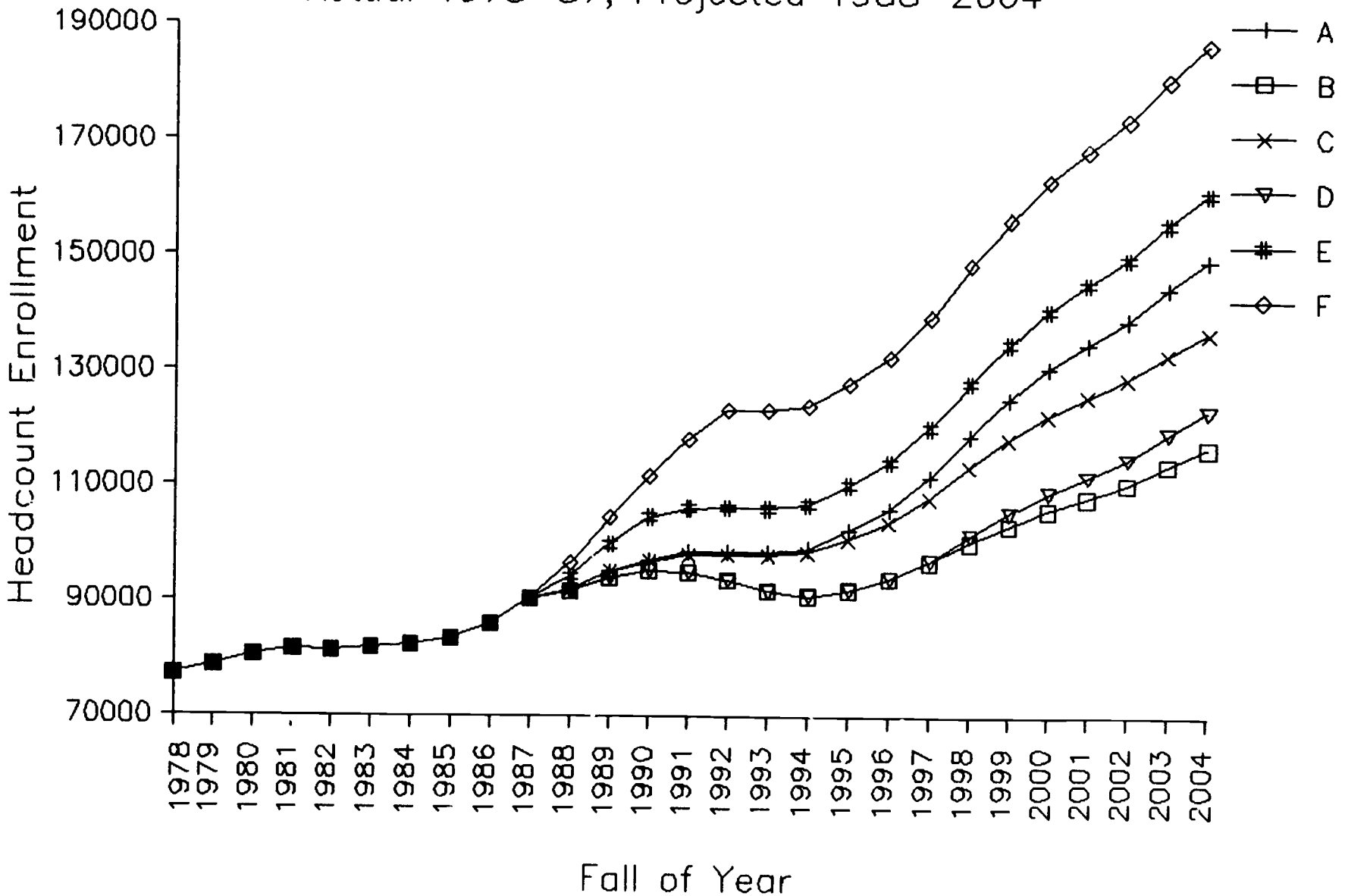
Figure D2. Public High School Grads in Selected States A

Figure D3. Public High School Grads in Selected States B

D1

Arizona Universities Total Enrollment

Actual 1978–87; Projected 1988–2004

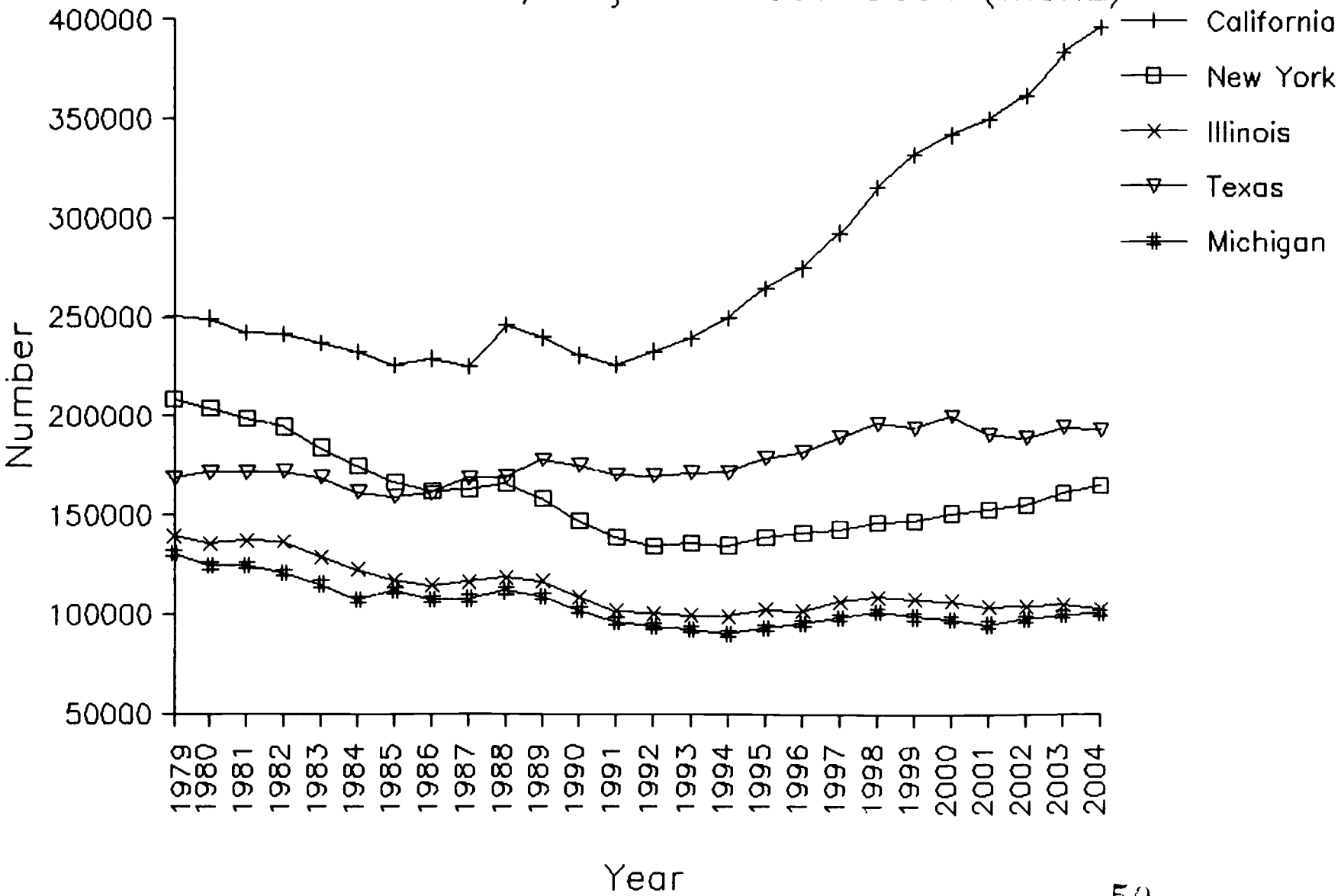


D1

1124

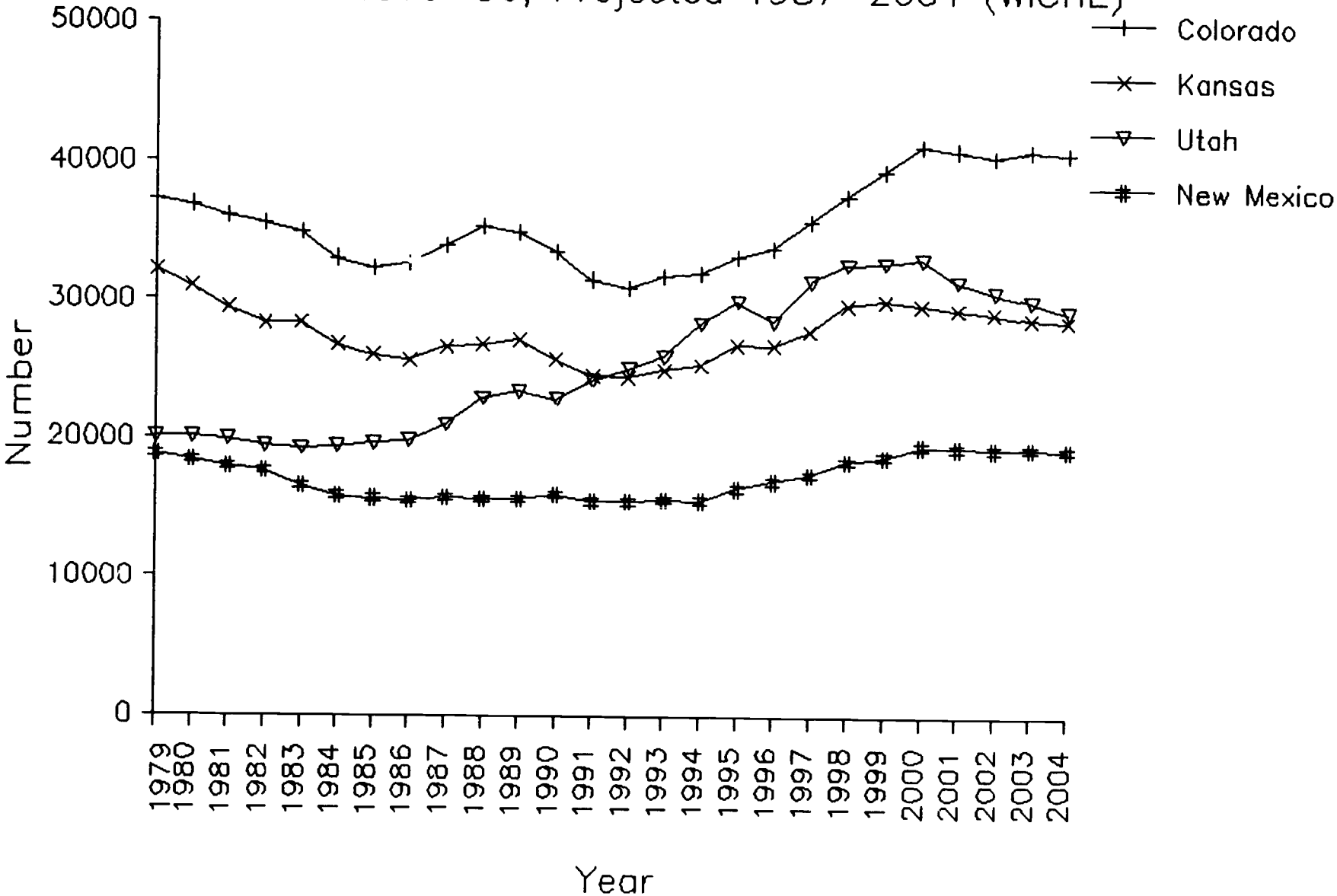
Public HS Grads in Selected States -- A

Actual 1979-86; Projected 1987-2004 (WICHE)



Public HS Grads in Selected States -- B

Actual 1979-86; Projected 1987-2004 (WICHE)



ENDNOTES

1. For a more detailed discussion of enrollment management concepts see Appendix A.

2. For a detailed discussion of possible future changes see the Task Force Working Paper "Future Changes: Implications for Arizona Universities," July 1988.

3. The WICHE data for high school graduates and population estimates for Arizona were obtained from the Arizona Department of Economic Security.

4. The U.S. Bureau of Census estimate includes the changing migration rates and when viewed in the overall history and context of change in Arizona populations appears to be more a more realistic estimate.

5. The ASU West figure is not a projected value but a planning figure; the NAU estimates do not include NAU Yuma.

6. The model used by Plane incorporates interstate migration data for academic year 1978-79 and assumes the historic pattern of college-going remains constant. These models do not account for variables other than the stated interstate migration shifts and the WICHE determined high school graduates.

7. It is very important to recognize these assumptions were selected to provide a range of possible actions to develop several realistic forecasts for the year 2000 enrollment of the combined universities. Actual assumptions will vary by university and may be quite different than those listed here for purposes of discussion.

8. Source is NCHEMS fall 86 data of 3,500 institutions in the United States, public and private, 2-year and 4-year.

9. This is a very difficult concept to substantiate empirically. There is a general feeling among those contacted that you loose educational value when sizes get large, but it depends on the institutional location and purpose. There are also views to the contrary.

10. It is not clear how the recent increases in out-of-state admission standards will affect enrollment growth at Arizona's universities. Such increases are planned for two institutions for in-state students and provide "windows" for provisional admission for those not meeting the formal standards.

11. A recent controversy in California on the need and location of a new campus (for reasons similar to the Arizona case) has prompted the University of California Vice President William B. Baker to state "it's just not academically sound to have campuses of 40,000 to 50,000 students." Chronicle of Higher Education July 13, 1988, page A17.

12. The issue of "maximum enrollments" was raised in the 1974 ABOR document "University Development in the Mid-Seventies: A Long Range Plan," but concludes that

the decision will be deferred until 1979. There has not been any formal discussion since the 1974 document was released.

13. The availability of ASU West as a receiver for many of these students is not clear given the current curriculum and the geographical location.

14. All FTE calculations in this section are stated under the old definition (lower and upper division treated equally). The current method treats upper division differently.