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ABSTRACT
        In order to project public postsecondary enrollments,
the total enrollments for all the institutions in the state, both
public and private and independent, needed to be considered. Data for
all Indiana institutions were collected for freshmen, sophomore,
junior, senior, other, professional and graduate levels. Individual
institutions and individual campus projections were made for the
public institutions. Independent school data were used to project
enrollment by level in aggregate. Emphasis is placed on demographic
and economic background data, postsecondary education in Indiana,
projections of enrollment in Indiana, and recommendations for
developing future projections of enrollment. Statistical data and
abstracts of various enrollment studies by state are included.
(MJM)

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Enrollment Projections for Indiana Postsecondary Education 1974-1990

Prepared for
COMMISSION FOR HIGHER EDUCATION
STATE OF INDIANA

MD

MANAGEMENT DIVISION
ACADEMY FOR EDUCATIONAL DEVELOPMENT, INC.
1974

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MD

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Preface

One of the essential elements in a state government plan and budget for postsecondary education is an enrollment forecast. In many states the projections of enrollment made recently by individual institutions and campuses have tended to be unduly optimistic. After twenty years of growth, it has been difficult to begin to plan for either stable enrollments or even decreases in enrollment.

In October 1973, under contract with the Commission for Higher Education, State of Indiana, the Academy for Educational Development began a study of the financial planning for state government support of higher education in Indiana. Mr. Andrew H. Lupton has directed this study. As an essential part of this investigation, the Academy entered into a subcontract with Purdue University in May 1974, to prepare an analysis of enrollment projection techniques.

Purdue University selected from its staff Betty M. Suddarth, Research Coordinator for Student Services, and Thomas N. Gunderson, Associate Registrar, to direct this analysis. Kenneth M. Kalamuck and Franklin E. Woeste became research associates. In addition N.M. Parkhurst, Registrar, Purdue University, and his entire staff, along with representatives from the other five state-supported institutions of higher education in Indiana cooperated. In every sense this was *a study team.*

Because the enrollment analysis prepared by the Purdue University team is of general interest and potential usefulness to other states, the Academy for Educational Development is making this report generally available.

It should be added that this project for the Indiana Commission was made possible by a grant from the Lilly Endowment of Indianapolis.

The methodology of this study employs models not used in other studies and so contributes to the technique of enrollment projections. At the same time other factors not included in this study may very well influence the future course of enrollments in public institutions of higher education: the enrollment of "non-traditional" students, the future enrollment experience of private colleges and universities resulting from public policy developments, and other factors.

Enrollment projections are not yet based upon an exact science. Public policy decisions, economic circumstances, social objectives, and individual decisions will continue to influence, and complicate, the enrollment experience of American higher education. The Academy for Educational Development believes that this report will assist the Indiana Commission for Higher Education in its own planning and budgeting activities of the future and is hopeful that it will be helpful to other states.

Alvin C. Eurich
President

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1 Introduction

Information concerning potential postsecondary enrollments is essential to conduct financial, facility and program planning for postsecondary institutions. Therefore, the Indiana Commission for Higher Education through the Academy for Educational Development, Inc. initiated a study at Purdue University to develop enrollment projection models for the public postsecondary institutions in the State of Indiana.

In order to project public postsecondary enrollments, the total enrollments for all the institutions in the state, both public and independent, needed to be considered. Data for all Indiana institutions were collected for freshman, sophomore, junior, senior, other, professional and graduate levels. Individual institution and individual campus projections were made for the public institutions. Independent school data were used to project enrollment by level in the aggregate.

Of paramount importance was a predictive system which would be appropriate for the 1975-77 biennium as well as through the period ending in 1990. At the same time suggestions for future design or refinements of the predictive system, as well as recommendations for additional data acquisitions, were objectives of the study.

Various state and institutional studies in Indiana and elsewhere have been conducted over the years. Up until 1971, linear models have been successful, at least on a state level. However, the historical trend of the data is changing and linear models are no longer adequate for most institutions.

Any mathematical model used, however, is merely a representation or abstraction to describe the actual situation in a useful analytical language. Even though the model is constructed using scientific procedures, its value in answering any given need is governed by the fundamental assumptions on which it is based. For example, the historical period of time used influences the result. The base period selection is a matter of judgment. The main assumptions must be that some historical pattern exists, that it can be identified, that data can be collected to measure it, and that this pattern reflects what is to occur in the future.

It is important to recognize the difference between projection or forecasting and future planning. Planning, if properly implemented and scheduled, utilizes the projection to generate activity that can cause events to occur that are contrary to the projection. For instance, given a projected downward trend in some enrollment characteristic, an administration might create and execute plans that would successfully halt the decline or create an upward change. Thus, the projection would ultimately appear to be erroneous, but, in reality, would be the instrument causing the action leading to the discrepancy. Consequently, projections can be valuable tools for shaping the future. The projection must be appraised later, when the future arrives, to reveal the role played by the projection itself.

2 Review of Other Studies and Methods

Enrollment projections for postsecondary institutions have been made for nearly every state. In addition, several national projections have been undertaken. Abstracts of individual studies reviewed are given in the Appendix. A general discussion of these studies is presented here.

Various methods have been used to project enrollments. It is mathematically possible to present enrollments as a function of time alone, but this method does not take into account any other effects on enrollment. While variables such as per capita income, tuition rates, and other socio-economic factors have been investigated, they have not been successfully related to enrollment factors. In addition, predictions of these variables are themselves difficult. The most frequently used and historically satisfactory variable, along with time. has been the relationship of the college-age population to enrollment. The college-age population can be determined from either birth data for the appropriate time period, high school graduates, or population data. Estimates of future high school graduates and future population age groups are, in reality, dependent upon the extensions of the birth data from earlier years. Most states, including Indiana, have difficulty in obtaining accurate historical high school information, especially for private high schools. Population data developed for other purposes frequently do not consist of the appropriate ages for the college-age group, and except for census years, they are estimates. Births, however, are recorded with a high degree of accuracy in most states and are available for projecting at least eighteen years of college enrollments. Consequently, the use of birth data as an input variable in the model is the most reliable method of determining the college-age population.

Most enrollment projections consider changes in the college-age population and changes in the percentage of that population enrolled in postsecondary institutions. This percentage is called the enrollment rate. Cohort survival has been defined as the technique used to track individuals through the various primary and secondary school grades, through high school graduation. and then to college. The ratio method has been defined as expressing freshmen or a given college group (e.g. total undergraduates) as a ratio of the appropriate age group. A few studies used county or regional population data, but most used state population data. Several studies predicted individual institutional enrollments and then summed these to determine the total for the state. Other studies obtained total state enrollments and allocated these back to the institutions to determine their individual enrollments. Most prediction studies undertaken before 1970 used linear regression techniques to project the percentage of the college-age population attending college. These techniques fit the statistically "best" straight line to the past data. By means of extending this line, the projected enrollments are obtained. In some cases, the freshmen were predicted and then advanced, using advancement ratios to project successive classifications of undergraduate students. A procedure employed more frequently used the linear regression technique to predict total undergraduate students and

then allocated these students into the four undergraduate classes. Both of these techniques were used in 1955 and 1968 for the State of Indiana. In a 1969 Indiana study only the freshmen were predicted and advanced for the appropriate upper classes. Figures 1. 2. and 3 demonstrate the degree of accuracy of these projections. Details concerning these studies are reported in the Appendix. Prior to 1972 the projections are acceptably accurate when compared to the actual enrollments. A linear trend, however, with a positive slope predicts a constantly increasing enrollment rate. Thus, these earlier studies have been overprojecting the enrollment rates and, consequently, total enrollments since 1972. Overestimation was also the result in national, as well as other state studies, which utilized linear regression techniques. Even so, linear projections were still used in several recent studies.

To counteract overestimation. many of the more recent studies used a constant percentage of the appropriate population. This percentage was often based on an average of the more recent years, and in some instances was based on the most recent year only. Still other authors of reports relied primarily on subjective judgment and increased the enrollment rate for a selected period and then used a constant rate. In these cases, no historical trends were considered in the projected enrollments.

Autoregression, a technique used by economists when dealing with time series data. was used in at least one study. This technique is appropriate when successive values of the variable are correlated. Forecasted data are then obtained by weighting previous values of the variable to be forecast. Since this study was only recently completed, the success of this technique cannot be measured at the present time.

For recent national projections, the U.S. Office of Education has used linear regression. constant percentages and logistic growth curves. depending on the historical data.

Computer software packages have been developed in some states to produce student flow models based on probabilities of the transition of a student from one category to another. The technique. sometimes referred to as a type of Markov Process. is similar to advancement ratios but is more complex. For example, instead of expressing sophomores as a percentage of the freshmen for the preceding year, sophomores are categorized on the basis of various inputs such as transfers. freshmen advanced to sophomores. retained sophomores, etc. Thus, the student body is divided by level and source category. New entrants from high school, transfers. continuers, graduates and withdrawers are usually identified. While these models are fairly complicated, they are, of course, dependent upon the amount and the quality of the input data. Most of the studies used data from the most recent year only. Frequently subjective estimates for certain enrollment categories were necessary because of limited input data.

Problems encountered in many states revolved around incompatible or incomplete data. Few technical institutions were projected due to the lack of historical data and the categorization of enrollments. Adult education projections were avoided for the same reasons. Graduates from private high schools frequently had to be estimated. Migration factors. for both the general population and college students, were difficult to assess and were. therefore. usually ignored.

Special mention should be made concerning a report by Lins' and a preliminary document by Wing and Tsai² which both focus on methods of enrollment projection. Lins presents four methods: curve fitting. ratio, cohort survival and correlational analysis. In reality, there is little difference in technique between ratio and cohort survival. Ad-

COMPARISON OF ACTUAL AND PROJECTED FRESHMAN ENROLLMENT IN INDIANA 1950 - 1985

LEGEND

o——o ACTUAL
•----• 1955 - C-1 } (PARKHURST, SUDDARTH)
□——□ 1955 - C-3 }
•——• 1968 - UPM-I } (PARKHURST, SUDDARTH)
x----x 1968 - UPM-2 }
x——— 1969 - (ELLIOTT)

FIGURE I

FRESHMAN ENROLLMENT (THOUSANDS)
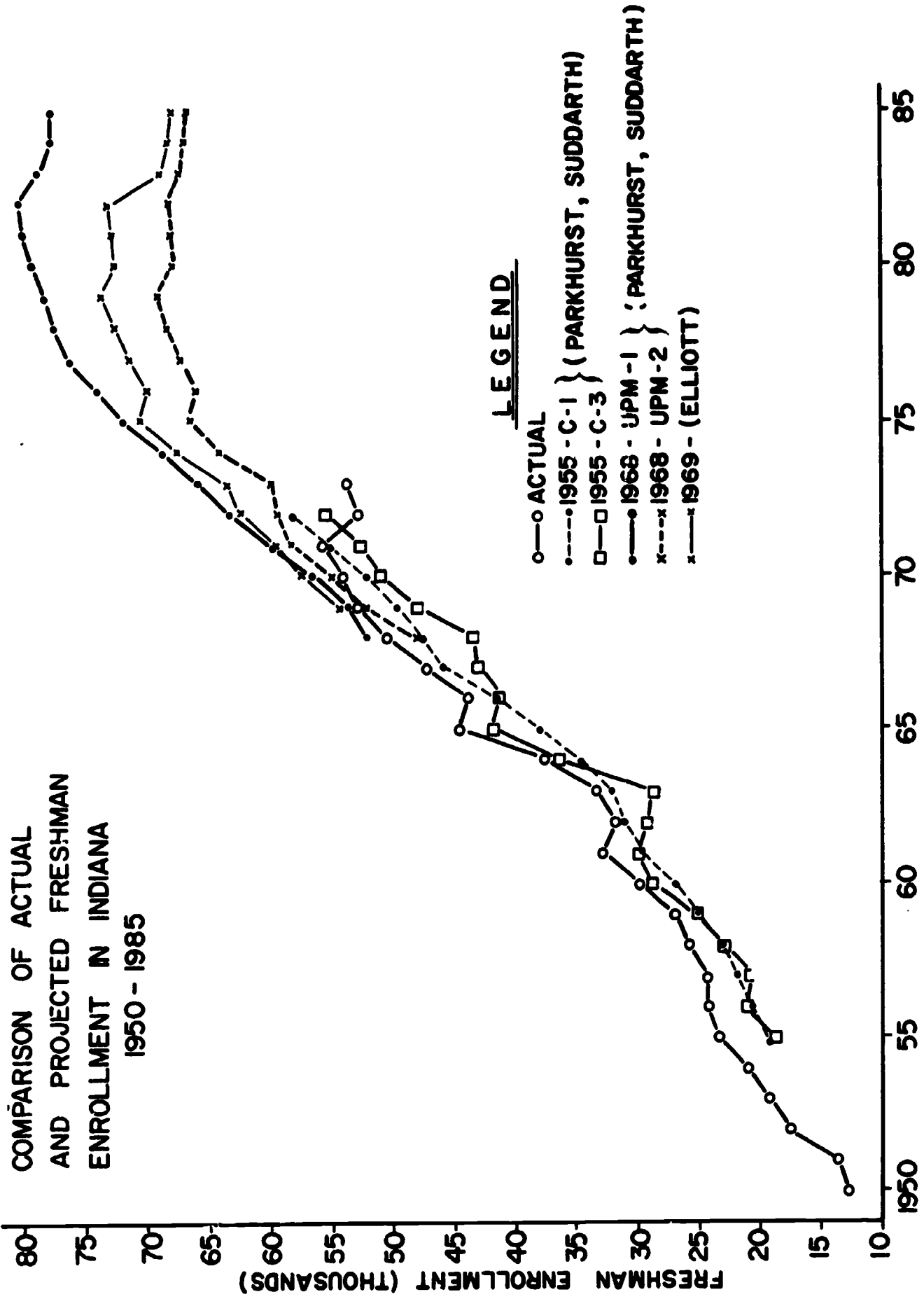
COMPARISON OF ACTUAL
AND PROJECTED TOTAL
UNDERGRADUATE ENROLLMENT
IN INDIANA
1950 - 1985

UNDERGRADUATE ENROLLMENT (THOUSANDS)

210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40

1950 55 60 65 70 75 80 85

FIGURE 2

LEGEND

ACTUAL
1955 –C-I } (PARKHURST, SUDDARTH)
1955 –C-3 }
1968 – UPM-I } (PARKHURST, SUDDARTH)
1968 – UPM-2 }
1969 –(ELLIOTT)

6
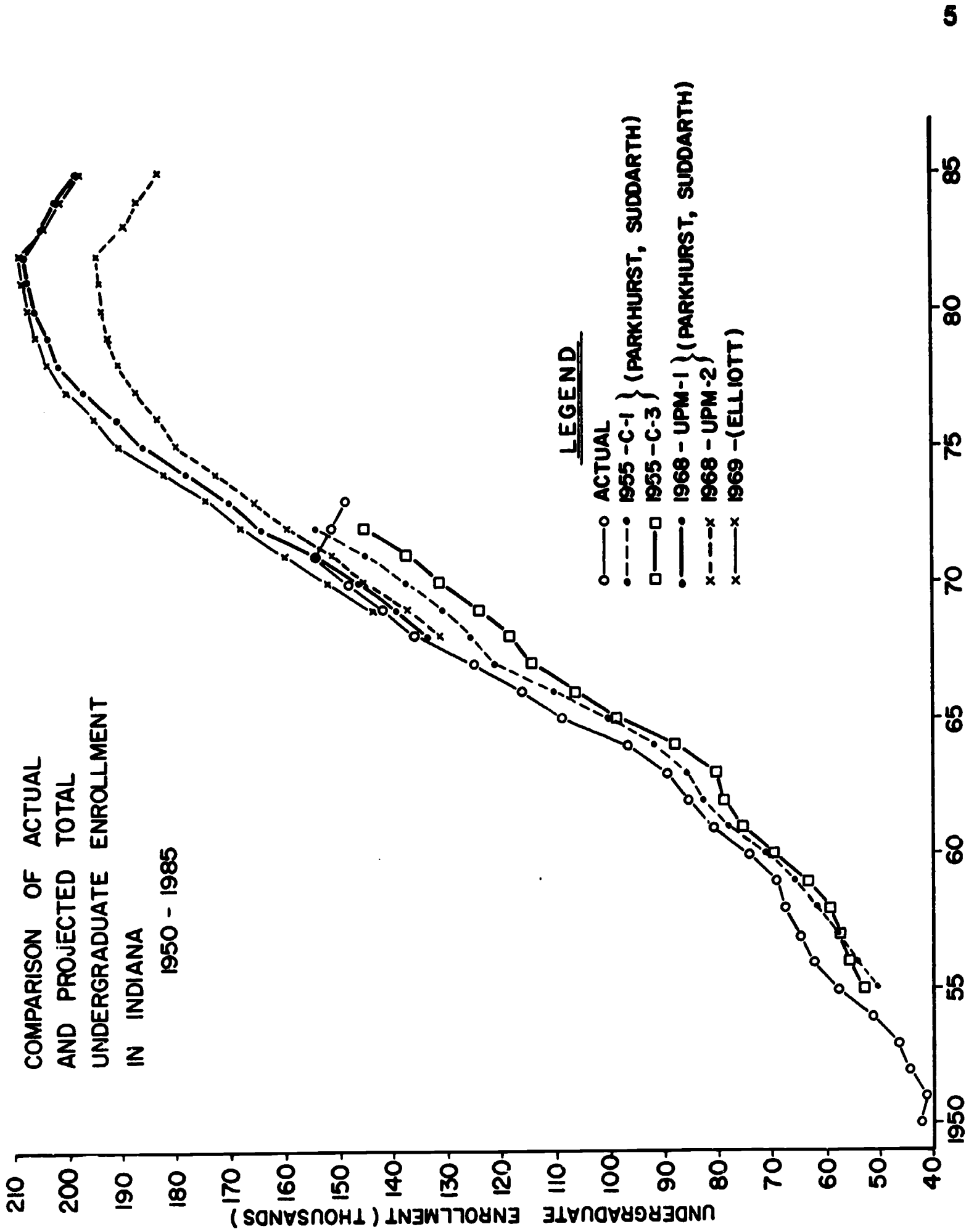
COMPARISON OF ACTUAL AND
PROJECTED GRADUATE + FIRST
PROFESSIONAL ENROLLMENT IN
INDIANA

1950 - 1985

LEGEND

o——o	ACTUAL
x——x	1955 - Y-I
•——•	1955 - X (C-I) } (PARKHURST, SUDDARTH)
□——□	1955 - X (C-3)
•——•	1968 - UPM-I } (PARKHURST, SUDDARTH)
x——x	1968 - UPM-2
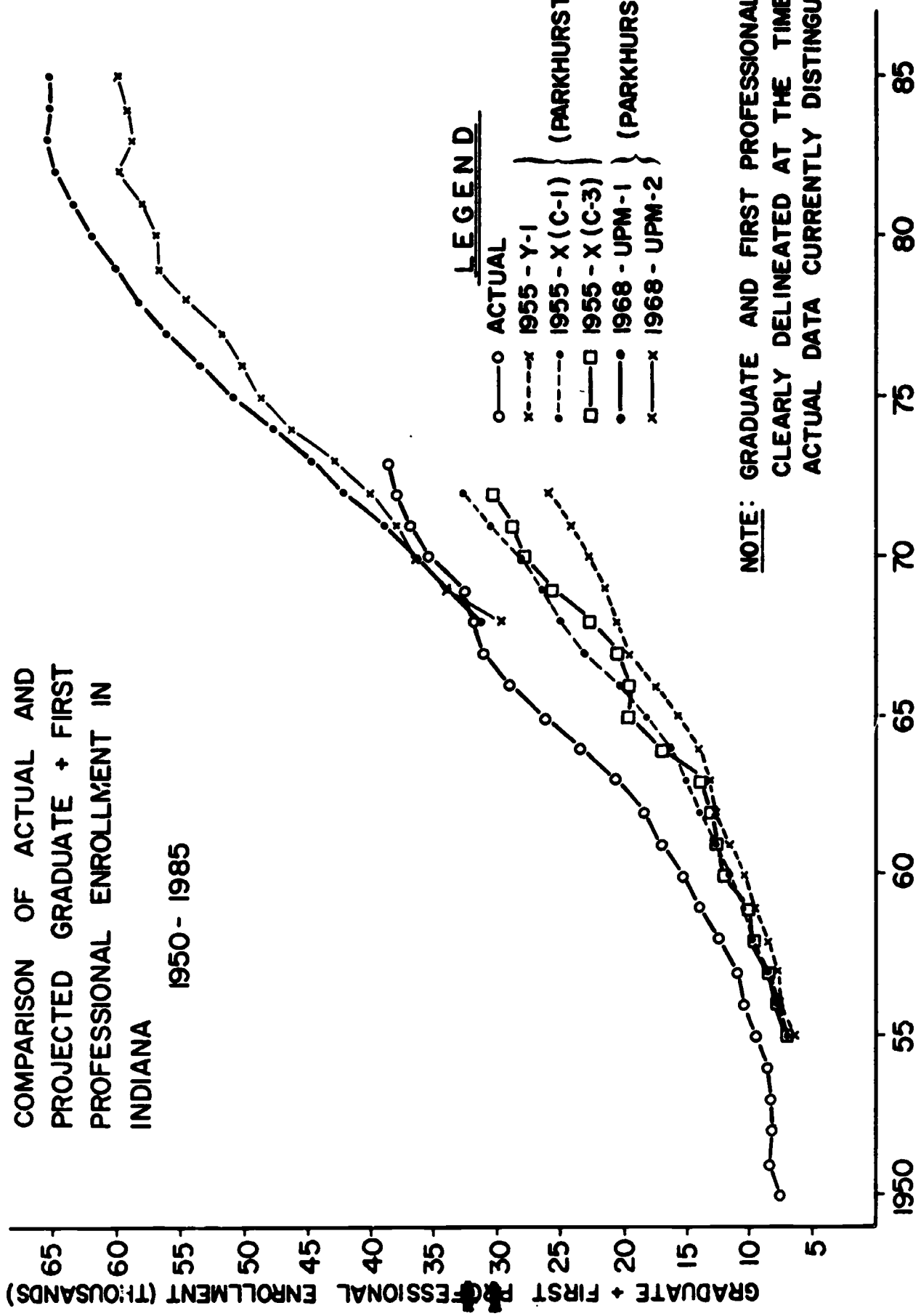
NOTE: GRADUATE AND FIRST PROFESSIONAL WERE NOT
CLEARLY DELINEATED AT THE TIME OF PROJECTIONS.
ACTUAL DATA CURRENTLY DISTINGUISH BOTH.

GRADUATE + FIRST PROFESSIONAL ENROLLMENT (THOUSANDS)

65 60 55 50 45 40 35 30 25 20 15 10 5

1950   55   60   65   70   75   80   85

FIGURE   3

ditionally, correlational analysis and curve fitting can be similar. Wing and Tsai covered these methods and techniques such as moving averages and exponential smoothing. The latter techniques are only appropriate for short range forecasting to "smooth" out cyclical trends in basically horizontal data.

Wheelwright and Makridakis' in an economic text describe forecasting methods in detail and point out: "In any modeling effort there is a choice. We can either construct a simple model which may not completely duplicate reality or we can build a highly sophisticated and complex model which can be accurate but which also requires a large amount of effort and resources to be developed and manipulated. Even if the most sophisticated model could be developed. there would still be some part of reality that could not be explained by the model. The number of factors in real life phenomena is infinite." (pp. 80-81)

In conclusion, as the model becomes more sophisticated. the historical data requirements become both more exacting and extensive. The accuracy of any projection is dependent upon the completeness and accuracy of the historical data. the theoretical model used including the assumptions required, and the continuation of a relationship from the past to the future. Sophistication of technique must be balanced against the practical realities of modeling costs and future uncertainties.

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1 Lins. L J Methodology of Enrollment Projections for Colleges and Universities. The American Association of Collegiate Registrars and Admissions Officers. 1960

2 Wing. Paul and Tsai. Yung-mei Higher Education Enrollment Forecasting. (Preliminary Draft) National Center for Higher Education Management Systems at Western Interstate Commission for Higher Education, Boulder. Colorado. 1974

3 Wheelwright. Steven C and Makridakis. Spyros. Forecasting Methods for Management. New York. 1973

3 Demographic and Economic Background Data

The potential age group available to attend postsecondary institutions is an important variable in determining future enrollments. In order to reflect accurately the potential age group for Indiana, population, migration and birth data were collected and analyzed.

The State of Indiana and the United States have followed similar population and birth trends. Indiana's births have accounted for approximately 2.6 percent of the United States births (Table 1, Figure 4). Further, Indiana's population has represented between 2.5 and 2.6 percent of the United States population for many years (Table 2, Figure 5).

Because of these similar population and birth trends, it is possible to use Indiana birth and population data to predict postsecondary enrollments in Indiana even though many of the students are not from Indiana. The results of using national data, which would be required to compensate for out-of-state enrollments, would simply be the same as applying a constant multiplier to the state data.

These similar state and national trends also indicate that migration is not an important factor in population data for the state. Estimates of migration for the state for the last six years, using population changes, births and deaths, resulted in an average net in-migration of less than one tenth of one percent. Consequently, births eighteen years earlier can be used to predict college freshmen, as migration should not create any significant difference between the number of eighteen year olds and the number of births eighteen years earlier. Corrections for mortality are not necessary, if the age group used in the projection consists of only one age, since only a constant multiplier would be applied to correct for mortality. However, if a composite age group is used, mortality must be considered, as the mortality factor is different for each age of the composite.

The most accurate birth figures available were obtained from the Indiana State Board of Health. Completeness tests on birth registrations were made in 1940 and 1950 by the United States Public Health Service. These tests indicated a 96.5 percent completeness of registration in 1940 and a 99 percent completeness in 1950. The United States Census Bureau determined it was unnecessary to compensate for underregistration after 1959. Therefore, the completeness of registration was assumed to be 100 percent from 1960 to the present. Linear interpolation was used to obtain the percentages of completeness between those known for 1940, 1950, and 1960. Table 3 gives the registered births, percent completeness, and corrected births for the years 1941 to 1973. Figure 6 shows that the peak birth year was 1957. It follows that the eighteen year olds in 1975 should be the largest group for the projection period. In 1975, the number of eighteen year olds will be 106 percent of the 1973 group. By 1990, however, the number of eighteen year olds will be only 80 percent of the 1973 group.

Many Indiana campuses obtain a large proportion of their enrollments from contiguous regional or county areas. For this reason each public institution was requested to supply reports depicting the geographic distribution of the students enrolled for the most recent year. These reports demonstrated that ten campuses drew over 70 percent of their

Table 1

BIRTHS IN INDIANA COMPARED WITH
BIRTHS IN THE UNITED STATES (1935-72)

Year	Registered Births in the United States (thousands)	Registered Births in Indiana (thousands)	Births in Indiana as a Percent of Total in United States
1935	2155	52.9	2.46%
36	2145	54.0	2.52
37	2203	56.1	2.55
38	2287	60.2	2.63
39	2266	58.3	2.58
1940	2360	61.7	2.61
41	2513	65.6	2.61
42	2809	73.7	2.62
43	2935	74.7	2.54
44	2795	71.4	2.55
1945	2735	68.4	2.50
46	3289	85.5	2.60
47	3700	96.4	2.60
48	3535	92.5	2.62
49	3560	94.2	2.65
1950	3554	93.3	2.62
51	3751	101.1	2.70
52	3847	104.4	2.71
53	3965	105.4	2.66
54	4078	109.0	2.67
1955	4104	108.4	2.64
56	4218	113.4	2.69
57	4307	115.7	2.69
58	4250	112.5	2.65
59	4298	112.7	2.62
1960	4258	112.7	2.65
61	4268	112.2	2.63
62	4167	108.7	2.61
63	4098	107.0	2.61
64	4027	106.0	2.63
1965	3760	98.1	2.61
66	3606	95.7	2.65
67	3521	93.6	2.66
68	3502	91.5	2.61
69	3571	93.8	2.63
1970	3718	99.4	2.67
71	3559	95.5	2.68
72	3256	87.1	2.66

Births in the United States from U. S. Bureau of the Census, Statistical Abstract of the United States, Washington, D.C. Births in Indiana from the Indiana State Board of Health.

Table 2

POPULATION IN INDIANA COMPARED WITH
POPULATION IN THE UNITED STATES (1935-72)

Year	Population in Indiana (millions)	Population in United States (millions)	Population in Indiana as Percentage of U.S. Population
1935	3.352	127.2	2.63%
36	3.367	128.0	2.63
37	3.391	128.8	2.63
38	3.399	129.8	2.62
39	3.410	130.9	2.61
1940	3.428	132.5	2.59
41	3.455	133.7	2.58
42	3.481	134.6	2.59
43	3.477	135.1	2.57
44	3.440	133.9	2.57
1945	3.427	133.4	2.56
46	3.702	140.7	2.63
47	3.779	144.1	2.62
48	3.877	146.7	2.64
49	3.958	149.3	2.65
1950	3.964	151.9	2.61
51	4.069	154.0	2.64
52	4.148	156.4	2.65
53	4.186	159.0	2.63
54	4.245	161.9	2.62
1955	4.337	165.1	2.63
56	4.433	168.1	2.64
57	4.508	171.2	2.63
58	4.565	174.1	2.62
59	4.638	177.1	2.62
1960	4.673	180.0	2.60
61	4.724	183.0	2.58
62	4.725	185.8	2.54
63	4.780	188.5	2.54
64	4.856	191.1	2.54
1965	4.922	193.5	2.54
66	4.999	195.6	2.56
67	5.053	197.5	2.56
68	5.093	199.4	2.55
69	5.143	201.4	2.55
1970	5.203	203.8	2.55
71	5.244	206.2	2.54
72	5.291	208.2	2.54

Population figures obtained from U.S. Bureau of the Census, Statistical Abstract of the United States, Washington, D. C.
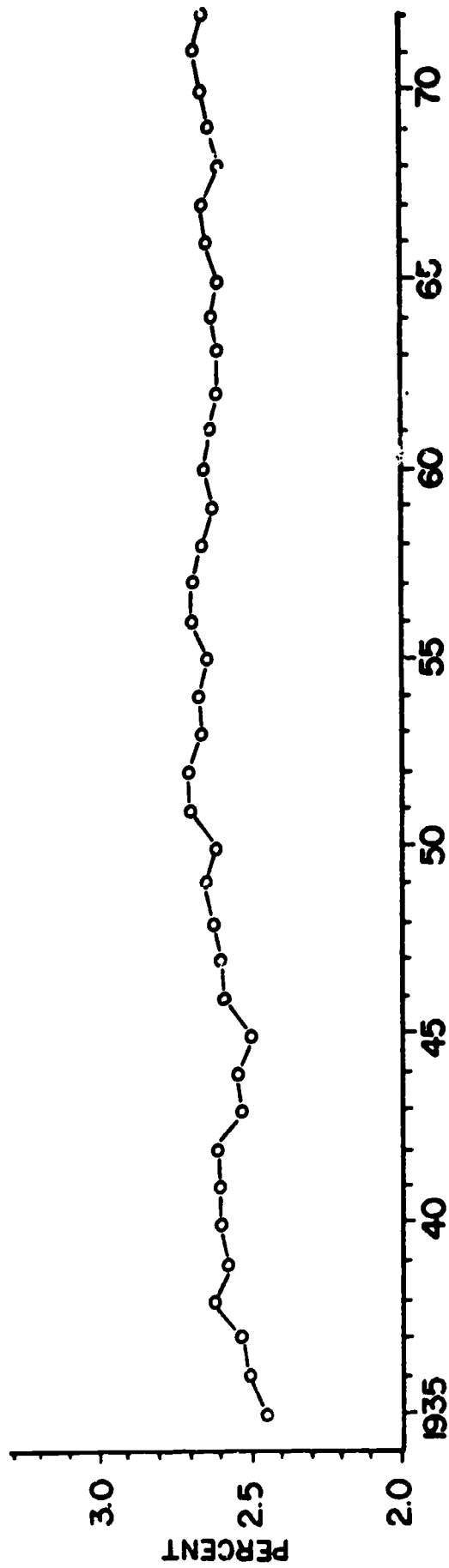
FIGURE 4

INDIANA BIRTHS AS A PERCENT OF U.S. BIRTHS, 1935-1972
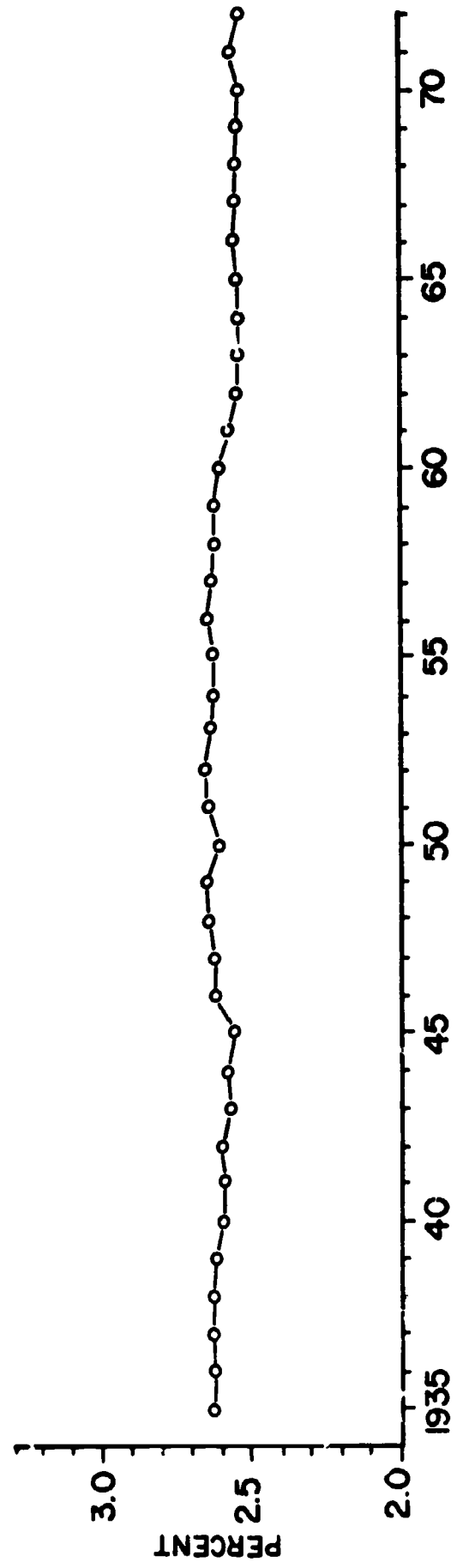
FIGURE 5

INDIANA POPULATION AS A PERCENT OF U.S. POPULATION, 1935-1972

Table 3

LIVE BIRTHS IN INDIANA (1935-72)

Year	Number of Births Registered	Percent Completeness of Registration	Number of Births Corrected for Under-registration
1935	52,909	95.3%	55,518
36	54,034	95.5	56,580
37	55,825	95.8	58,272
38	59,908	96.0	62,404
39	58,183	96.3	60,418
1940 +	61,660	96.5	63,896
41	65,594	96.8	67,762
42	73,706	97.0	75,986
43	74,672	97.3	76,744
44	71,354	97.5	73,184
1945	68,444	97.8	69,984
46	85,515	98.0	87,260
47	95,758	98.3	97,414
48	92,131	98.5	93,534
49	93,949	98.9	95,090
1950 +	93,256	99.0	94,198
51	101,099	99.1	102,017
52	104,469	99.2	105,311
53	105,723	99.3	106,468
54	109,008	99.4	109,666
1955	108,430	99.5	108,975
56	113,450	99.6	113,906
57	115,727	99.7	116,075
58	112,486	99.8	112,711
59	112,670	99.9	112,783
1960	112,711	100.0	112,711
61	112,208	100.0	112,208
62	108,700	100.0	108,700
63	106,956	100.0	106,956
64	105,962	100.0	105,962
1965	98,075	100.0	98,075
66	95,658	100.0	95,658
67	93,619	100.0	93,619
68	91,511	100.0	91,511
69	93,795	100.0	93,795
1970	99,379	100.0	99,379
71	95,499	100.0	95,499
72	87,140	100.0	87,140

Number of births registered from the Indiana State Board of Health.
+ Percentages of completeness for 1940 and 1950 reported in Sam Shaprio and Joseph Schachter, "Birth Registration Completeness, United States," Public Health Reports, LXVII, No. 6, (Washington, D.C.: U. S. Govt. Printing Office, 1950), pp. 513-24.

enrollments from an area consisting of, at most, three counties (Table 4). All other campuses had enrollments dispersed sufficiently throughout the state such that state birth data were deemed appropriate.

Births from the county areas presented in Table 4 were compared to state births by standardizing the births and conducting paired t tests. The paired t test indicates whether a difference in the distributions (i.e. area births vs state births) is statistically significant or not. The standardized births in Allen County, Lake County, and the area of Clark and Floyd Counties were not significantly different from the standardized state births. Therefore, for campuses drawing from these areas, the state birth data were used. The other county areas were significantly different from the state as far as birth data were concerned. Enrollment data for the schools drawing heavily from these areas were projected using both the area and state birth data. The resulting projections were weighted according to the percentage of students enrolled from the area and the percentage of students from outside of the area in the fall of 1973.

Net migration was investigated for the areas given in Table 4. Information was collected from United States Census Reports, Indiana Vital Statistics and an unpublished Indiana University population study. Using population changes, births and deaths for the time span of interest, various migration patterns were found for the specified counties and areas. Several difficulties arose in trying to estimate migration. Examining the total population for a five year age group did not necessarily explain the migration for the age desired, namely eighteen year olds. The migration pattern in many of the counties fluctuated throughout the span of years considered. For example, during a given period of time there was a net out-migration for the total population while during another span of years there was a net in-migration. To properly account for migration the cumulative effect over the eighteen year time span from birth to college age is required, and, consequently, an adequate correction method would be difficult to implement.

For all the counties and areas used for projections except the area consisting of LaPorte and Porter Counties, the magnitude of the annual net migration was generally one percent or less. The LaPorte and Porter County area had an annual net in-migration of about one and a half percent. It should be realized that any smooth migration trend would be accounted for by a nonlinear regression technique that used a ratio of freshmen births eighteen years earlier as the dependent variable and time as the independent variable. The migration trend, of course, would then also be projected as part of the future. Therefore, only migrations which have no simple pattern could pose problems. For the current study it was assumed that migration influence was negligible for the areas used.

Investigation of economic factors indicated that average charges for full time resident degree credit students have been steadily increasing for both the public and the private institutions in the United States. The average public charges have risen 13 percent from 1962 to 1972 while the average private charges have risen nearly 24 percent during the same period (Table 5). Figure 7 shows the relationship between the ratio of enrollments in public and private schools and the ratio of their average costs. It demonstrates clearly that as the costs of private institutions have risen in relation to the costs of public institutions, the enrollment in private institutions compared to public institutions has decreased. If this trend continues into the future, it seems clear that the percentage of students enrolled in the private sector of higher education will continue to decrease.

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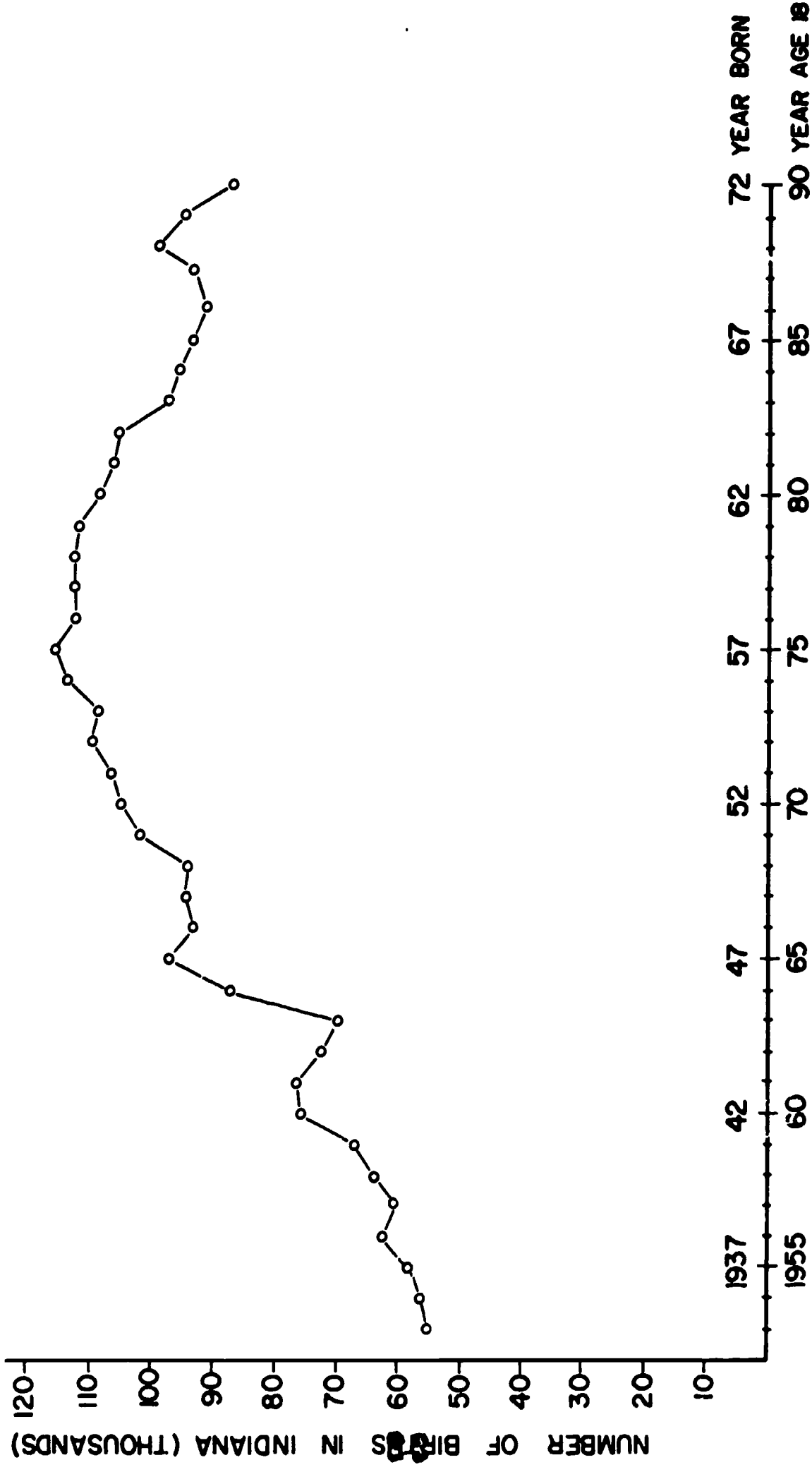
FIGURE 6
INDIANA BIRTHS, 1935 - 1972
AND YEAR AGE EIGHTEEN, 1953 - 1990

NUMBER OF BIRTHS IN INDIANA (THOUSANDS)

23

Table 4

INDIANA PUBLIC CAMPUSES WITH HIGH PERCENTAGES
OF ENROLLMENTS FROM REGIONAL AREAS

Fall, 1973

Campus	Regional Area	Percent of Total Enrolled from Region
Indiana University:		
East	Wayne and Fayette Counties	80.1
Fort Wayne	Allen County	71.3
Kokomo	Howard, Cass & Miami Counties	75.3
Northwest	Lake County	86.4
South Bend	St. Joseph & Elkhart Counties	86.0
Southeast	Clark & Floyd Counties	78.8
Indiana State University:		
Evansville	Vanderburgh County	75.7
Purdue University:		
Calumet	Lake County	84.5
Fort Wayne	Allen County	70.7
North Central	Laporte & Porter Counties	89.6

However, it will probably level off eventually as there are some schools whose drawing power appears to be nearly independent of their charges.

Interestingly, while the average costs for both private and public full time enrollment are increasing, these costs as a percentage of median family income have been decreasing (Figure 8). While rising average college costs may be a factor tending to decrease enrollments, the fact that these costs are decreasing compared to income should minimize the factor's effect.

In summary, the following statements concerning the population and economic data relevent to projecting enrollment in Indiana institutions of postsecondary education can be made:

1. Indiana birth data are appropriate for use in predicting state enrollments as well as enrollments for institutions that receive students from a statewide distribution.
2. Enrollments for institutions that draw from those counties or areas that have birth data whose variation is not statistically different from that of the state data can be projected using state birth data.
3. Enrollments for institutions that draw from those counties or areas that have birth data whose variation is statistically different from that of the state data can be projected on area and state birth data if weighted appropriately.
4. Migration is not a significant factor for the state or areas considered.
5. The ratio of enrollments in the public and private sectors is sensitive to the ratio of the average costs charged by these sectors.
6. College costs, although rising in terms of constant dollars, have actually decreased relative to family income, which casts doubt upon the belief that they will be responsible for overall enrollment decreases.

Table 5

AVERAGE CHARGES FOR FULL-TIME RESIDENT
DEGREE CREDIT STUDENTS IN THE UNITED STATES
(1972-73 dollars)

Year	Costs Private Colleges	Costs Public Colleges	Ratios Private to Public
1962	$2425	$1267	1.91
1963	2518	1285	1.96
1964	2611	1301	2.01
1965	2686	1318	2.04
1966	2762	1334	2.07
1967	2775	1338	2.07
1968	2786	1341	2.08
1969	2869	1364	2.10
1970	2952	1387	2.13
1971	3035	1411	2.15
1972	3098	1426	2.17

Source: Average Charges: "Projection of Educational Statistics
to 1982-83", 1973, Table 44.

COMPARISON OF THE RATIO OF
PRIVATE TO PUBLIC ENROLLMENT
TO THE RATIO OF AVERAGE PRIVATE
TO PUBLIC COSTS IN THE U.S.
1962 - 1972

RATIO OF AVERAGE PRIVATE TO PUBLIC COSTS

FIGURE 7

AVERAGE COSTS FOR
FULL - TIME STUDENT AS A
PERCENT OF MEDIAN FAMILY
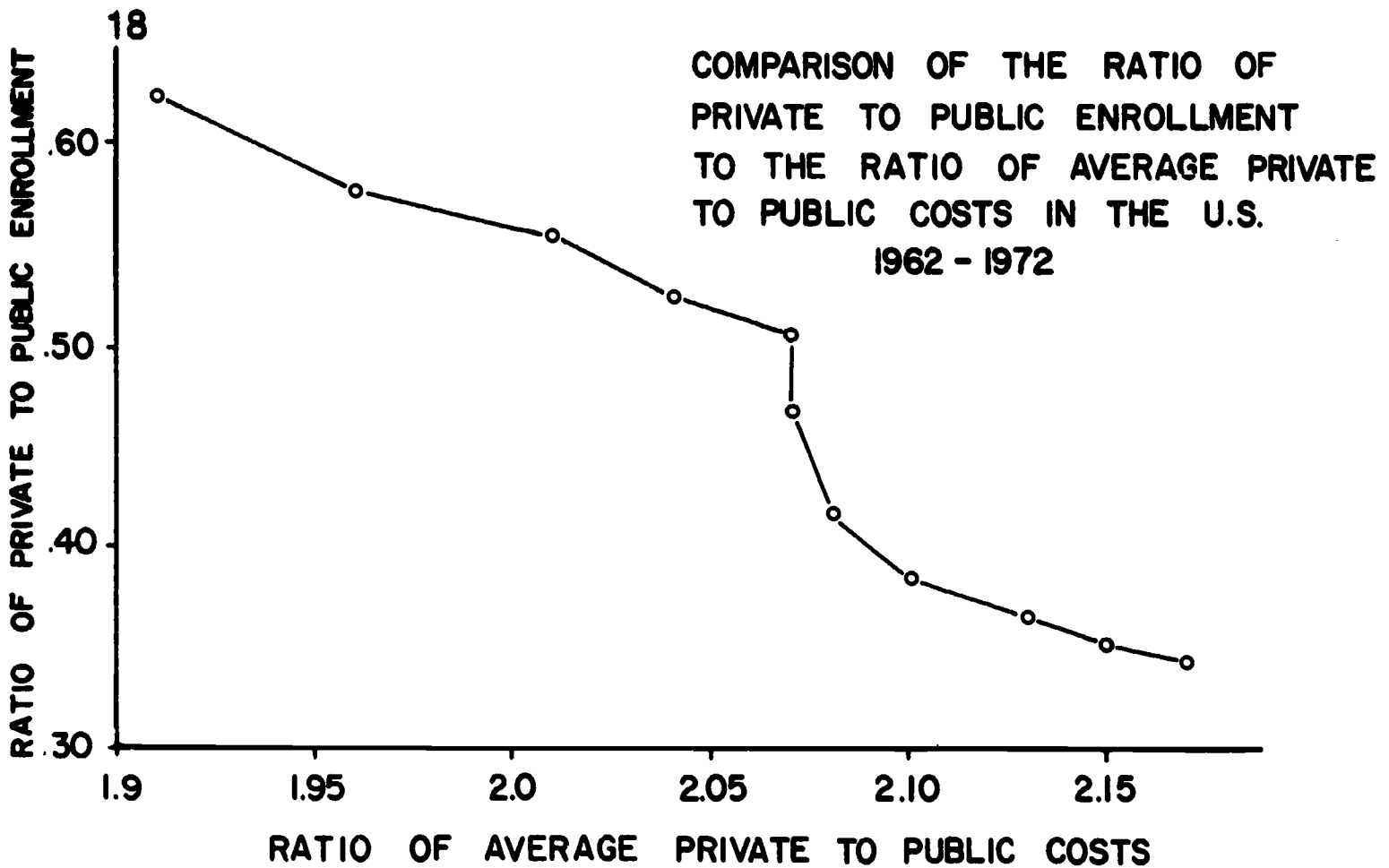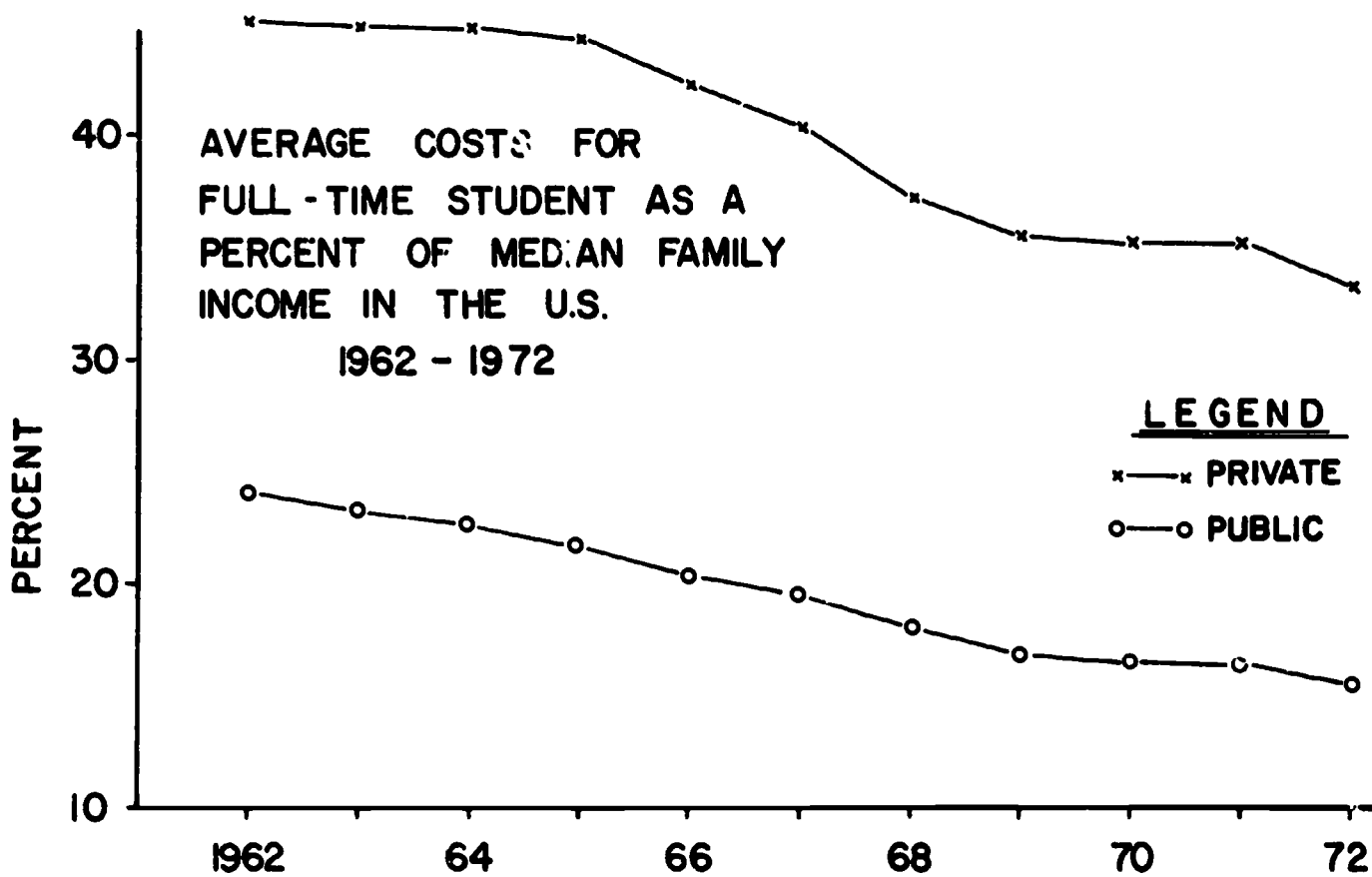INCOME IN THE U.S.
1962 - 1972

LEGEND

x——x PRIVATE
o——o PUBLIC

FIGURE 8

Average Costs and Enrollments: "Projections of Educational Statistics to 1982-83, 1973.
Median Family Income: Current Population Reports, P-60, 90, 1973.

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4 Postsecondary Education in Indiana

Fall enrollments of postsecondary institutions in Indiana have been obtained for the years 1950 to 1973 by the Indiana Association of Collegiate Registrars and Admissions Officers. These data were received from both public and independent institutions by freshman, sophomore, junior. senior, other and graduate categories. For the past four years professional students were categorized separately. The Indiana Vocational Technical College has reported enrollments for only the past three years. Although these students were originally reported as freshmen, investigation of their characteristics suggested that the "other" category was more appropriate. Therefore they were reclassified as "others".

In order to have a more accurate and complete data base, each public institution was given a copy of its historical information for audit and modification. Several independent schools were contacted to correct or augment their information.

Each institution was asked to isolate their professional students for the years preceding 1970 as there was not a separate category for these students at that time. Additionally, the institutions refined their "other" category to contain only undergraduate students enrolled in at least one degree credit course but who were not classifiable in any other category.

Several definitional problems occurred in attempting to improve the data base. Each institution has unique ways of classifying students, especially those who do not fall in the standard undergraduate and graduate categories Consequently, a set of definitions was developed on the basis of the information provided by the various schools. These definitions are consistent with current categorizations but, in some cases, may vary from those used throughout the historical time frame. Recommendations for better data definitions and collection for future studies will be presented in Chapter 6. The following definitions were used for the current study.

1. INSTITUTIONS
   Indiana's current system of postsecondary education consists of an independent sector and a public sector. The independent sector included in this report consists of thirty-seven different institutions. The public sector consists of six institutions which are composed of thirty-four different campuses, regional institutes and extensions or extension centers.

2. STUDENTS
   All those enrolled in degree credit programs or in courses which may be used to satisfy the requirements of a degree credit program. Among those not included in this definition are:
   A. Auditors, those students enrolled solely in courses for which no credit hours will be generated and which cannot be used to satisfy degree requirements.
   B. Pupils enrolled in special children's classes, nursery, elementary, or secondary school programs though they may be operated by the university.
   C. Those enrolled in courses conducted by mail (i.e. correspondence courses).

3. DEGREE CREDIT PROGRAMS

*Associate:*This is the degree objective of students enrolled in a program comprised of at least two but less than four years of postsecondary education whether it be for the first two years of a four-year baccalaureate program or a two-year occupational program. Completion of the program is signified by the awarding of an associate degree.

Baccalaureate: This degree objective includes students enrolled in baccalaureate degree programs comprised of at least four but not more than five years of college work.

First-Professional: This is the degree objective of students enrolled in programs which require at least two academic years of previous college work for entrance and a total of at least six academic years of college work for a degree. Included are the first-professional degrees in the following fields: Dentistry (D.D.S. or D.M.D. only), Law (LL.B. or J.D. only), Medicine (M.D. only), Theology (B.D. only), Veterinary Medicine (D.V.M. only), Chiropody, Podiatry (D.S.C. or D.P.), Osteopathy (D.O.), Optometry (O.D.). Also included are the students enrolled in the statewide Medical Education Program. Degrees which require four or five years of college work (Pharmacy, Architecture, Forestry) for completion of the academic requirements for the degree are considered as baccalaureate programs.

Graduate—Master's: The degree objective of students enrolled in a program leading to the master's degree. Such programs require one or two academic years of work beyond the baccalaureate degree.

Graduate—Intermediate: The degree objective of students enrolled in a program leading to a degree between the master's and the doctorate levels. This achievement level objective is not intended to be a necessary or logical step between the master's and doctorate levels. Degrees included here are, Educational Specialist (Ed.S.) and Educational Administration (Ed.A.)

Graduate—Doctorate: The degree objective of students enrolled in a program leading to a doctorate degree. Included are such degrees as Doctor of Education (Ed.D.), Doctor of Arts (D.A.), and Doctor of Philosphy (Ph.D.). The degrees of D.V.M., M.D., J.D., D.D.S., D.O., etc. are *First-Professional.*

4. STUDENT CLASSIFICATION

Undergraduate Student Classification: A measure of the undergraduate student's progress toward an associate or baccalaureate degree objective. The classification categories are freshman, sophomore, junior, and senior. The classification system denotes completion of the following amount of degree requirements:

	Two Year Degree Program	Four Year Degree Program	Five Year Degree Program
Freshman	less than 50%	less than 25%	less than 20%
Sophomore	50% to 100%	25% to 50%	20% to 40%
Junior		50% to 75%	40% to 60%
Senior		75% to 100%	60% to 100%

(Students in five year programs are classified as seniors in the last two years of their enrollment.)

Professional Student Classification: All students regardless of year of study pursuing a First-Professional degree as defined above. Students enrolled in the statewide Medical Education Program are included in the enrollment figures at the institution at which the students are in residence, except at Evansville where these students are included in IUPUI.

Graduate Student Classification: All students pursuing a Master's, Intermediate or Doctorate degree objective as defined above. Additionally this classification includes those students who are enrolled in courses which may be used to satisfy the requirements of a graduate degree program but who have not designated a degree objective program or have not been accepted for the graduate degree program. Included as well are students who have enrolled to complete the certification requirements needed to obtain a teaching license if such students are concurrently pursuing a master's or higher degree objective.

"Other" Student Classification: Those students (as defined in 2 above) not classifiable in one of the foregoing classifications. They are students who do not hold an undergraduate degree (associate or baccalaureate) and who are enrolled in, at least, one credit course. They are labeled "Special " at Ball State University, "Non-degree" at Indiana State University, "Evening" or "Special" at Indiana University, "Non-degree" at Purdue University, and "Extended Services", "Evening", or "Non-degree" at Vincennes University.

The historical enrollment of Indiana University-Purdue University at Indianapolis (IUPUI) was obtained by adding the enrollments of Indiana University-Indianapolis, what had been called Indiana University-Indianapolis Professional Divisions, Purdue University-Indianapolis and John Herron Institute.

A refinement deemed necessary was to identify the extension centers. These centers offer degree courses essentially for part-time students that are frequently off the campus. Many of these individuals are completing requirements for a teacher's license after having already obtained their undergraduate degree. Additionally, these enrollments sometimes represent only one class being taught for some specific purpose.

Because of the limited enrollment information for the Indiana Vocational Technical College (IVTC), both in terms of the historical time period and the categorization, no projections of future enrollments were made. In order to report actual state and public enrollments in a compatible manner with the predicted enrollments, the three years of IVTC enrollments were deleted from the actual public and total enrollment summaries.

On the basis of the foregoing definitions and data base obtained. Table 6 shows the summarization of postsecondary enrollments for the State of Indiana from 1950 to 1973. Enrollments have increased from 58,254 in 1950 to 194,465 in 1973 for an annual average growth of 5.4 percent.

Tables 7 and 8, respectively, give the enrollments for the public and independent schools in Indiana. From these it can be seen that, while the public enrollments have increased 279 percent, the independent enrollments have increased 152 percent during the 1950-1973 period. The independent schools had a peak enrollment of 55,666 for the fall of 1970. The public schools recorded a peak enrollment of 143,066 during the fall of 1972.

Figure 9 and Table 9 show the trend of Indiana enrollments as a percentage of United States enrollments from 1962 to the present. Additionally, Figure 9 includes Indiana population as a percentage of the United States population. While the population trend has

Table 6

TOTAL COLLEGE ENROLLMENT IN INDIANA

YEAR	FRESHMAN	SOPHOMORE	JUNIOR	SENIOR	TOTAL UNDERGRAD	OTHER	GRAD.	PROF.	GRAND TOTAL
1950	13058	10598	9448	8597	42701	7958	6141	1554	53254
1951	13734	9860	8730	8855	41179	9053	7038	1652	53922
1952	17727	10149	8638	8246	44760	6064	5943	1631	59343
1953	19440	11541	8177	7668	45819	5477	5954	1609	61253
1954	21258	13013	9237	7728	51306	4559	7390	1554	64419
1955	23542	15116	10326	6070	54614	3546	8243	1609	72152
1956	24374	15660	12290	10452	62736	4673	7021	1629	74051
1957	24433	16213	12641	11467	64794	4905	9510	1609	80773
1958	26031	16779	12950	12020	67680	4879	10924	1745	85228
1959	26987	17344	13091	11938	69407	5390	12180	1435	88435
1960	29360	18167	13560	12166	73543	6214	13595	1950	95552
1961	33062	20342	14540	12570	81154	6825	15118	1997	105574
1962	31842	23830	16402	13612	85126	8240	16355	2247	112008
1963	33411	22766	17433	15402	89402	7336	18279	2430	117457
1964	37613	23672	17952	16978	96215	7655	20741	2730	127341
1965	44816	27030	13067	17708	108630	7966	23554	2841	147021
1966	43855	32274	21482	13392	115934	8794	26027	3035	157430
1967	47531	32140	23311	20311	125157	8793	27125	3173	164244
1968	50486	34865	26221	24435	135507	8913	28685	3121	176226
1969	53113	35035	27753	25251	142802	8165	29748	3327	183542
1970	54150	38136	28189	27300	147781	7995	31799	3762	191237
1971	55762	32741	29976	23503	154022	6457	32879	4093	197461
1972	52291	34185	30491	29651	151228	6821	33588	4302	195939
1973	53787	37449	23906	28801	144893	7064	34341	4221	194463

remained basically constant from 1962 to 1972. Indiana's percentage of United States enrollments for both the public and independent sectors has decreased. This would indicate that Indiana is not keeping pace with other states in the area of higher education.

Figure 10 compares the percentage of total enrollment that is public for Indiana with that of the United States. In both instances the percentages are increasing, with the public institutions accounting for over 77 percent of the total for the United States and nearly 74 percent of the total for Indiana.

Table 7

TOTAL PUBLIC COLLEGE ENROLLMENT IN INDIANA

YEAR	FRESHMAN	SOPHOMORE	JUNIOR	SENIOR	TOTAL UNDERGRAD	OTHER	GRAD.	PROF.	GRAND TOTAL
1950	7447	5780	5664	5726	24887	6291	4979	1375	37482
1951	6516	4637	4652	4761	20716	5743	5008	1293	33750
1952	9948	5201	4562	4439	24149	1726	5525	1244	32544
1953	10840	5917	4725	4078	25116	1328	5544	1240	33329
1954	12011	5947	5147	4195	29700	1985	6067	1244	27503
1955	13634	7965	6099	4912	32700	847	6914	1247	41652
1956	14044	8393	6557	5568	34562	1822	7433	1313	45135
1957	13467	7734	6695	6020	35320	1799	7863	1351	46333
1958	15290	7244	6447	6252	37183	1774	9070	1426	49457
1959	16355	9653	6942	5877	38367	1727	10295	1529	51919
1960	18710	9384	7246	6128	42078	1775	11373	1639	55865
1961	21415	12288	7724	6292	47710	2529	12696	1712	64649
1962	20532	14225	8028	6845	50770	3295	13584	1879	69529
1963	21934	13915	10171	8126	54086	2439	15064	2021	73513
1964	24892	14541	10282	9344	59050	2644	17073	2220	80936
1965	30832	15970	11950	9930	68842	2810	19372	2371	93395
1966	31177	21217	12702	10468	75594	3790	21415	2452	102751
1967	34421	21702	13771	11877	83771	3431	22256	2519	112959
1968	37034	23329	17127	15207	92787	3532	24430	2449	122339
1969	38747	24704	18178	17146	98271	3287	23305	2590	128053
1970	39569	26707	14935	18128	103239	3510	26078	2894	135631
1971	41243	28459	20168	19510	109396	2910	27293	3060	142649
1972	39453	27830	21040	20574	108903	3179	27742	3242	143066
1973	39924	27261	19916	20019	107120	3317	28445	3221	142103

Table 8

TOTAL INDEPENDENT COLLEGE ENROLLMENT IN INDIANA

YEAR	FRESHMAN	SOPHOMORE	JUNIOR	SENIOR	TOTAL UNDERGRAD	OTHER	GRAD.	PROF.	GRAND TOTAL
1950	5571	6012	3734	3461	17964	1565	1162	179	25773
1951	7113	6113	4078	4104	20463	2304	2039	359	26156
1952	7779	6748	4976	3808	20611	4438	1418	357	26724
1953	6500	5268	3905	3670	21703	3949	1410	369	27431
1954	6747	5756	4900	3613	23600	2572	1377	356	27255
1955	9343	7121	4327	4118	25914	2830	1425	322	30530
1956	10230	7267	4733	4844	29174	2851	1590	311	32326
1957	10565	7579	5342	5397	29474	3007	1656	708	34445
1958	10871	7535	5363	5758	30497	3105	1854	319	35775
1959	11132	7771	5290	6041	31033	3663	1895	336	36317
1960	11250	8143	5444	6078	31905	4439	2132	311	39737
1961	11645	8594	5816	6228	33444	4296	2428	285	40453
1962	11250	9005	7374	6727	34356	4345	2771	408	42449
1963	11477	8351	7662	7225	35316	4897	3215	479	43457
1964	12721	8131	7670	7634	37156	5011	3708	510	46385
1965	13224	10369	8717	7779	33789	5146	4182	510	49625
1966	12573	11057	8740	7824	40340	5494	4612	603	51149
1967	12370	10478	9540	8434	41382	5362	4869	663	52275
1968	13452	11036	6064	9178	42720	5281	5255	632	53849
1969	14770	11441	8575	9105	44531	4878	5343	737	55433
1970	14547	11429	8954	9172	44542	4485	5721	918	55656
1971	14513	11322	8798	8953	44636	3557	5586	1033	54317
1972	13442	11345	9451	9077	47325	3642	5846	1030	52373
1973	13953	10328	8950	8722	41763	3747	5856	1030	52366

Table 9

INDIANA POSTSECONDARY ENROLLMENT AS
A PERCENTAGE OF UNITED STATES POSTSECONDARY
ENROLLMENT, 1962-1973

Year	Private Indiana Enrollment as Percent of Private U.S.	Public Indiana Enrollment as Percent of Public U.S.	Total Indiana Enrollment as Percent of Total U.S.
1962	2.57	2.53	2.54
1963	2.58	2.40	2.45
1964	2.56	2.34	2.41
1965	2.54	2.35	2.42
1966	2.50	2.36	2.41
1967	2.50	2.33	2.37
1968	2.59	2.25	2.34
1969	2.65	2.17	2.30
1970	2.59	2.11	2.23
1971	2.56	2.19	2.26
1972	2.46	2.11	2.19
1973	2.41	2.00	2.10

Sources for National Data: "Projection of Educational Statistics to 1982-83",
    1973, Tables 5, 6, and 9. "1973 Fall Enrollment by State", Chronicle of
    Higher Education, from the National Center for Educational Statistics, 1974.

Indiana data include enrollments from Tables 6, 7, and 8 of this report and,
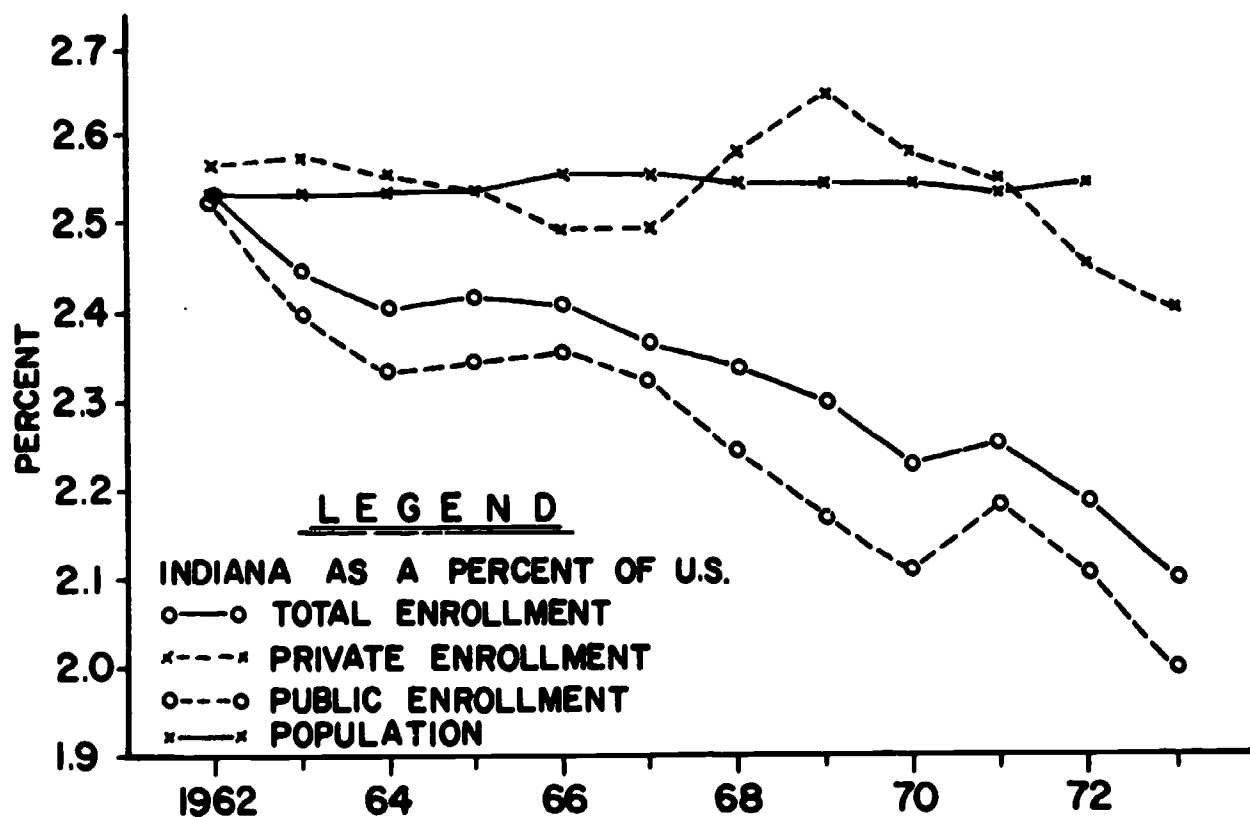also, Indiana Vocational Technical College enrollments.

FIGURE 9

POPULATION AND ENROLLMENTS

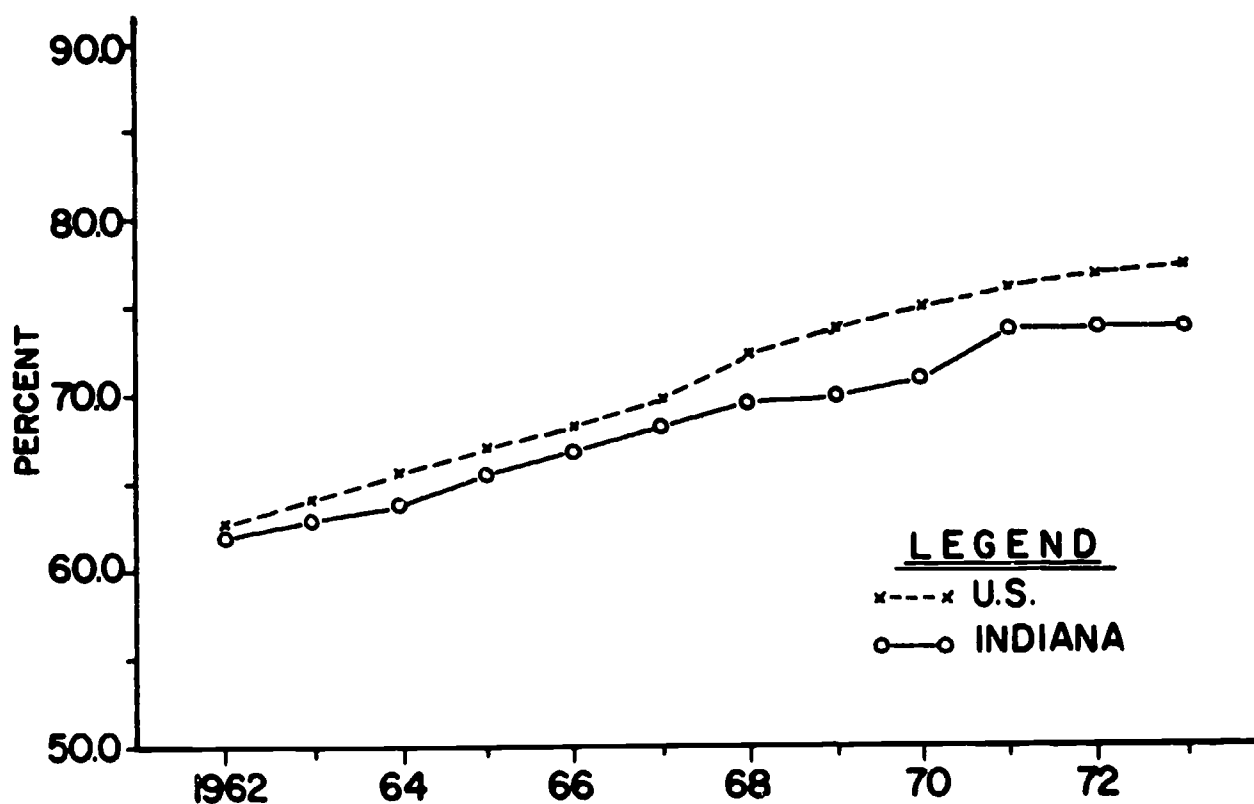IN INDIANA COMPARED TO THOSE IN THE U.S., 1962-73

FIGURE 10

PUBLIC ENROLLMENT COMPARED WITH TOTAL ENROLLMENT

IN INDIANA AND THE U.S., 1962-73

5 Projections of Enrollment in Indiana

While enrollment data were available from 1950 to the present, the base period selected for projection was 1959 to 1973. The latter period was more homogeneous than the total period because reporting patterns and institutional programs underwent fewer significant changes. Furthermore, it was judged to be a period of relative normalcy of sufficient length to establish trends.

In order to accomplish projections. judgments must be made concerning relationships and methods. Reliance on historical data is necessary since a basic assumption required for analytical projections is that the future will reflect the past in some manner that can be mathematically described. The system chosen, referred to as a mathematical model, is an attempt to represent the actual situation. In this way trends are incorporated into a mathematical expression which. when fitted to the past, can carry characteristics into the future.

Freshman enrollment expressed as a percentage of the births eighteen years earlier was chosen as the variable to be projected. Other variables considered were total un-degraduates expressed as a percentage of the eighteen to twenty-one year old age group and total enrollments expressed as a percentage of the eighteen to twenty-four year old age group. These latter variables were not used because of the lack of independence from one time period to the next. More specifically. the age group for the sophomores for a given year is the same age group used for the freshmen for the preceding year, the age group for the juniors the same as that for the sophomores for the preceding year, and the age group for the seniors the same as that for the juniors for the preceding year. The total un-dergraduates. therefore. would contain three groups each year (sophomores, juniors and seniors) which were from the same population group as three of those in the preceding year (freshmen. sophomores and juniors). In a similar fashion the total enrollments would contain groups that are not independent from one another from one year to the next. This lack of independence violates assumptions involved in regression techniques. Estimates of some of the parameters are biased if the predicted variable lacks statistical independence. In this study the parameters are not used in a statistical sense (for example. confidence limits are not appropriate). However, the authors discourage combining age groups unless adjustments for this relationship (i.e. autocorrelation) are made.

One way to compensate for autocorrelation is to use autoregression techniques. These techniques relate succeeding values of a given variable to the preceding ones by various weighting methods. A weighted average, for example, would be one method. Another might be the establishment of a relationship over time using the differences between successive values of the measured variable.

A related assumption in regression techniques is that the residuals, after the regression curve is fitted. are independent of each other. If this is not the case. autocorrelation of the residual exists. and again biased estimates of the parameters can occur. The residuals for

the variable, freshmen as a percentage of births eighteen years earlier, were tested for autocorrelation and did not have statistically significant autocorrelation. Therefore, ordinary regression techniques could be used.

The freshmen as a percentage of births eighteen years earlier were plotted for each year from 1959 to 1973 by individual campuses for the public institutions as well as for the total public, total private and total Indiana institutions.

The simplest mathematical function to investigate is a straight line. Simple linear regression fits the "best" straight line to the given data points by minimizing the squared deviations of the actual data points from the straight line. Regression lines were, therefore, fitted to the data, using the year as the independent variable and the percentage as the dependent variable.

It was clear when examining both the graphs and the regression information that, in most cases, a linear fit was inappropriate. Some schools, over the projection period, would have had greatly reduced freshman enrollments while others would have increased unrealistically. To prevent a limitless rise or fall in predictions, curvilinear methods were the next logical choice.

Curvilinear extensions of the past into the future that are either ascending or descending should be subjected to a decay in the rate of ascent or descent which eventually levels the predicted value. Three simple functions which satisfy this specification are as follows:

$$(1) \qquad Y = \frac{\alpha}{(X+A)} + B$$

$$(2) \qquad Y = \frac{\alpha}{(X+A)^2} + B$$

$$(3) \qquad Y = \frac{A}{1 + e^{(B+CX)}}$$

$\alpha = +1$ for descending curves and $\alpha = -1$ for ascending curves in the upper right quadrant. α is chosen and, therefore, not a parameter. A, B, and C are parameters. Y is the freshman enrollment as a percentage of births eighteen years earlier and X is the year. The rate of change for equation (1) is governed by the second power of X, or time, while (2) is governed by the third power. This means the rate of change for equation (2) will be more rapid than (1). Equation (3) has greater flexibility because it has three parameters and the decay in the rate of change is variable depending upon these parameters. Furthermore, double curvature is possible with equation (3) while the other two can curve in only one direction.

For these reasons, equation (3) was selected as the basic equation to apply first. This type of equation has been used by the United States Office of Education for some projections. However, they arbitrarily set the parameter, "A", equal to a given constant. This makes it possible to transform the equation into a linear equation but, at the same time, reduces the flexibility and requires a subjective decision to be made on the upper limits of the curve.

The program NCNLINEAR from the Statistical Package for the Social Sciences (SPSS) was used to obtain the parameters of the specific equations. The main campuses for Purdue University and Indiana University exhibited no more than random variation over the time period. Consequently, since no trend could be established, an average percentage was used to obtain the freshman enrollments for each of these schools. Equation (3), as a model, was successful for all the other individual public schools, except for Vincennes University and Indiana State University. For Vincennes University and Indiana State University, equation (2) was used. Equation (3) was used for the projections of public freshman birth percentages and independent freshman birth percentages. The results are depicted in Figures 11 and 12, respectively.

For the five regional campuses with area birth data differing from state birth data, two equations were developed. One of the equations used freshmen as a percentage of Indiana births eighteen years earlier as the projected variable. The other equation used freshmen as a percentage of the area births eighteen years earlier. The general equation, which weights the area and out-of-area enrollments proportionally to their Fall 1973 geographic distribution, was as follows:

$$Z_k = P_a B_{ak} Y_{ak} + P_i B_{ik} Y_{ik}$$

where Z_k = freshmen for the kth year

P_a = percentage of enrollment from the area for Fall, 1973

B_{ak} = area births for the kth year

Y_{ak} = projected freshmen as percentage of area births

P_i percentage of enrollment from outside the area for Fall, 1973

B_{ik} = Indiana births for the kth year

Y_{ik} - projected freshmen as percentage of Indiana births

After the freshmen for each institution, as well as the total public and total private freshmen were projected, advancement ratios were applied to establish the numbers of sophomores, juniors and seniors. Tables 10 and 11 give the advancement ratios for the total public and total independent institutions for each year from 1959 to 1973. Investigation of trends in these ratios, including individual school ratios, did not yield realistic results. Consequently, averages based on the most recent three years were used in all cases. The sophomore, junior, and senior estimates were obtained by applying the appropriate advancement ratio to the freshmen, sophomores, and juniors, respectively, in the preceding year.

The "other" category was projected for the public institutions as a whole using a type (2) equation. The predicted variable was the "other" category as a percentage of the total

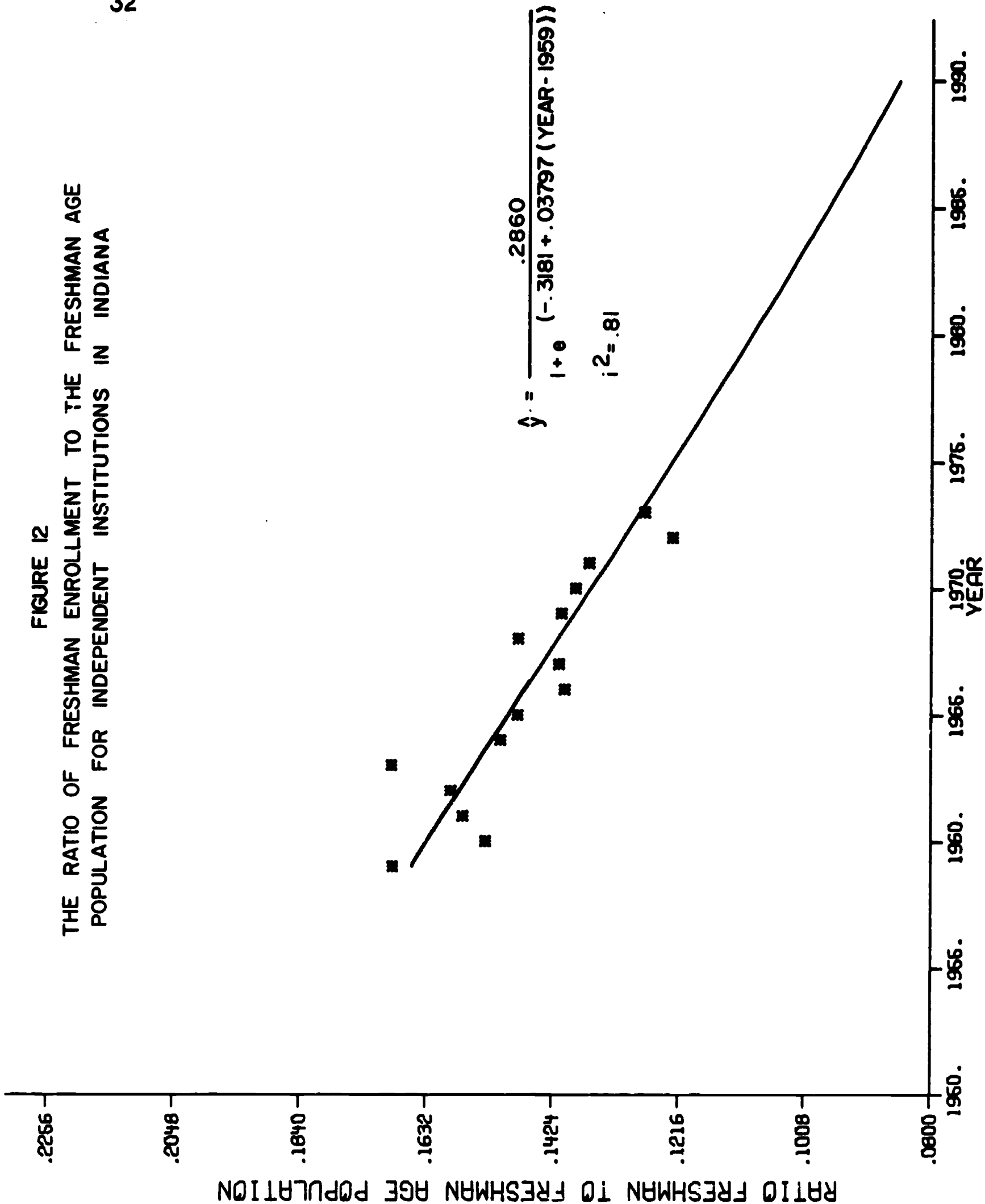FIGURE II

THE RATIO OF FRESHMAN ENROLLMENT

TO THE FRESHMAN AGE POPULATION FOR

PUBLIC INSTITUTIONS IN INDIANA
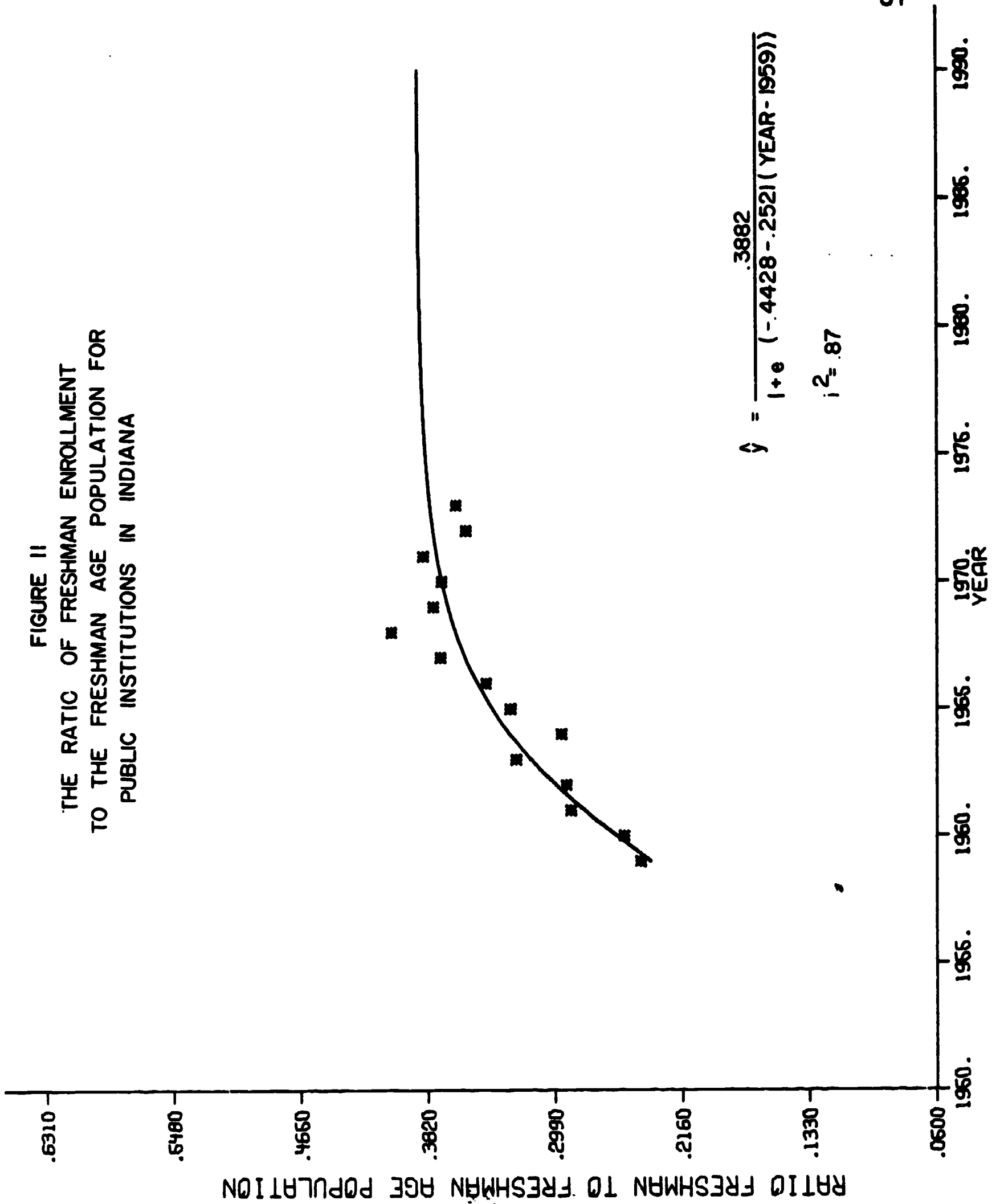
$$\hat{y} = \frac{.3882}{1+e^{(-.4428-.2521(YEAR-1959))}}$$

$r^2 = .87$

FIGURE 12

THE RATIO OF FRESHMAN ENROLLMENT TO THE FRESHMAN AGE POPULATION FOR INDEPENDENT INSTITUTIONS IN INDIANA

$$\hat{y} = \frac{.2860}{1 + e^{(-.3181 + .03797\,(\text{YEAR}-1959))}}$$

$$r^2 = .81$$

Table 10[+]

ADVANCEMENT RATIOS PUBLIC SCHOOLS [+]

	FRESHMAN TO SOPHMORE	SOPHMORE TO JUNIOR	JUNIOR TO SENIOR
1959 TO 1960	.6213035	.7502022	.8778547
1960 TO 1961	.6514071	.7693464	.8534880
1961 TO 1962	.6581420	.7318137	.8793580
1962 TO 1963	.6631584	.7142147	.8390757
1963 TO 1964	.6550340	.7424852	.9104834
1964 TO 1965	.6767311	.7564594	.9571513
1965 TO 1966	.6807635	.7458056	.9463256
1966 TO 1967	.6872790	.7406579	.9259052
1967 TO 1968	.6699173	.7911523	.9646507
1968 TO 1969	.6451980	.7778047	.9377534
1969 TO 1970	.6777508	.7731046	.9951399
1970 TO 1971	.7098970	.7572934	1.0343341
1971 TO 1972	.6644384	.7393341	1.0133122
1972 TO 1973	.6804466	.7170116	.9484895

| LAST 3 YEAR AVERAGE | .06491400 | .73807370 | 1.00071197 |

[+] Excludes IUPUI-Health enrollments.

Table 11

ADVANCEMENT RATIOS INDEPENDENT SCHOOLS +

	FRESHMAN TO SOPHMORE	SOPHMORE TO JUNIOR	JUNIOR TO SENIOR
1959 TO 1960	.7417513	.8335274	.9701413
1960 TO 1961	.7728030	.8323-64	.9737914
1961 TO 1962	.7732269	.8441712	.9369+25
1962 TO 1963	.7956+44	.8508200	.9303+223
1963 TO 1964	.8004734	.8561373	.9363456
1964 TO 1965	.7915258	.8779980	1.0147908
1965 TO 1966	.7940365	.8719133	.9759262
1966 TO 1967	.8232510	.8628014	.9605923
1967 TO 1968	.8508857	.8712397	.9574610
1968 TO 1969	.8534730	.8676151	1.0012096
1969 TO 1970	.7953375	.81-737-	.9573112
1970 TO 1971	.7761705	.8581678	.9514063
1971 TO 1972	.7134932	.8347+6:	.925+690
1972 TO 1973	.7608397	.8565224	.9292138
LAST 3 YEAR AVERAGE	.75013917	.8504-7493	.93859557

+ Excludes IUPUI-Health enrollments

public undergraduates. After the public "other" was established, enrollments were distributed among the individual institutions for each future year on the basis of the institutions' last three years of "other" historical data. A distribution factor was obtained by a weighted average of the last three years. The weights are in direct proportion to the total number of "others" for each of the last three years. Table 12 gives the distribution factors.

The graduate enrollment was projected for the public institutions as a group and then distributed among the individual institutions by the same method as that used for the "other" category. The projected variable was the graduate enrollment as a percentage of the senior enrollment for the preceding year. For the public institutions a type (1) equation was used. Table 12 gives the distribution factors used to allocate the graduate enrollments to the individual institutions.

In both the "other" and graduate categories, the four extension centers—Purdue-Southern, Purdue-Lafayette District, Vincennes-Jasper, and Indiana University-Evansville—were projected with constant enrollments because the current percentage of the public totals for these institutions would have projected unrealistically small enrollments. Also, the freshman and sophomore enrollments for Vincennes-Jasper were projected as constants due to the lack of historical data.

For independent institutions the "other" category was projected as a percentage of the independent total undergraduates using a type (2) equation. The graduate category for independent institutions was projected as a percentage of the senior enrollment for the preceding year using a type (3) equation.

Professional enrollments were not projected for either the public or independer* schools. Rather, estimates were obtained from each institution. Most of the professional programs have essentially limited enrollments based on administrative decisions. Consequently, these enrollments in the future do not necessarily reflect a function of time or relationship with past trends.

Table 13 explains the procedure used for the Medical Education Program. While this program was administered by IUPUI, the past and projected enrollments reflect their location except for IUPUI-Evansville and IU-Northwest. The IU representatives established the projected enrollments for the Medical Education Program.

In the current study the IUPUI nealth programs were not projected for any classification. Their actual enrollments were included in the statewide totals presented in Tables 6 and 7. The projections presented here are those established by IU. Again the decision not to use the regular projection techniques for IUPUI health programs was based on the assumption that enrollments in these programs are established by administrative policy rather than historical trends. The IU projections were available up to and including 1984. The enrollments projected for 1984 were used for an additional six years to 1990. These projections for IUPUI health enrollments were then added to the other institutions and to the public state projections to give the enrollments presented in Tables 14 and 15.

Tables 16 and 17, respectively, give the projected independent enrollments and the total state enrollments obtained from the sum of the independent and public sector projections.

Figures 13, 14, and 15 give the actual enrollments and projected enrollments for the public, independent and total state institutions. The two projected lines for the public enrollments on each graph are a reflection of the two methods used to obtain the projec-

TABLE 12

DISTRIBUTION FACTORS USED TO ALLOCATE
GRADUATE STUDENTS AND OTHERS TO INSTITUTIONS

Institution	Distribution Factor of the Public Total	
	Graduate	Other
Ball State University	14.55%	9.29%
Indiana State University		
- Main Campus	5.55	0.00
- Terre Haute Extension	4.16	0.00
- Evansville	0.00	7.81
Indiana University		
- Main Campus	27.64	10.60
- East	0.15	0.00
- Fort Wayne	3.15	0.00
- Kokomo	1.16	0.00
- Northwest	2.98	0.00
- South Bend	4.45	0.00
- Southeast	1.82	0.00
- IUPUI - Nonhealth	8.53	0.00
Purdue University		
- Main Campus	18.96	11.08
- Calumet	4.38	16.50
- Fort Wayne	1.17	20.79
- North Central	0.75	11.04
Vincennes University		
- Main Campus	0.00	7.38

The base for the factors excludes the health enrollments of IUPUI.
The factors do not total 100% due to the exclusion of the enrollments
of the four extension centers that were projected as constants.

TABLE 13

STATEWIDE MEDICAL EDUCATION PROGRAM

				Enrollment		
Where Enrolled			Actual			Projected
	1969	1970	1971	1972	1973	1974-1990
Ball State University		4	10	12	12	16
Indiana State University			8	10	14	16
Indiana University Northwest Regional Campus				4	10	12
Indiana University IUPUI- Evansville				5	10	16
Indiana University Main Campus	48	44	46	67	56	60
Purdue University Main Campus	3	6	12	13	14	16
University of Notre Dame	2	10	10	14	14	16

The actual enrollments at all locations except Bloomington for the years 1969 thru 1973 have been included in the IUPUI headcount enrollment reported by Indiana University. Each institution has, as well, included the students enrolled at that location in their head-count enrollment. The credit hours generated by these students have been reported only by the institution at which the student is enrolled.

The students at Evansville were reported only at IUPUI for 1972 and 1973. Beginning in the fall semester of 1974, both Evansville and Northwest will register only at IUPUI. The headcount enrollment and the credit hours generated will be reported by IUPUI. Therefore, the Evansville and Northwest projections will be reported with the IUPUI pro-jection.

For this projection the actual enrollment at IUPUI has been adjusted so that the head-count of these students is reflected only once during each year. At each location these students have been reported as professional students.

Table 14

PUBLIC TOTAL AS A SUM OF INDIVIDUAL SCHOOL PROJECTIONS

YEAR	FRESHMAN	SOPHOMORE	JUNIOR	SENIOR	TOTAL UNDERGRAD	OTHER	GRAD.	PROF.	GRAND TOTAL
1974	42759	27749	19995	19911	110414	3550	30022	3388	147374
1975	43504	29558	20486	19963	113511	3639	29790	3468	159408
1976	42315	30042	21856	20450	114663	3674	29816	3505	151658
1977	42360	29230	22260	21804	115654	3701	30297	3564	153216
1978	42298	29239	21531	22211	115379	3681	33092	3604	155756
1979	42118	29196	21649	21578	114541	3646	33724	3643	155554
1980	40830	29066	21638	21590	113124	3599	32775	3671	153169
1981	40189	23176	21574	21562	111501	3541	32790	3710	151542
1982	39826	27737	20917	21469	109949	3496	32763	3749	149957
1983	36959	27480	20604	20804	135847	3373	32608	3789	145617
1984	36097	25523	20423	20488	102531	3272	31609	3829	141241
1985	35338	24926	18955	20290	99509	3173	31084	3829	137601
1986	34612	24407	18516	18831	96366	3079	30779	3829	134053
1987	35435	23897	18137	18395	95864	3058	28524	3829	131275
1988	37526	24462	17758	18016	97762	3106	27817	3829	132514
1989	36006	25876	18189	17636	97707	3103	27221	3829	131860
1990	32969	24947	19248	18064	95128	3024	26604	3829	128585

Table 15

PROJECTED PUBLIC COLLEGE ENROLLMENT IN INDIANA, 197- TO 1990

YEAR	FRESHMAN	SOPHOMORE	JUNIOR	SENIOR	TOTAL UNDERGRAD	OTHER	GRAD.	PROF.	GRAND TOTAL
1974	3470	27933	23065	19993	111451	3693	30945	3344	148142
1975	3438	30331	2072	23130	115081	3590	29710	3468	183043
1976	3651	3124	22472	2351	118378	3725	29836	3505	152144
1977	3473	3340	22343	2256	117383	3753	30321	3564	157027
1978	3603	30560	22349	23043	120070	3732	33133	3604	162639
1979	3557	30512	22453	22503	119453	3695	33767	3643	169560
1980	3274	30411	22576	22573	114103	3534	32814	3671	159242
1981	1933	29012	22403	22603	116611	3543	32878	3710	156732
1982	1540	29116	21354	22530	115102	3535	32931	3749	153188
1983	3054	29057	21433	21842	110360	3465	3264-7	3749	150701
1984	37034	2634	21522	21524	117343	3233	3161	3829	161157
1985	36357	29231	19745	21331	104254	3199	31113	3823	162395
1986	35047	25096	14314	19443	100344	3035	30400	3823	156528
1987	35353	25141	11323	13376	100373	3073	24537	3823	155418
1988	33110	25752	13514	13981	102357	3122	27827	3829	137135
1989	37015	27249	1132	14571	102343	3117	27225	3829	136504
1990	3435	29210	20062	13033	97061	3054	26605	3429	133129

tions. One is based on total public enrollments and the other is obtained by summing the projections for all the individual public campuses. Rather than adjust one or the other, both are presented as independent estimates of the total public enrollment. The largest discrepancy is approximately three percent. Considering the diversity of the individual campus projection curves, the similarity for public totals lends credibility to the methods used.

Using the projected enrollments obtained from Tables 15 and 17 and the actual enrollments in Tables 6 and 7, the following observations can be made:

1. While 74 percent of the freshmen are currently enrolled in public institutions, 82 percent of this group will be enrolled in public institutions by 1990.
2. The percentage of total undergraduates in Indiana enrolled in public institutions is estimated to increase from 72 percent in 1973 to 80 percent by 1990.
3. The percentage of total enrollments in Indiana in public institutions is estimated to increase from 73 percent in 1973 to 81 percent by 1990.

The United States Office of Education estimates 79 percent of the total enrollment will be in public institutions by 1982, which is the last year of their projection period. This compares with 78 percent for Indiana by 1982. Total enrollment projections in Indiana for 1982 represent 1.9 percent of the United States enrollment projections for that year. This is consistent with the historical data presented in Table 9 in Chapter 4. It must be remembered that IVTC is not included in the current projections for Indiana. Therefore, the Indiana data are not directly comparable to the United States data.

Of interest is the comparison between enrollments on the main campuses with the regional and extension campuses. Tables 18 and 19 show these projected subcategories. Students attending main campuses accounted for 64 percent of the total public enrollment in 1973. This is expected to drop to 61 percent by 1990.

Table 16

PROJECTED ENROLLMENT COLLEGE ENROLLMENT IN INDIANA, 1974 TO 1990

YEAR	FRESHMAN	SOPHOMORE	JUNIOR	SENIOR	TOTAL UNDERGRAD	OTHER	GRAD.	PROF.	GRAND TOTAL
1974	14252	10349	9694	9345	41694	3732	5655	1070	52121
1975	14714	10641	9146	9164	41313	3709	5349	1090	52072
1976	13503	10643	9042	8301	41559	3504	5282	1050	51545
1977	13214	10129	9044	8634	40945	3563	5379	1050	50347
1978	12911	9912	9014	8512	39949	3455	5536	1260	50300
1979	12562	9665	9429	8084	34761	3335	5526	1070	49082
1980	11933	9423	9336	7912	37450	3203	5252	1050	46981
1981	11420	9313	9014	7731	39083	3051	5142	1050	45371
1982	11061	8570	7584	7522	34727	2355	5026	1250	3768
1983	9343	8230	7843	7119	32680	2773	4991	1090	41404
1984	9500	7439	7050	6841	30990	2614	4629	1090	39103
1985	9009	7128	6363	6617	29181	2465	4449	1090	37155
1986	8543	6803	6000	5974	27494	2318	4704	1060	35156
1987	8535	6453	5785	5688	25591	2239	3938	1060	33773
1988	8012	6477	5013	5436	26335	2214	3700	1060	33309
1989	8342	6607	5009	5175	25716	2159	3532	1060	32467
1990	7410	6261	5637	5170	24634	2058	3366	1060	31013

Table 17

PROJECTED TOTAL COLLEGE ENROLLMENT IN VIRGINIA, 1974 TO 1990+

YEAR	FRESHMAN SOPHOMORE	JUNIOR	SENIOR	TOTAL UNDERGRAD	OTHER	GRAD.	PROF.	GRAND TOTAL
1974					7330	35720		201033
1975					7393	35139		205122
1976					7369	35118		206649
1977					7316	35730		208574
1978					7147	34669		210533
1979					7030	34233		2092+2
1980					6853	34966		245273
1981					6564	37970		207103
1982					6431	37827		184716
1983					6177	37534		192105
1984					5912	36276		185346
1985					5964	35562		179553
1986					5413	35104		173734
1987					5312	32425		169536
1988					5336	31527		170446
1989					5276	30757		169321
1990					5192	29971		164147

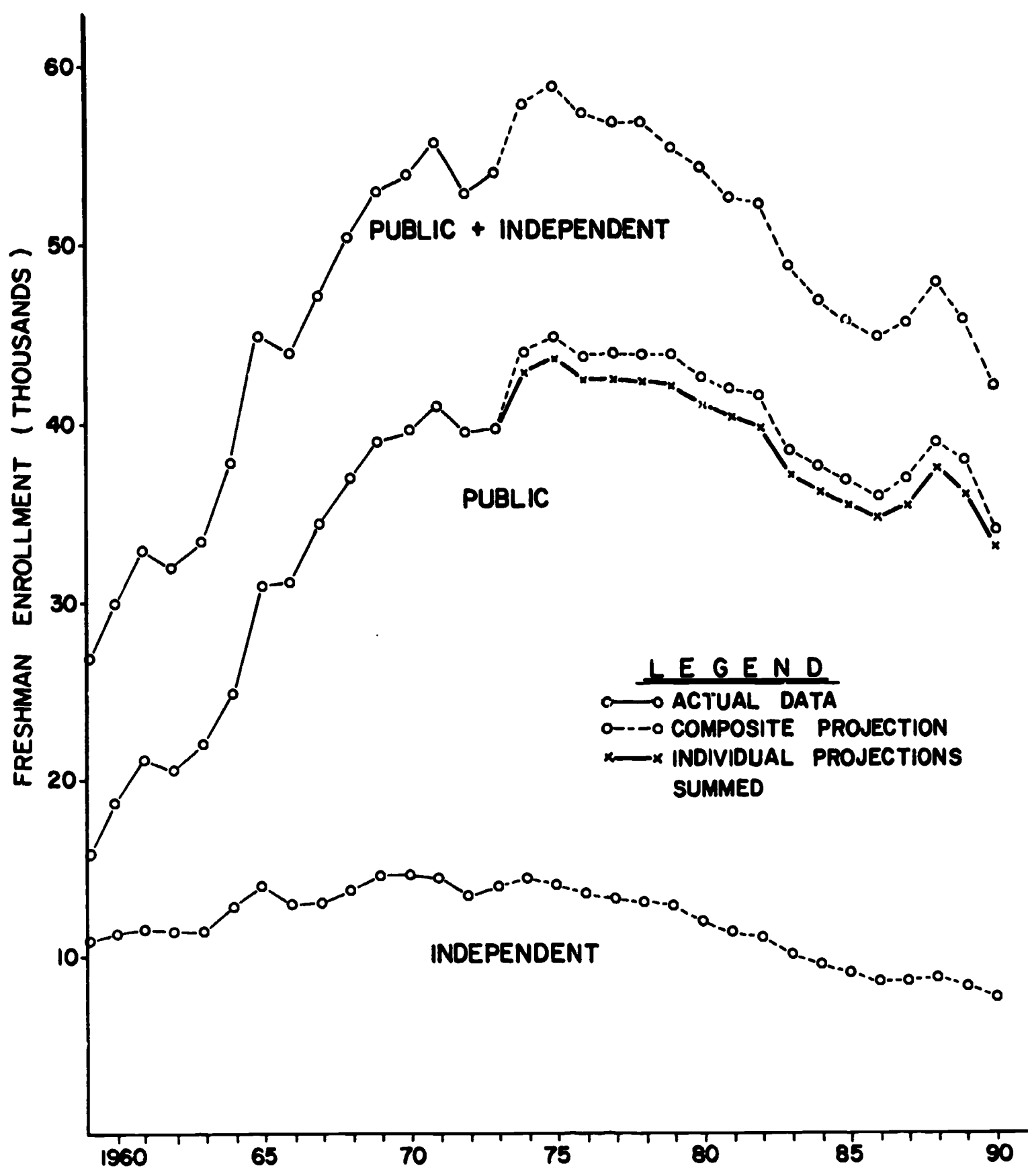+ Enrollments obtained by adding total public and total independent projections.

FIGURE 13

STATE OF INDIANA FRESHMAN ENROLLMENT
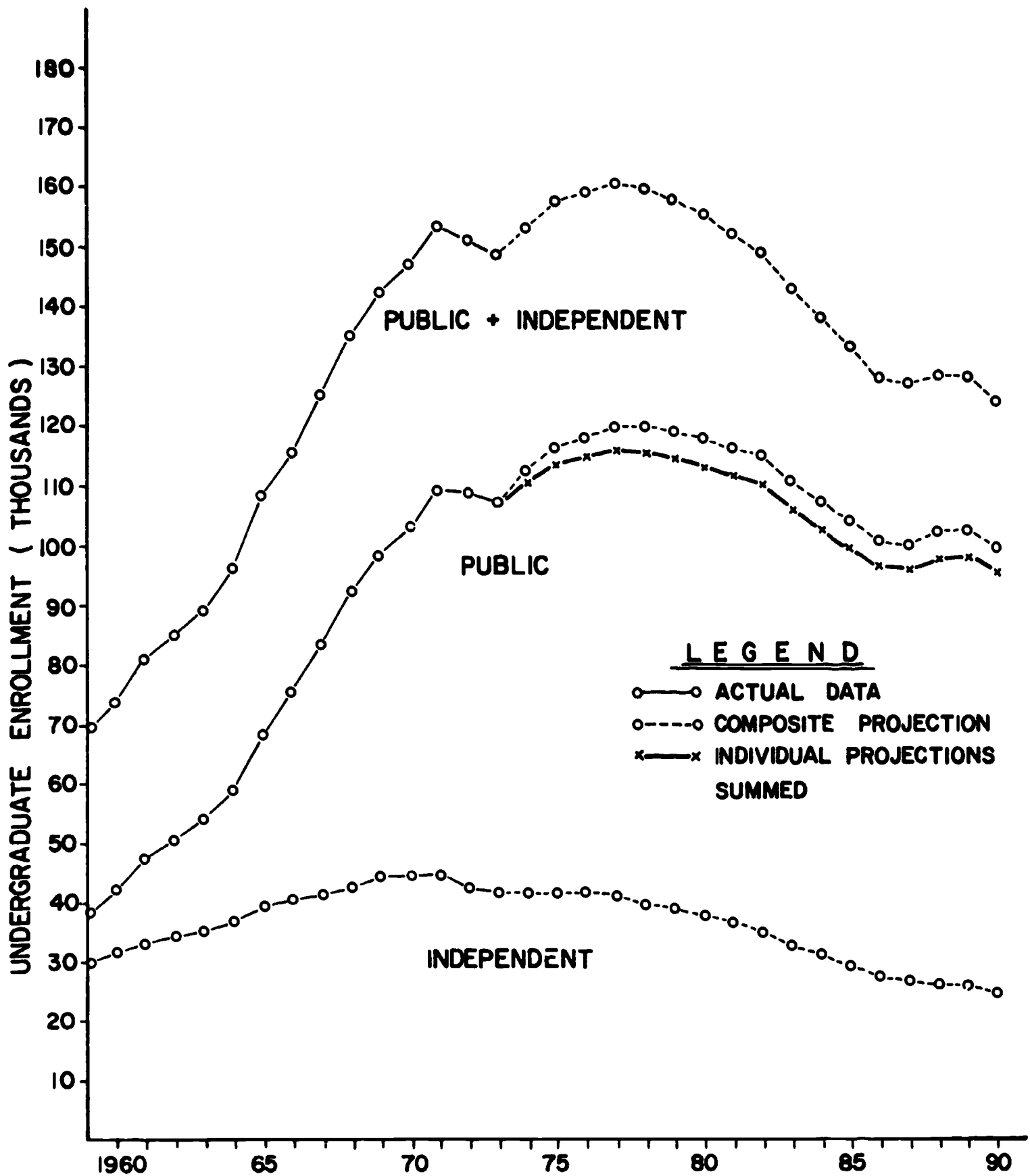
ACTUAL, 1959-1973

PROJECTED, 1974-1990

FIGURE 14

STATE OF INDIANA TOTAL UNDERGRADUATE ENROLLMENT
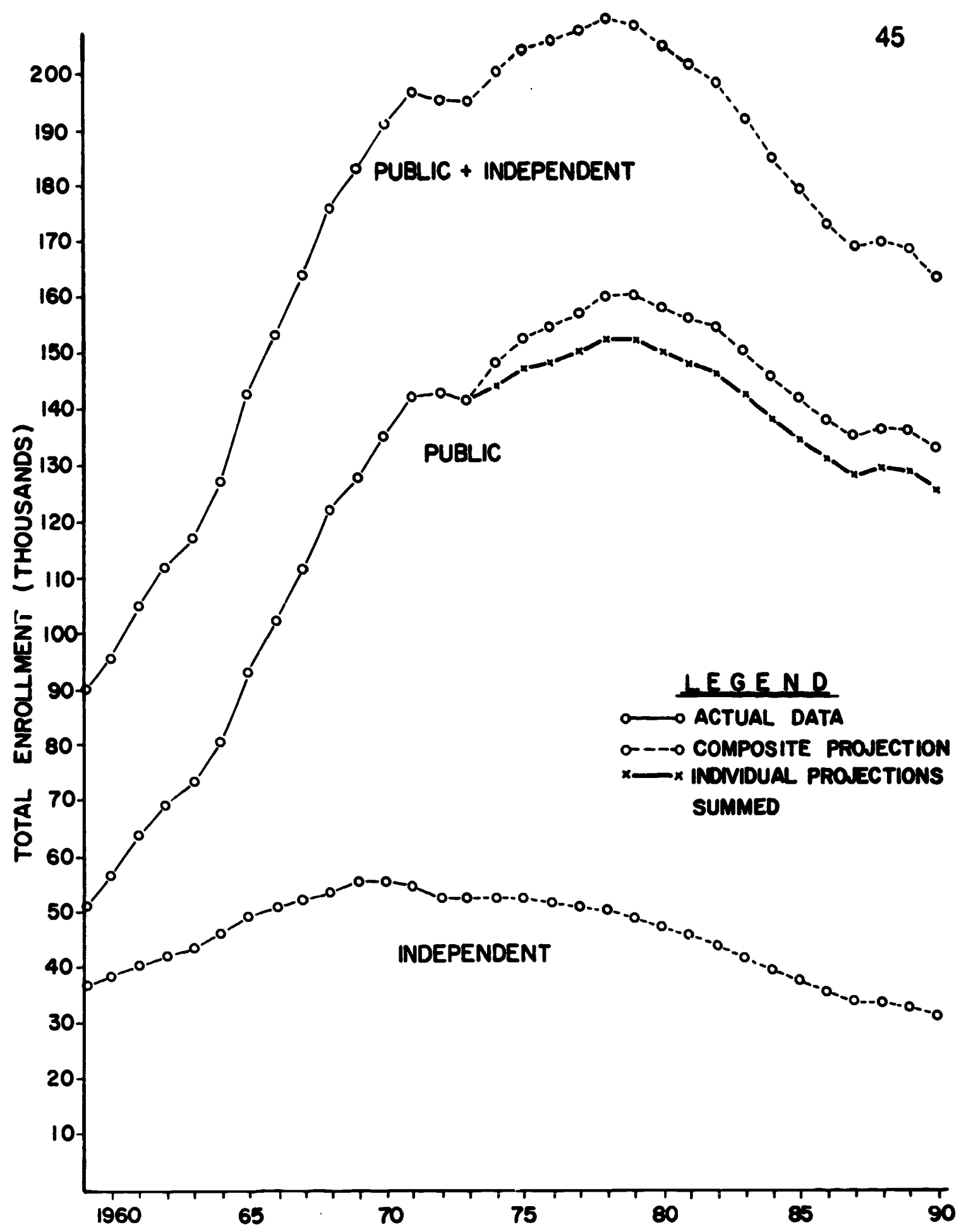ACTUAL, 1959-1973
PROJECTED, 1974-1990

FIGURE 15

STATE OF INDIANA TOTAL ENROLLMENT

ACTUAL, 1959-1973

PROJECTED, 1974-1990

Table 18

PROJECTED MAIN CAMPUS TOTAL

YEAR	FRESHMAN	SOPHOMORE	JUNIOR	SENIOR	TOTAL UNDERGRAD	OTHER	GRAD.	PROF.	GRAND TOTAL
1974	23706	18002	14190	15044	70942	1288	19684	907	92821
1975	23967	18329	14416	14928	72640	1322	19505	907	94374
1976	23122	18557	15483	15172	73334	1331	19535	907	95077
1977	23015	18581	15714	16271	73881	1339	19802	907	95929
1978	22937	18904	15209	16513	73423	1330	21662	907	97322
1979	22711	18717	15177	15982	72587	1314	22067	907	96875
1980	21931	18572	15134	15948	71585	1291	21412	907	95195
1981	21521	17939	15038	15903	70401	1267	21408	907	93983
1982	21271	17610	14545	15802	69228	1243	21374	907	92752
1983	19647	17410	14293	15283	66633	1191	21257	907	89988
1984	19129	16084	14144	15018	64375	1148	20570	907	87000
1985	18693	15663	13077	14862	62295	1111	20218	907	84531
1986	18245	15309	12744	13740	60038	1070	20010	907	82025
1987	18677	14943	12463	13391	59474	1062	18501	907	79944
1988	19768	15300	12172	13095	60335	1081	18026	907	80349
1989	18977	15195	12470	12799	60431	1079	17625	907	80042
1990	17300	15548	13205	13102	59155	1048	17212	907	78322

Table 19

PROJECTED REGIONAL CAMPUS AND EXTENSION TOTAL

YEAR	FRESHMAN	SOPHOMORE	JUNIOR	SENIOR	TOTAL UNDERGRAD	OTHER	GRAD.	PROF.	GRAND TOTAL
1974	19053	9747	5805	4867	39472	2262	10338	2481	54553
1975	19537	10229	6070	5035	40871	2317	10285	2561	56034
1976	19193	10405	6373	5278	41329	2343	10311	2598	56581
1977	19345	10349	6546	5533	41773	2362	10495	2657	57287
1978	19401	10435	6422	5698	41956	2351	11430	2697	58434
1979	19407	10479	6472	5596	41954	2332	11657	2736	58679
1980	18899	10494	6504	5642	41539	2308	11363	2764	57974
1981	18668	10237	6536	5659	41100	2274	11382	2803	57559
1982	18555	10127	6372	5667	40721	2253	11389	2842	57205
1983	17312	10070	6311	5521	39214	2182	11351	2882	55629
1984	16968	9439	6279	5470	39156	2124	11039	2922	54241
1985	16645	9263	5878	5428	37214	2069	10866	2922	53070
1986	16367	9098	5772	5091	36328	2009	10769	2922	52028
1987	16758	8954	5674	5004	36390	1996	10023	2922	51331
1988	17758	9162	5586	4921	37427	2025	9791	2922	52165
1989	17029	9681	5719	4847	37276	2024	9596	2922	51818
1990	15669	9299	6043	4962	35973	1976	9392	2922	50263

6 Recommendations For Developing Future Projections of Enrollment

As stated earlier, an enrollment projection can only be as precise and explicit as the data on which the projection is developed. This fact becomes quite evident to anyone who accepts the task of preparing such projections. Most enrollment projection endeavors reveal that much more exacting historical information is needed to develop meaningful and useful data for planning purposes. Unless these relevant needs are explored and unless action is taken to collect the information, the process of developing an adequate base for more detailed enrollment estimates is delayed. Insofar as the institutions in this state are concerned, the primary problem is the accessibility of information. The information needed to develop more meaningful enrollment projections is not foreign to but characteristic of and inherent in all institutions of higher education. The quality and magnitude of higher education in Indiana require information about the higher education system which is both understandable and manageable if that system of higher education is to maintain its reputation for quality and continue to grow and expand its service.

It is the recommendation of this study team that the Standardized Enrollment Report developed by the Enrollment Task Force and submitted on February 19, 1973, be implemented immediately as the report which all institutions of postsecondary education in the State of Indiana must prepare to report their enrollment throughout each academic year with the following exceptions and modifications:

1. The extant informational needs regarding financial and program planning must be identified so that superfluous detail can be omitted from the reporting requirements. For example, if contact hours are irrelevant for planning purposes, delete that information from the recommended report. Those sections that are not needed should be eliminated while those retained should be collected as part of the improved data base.
2. Institutional enrollments must be reported on the basis of the student's degree objective. In view of this, further delineation of undergraduate students is needed within the baccalaureate level. Lower and upper division categories are insufficient detail. They should be replaced by the four undergraduate designations depicting progress toward that objective with the respective definitions as follows:

	Two Year Degree Program	Four Year Degree Program	Five Year Degree Program
Freshman	less than 50%	less than 25%	less than 20%
Sophomore	50% to 100%	25% to 50%	20% to 40%
Junior		50% to 75%	40% to 60%
Senior		75% to 100%	60% to 100%

Though course or instructional unit enrollment is vital to financial planning it cannot serve the purpose of classifying a student's progress toward his degree objective.

Classification by instructional unit enrollment assumes standardization of the manner in which institutions assign course numbers. It further assumes that all students take courses from an established series for a given year of study. Neither of these assumptions is true.

3. Correspondence course enrollment should not be reported as an integral part of the Off-Campus enrollment. A school that gives instruction by mail, sending lessons and examinations to a student periodically, and correcting and grading the answers returned should report the enrollment in such courses independent of any other category of students. Students enrolled in such courses should be reported by achievement objective. Their enrollment status (i.e. full or part time, resident, credit hours, etc.) should be categorized in the same manner as other students. Additional information needed for correspondence students is the number of students enrolled at the time of reporting, the number of lessons processed, and the number of courses completed since the last time the enrollment was established.

4. Students enrolled in courses as listeners, receiving no credit, must be isolated from the students enrolled who do receive credit. Though auditing is a recognized part of the service provided by nearly all postsecondary institutions, auditors should not be included with students enrolled for credit. If this category were clearly labeled, it would produce an additional refinement of the data.

5. Information regarding students who are new to or who are reentering the institutions would be useful in analyzing and/or determining the causes for shifts in enrollment patterns. Categories of students which should become an integral part of the Standardized Enrollment Report are:

Beginners— New students who have not previously attended an institution of higher education.

Transfers— Students who are new to that institution and have previously been enrolled at some other postsecondary institution

Reentries— Students who previously attended, interrupted their program for whatever reason(s) and have now resumed their degree objective.

6. The geographic origin of the students by Indiana counties and by state and country outside of Indiana is fundamental to the development of enrollment projections for certain types of institutions. While a report containing this information for each institution is not needed every semester, such a report prepared annually for the fall semester would detect changes in enrollment patterns and could improve the accuracy of enrollment projections.

7. The "Reported as of" date described in the recommended Standardized Enrollment Report should be further defined. The definition in that report should be replaced by the following: The date in the session selected for determining student enrollment is to be that date deemed most appropriate by each institution, but in no case will the date selected be later than the end of the regular late registration and schedule revision period as designated in the school's academic calendar for the session.

8. The Indiana Commission for Higher Education should create a team of individuals composed of commission staff and institutional representatives familiar with academic record keeping procedures. The major purpose of this team would be to

assist institutions in preparing the report to assure compliance of the data reported with the stated definitions of the elements. It should be the further purpose of this team to make definitional modifications as appropriate to refine the report itself and thereby make it a useful management information source.

The modified Standardized Enrollment Report recommended should amply meet the needs of the Commission and its staff. It would provide the more specific information needed and resolve the problems which emerged when this study team began using the historical data available at the present time. These problem areas were and are as follows:

1. Aggregate graduate student data are difficult to deal with in projections. Differentiation of graduate students on the basis of their objective is required to improve the degree of accuracy of the projection.
2. All students are not classified consistently. The recommended report would resolve the current practice of concurrently. on the same table of enrollment data, depicting one group of students enrolled by degree objective while another group is categorized by program.
3. Extension and or off-campus enrollment must be reported separately from campus enrollment in order to accurately represent the respective unit's enrollment. Information for the students in the extension. similar to that for campus students, is needed for planning and projection purposes.
4. Enrollment in non-credit programs. which is an integral part of an institution's function. is information which the present reporting structure does not definitionally account for or identify.

Since budgets are developed for an annual operating period. enrollments should be annualized to correspond to this method of fiscal planning. The primary emphasis of those who work in and with institutions of higher education appears to be with those students currently enrolled. Little if any attention is devoted to the student once he reaches his enrollment objective. The data pertaining to the students who complete their objective should be an integral part of the management of any system of postsecondary education. If properly integrated in the planning for the system of higher education. an overabundance of professions in a field with a restrictive or limited job market might be averted. Further. new programs can be implemented and existing programs can be expanded. if needed. to utilize to the fullest extent the services and facilities of all institutions. The benefits of such planning are boundless for both the institutions and the students. For these reasons it is recommended that a report providing information relative to achievement objectives attained. including the area of specialization. be designed and implemented as soon as possible for submission on an annual basis by each institution.

It is recommended further that the current reporting procedure to IACRAO continue. This is necessary both to evaluate the present projections for accuracy and to update or initiate projections until sufficient data have been collected with the new reporting forms to establish historical trends.

As discussed in Chapter 2. efforts are being made in some states to develop computer packages which will allow input of the most recent data to produce continuously updated enrollment projections. The current study has convinced the authors that this is extremely restrictive unless an interactive mechanis n is included. Investigations at many points during the process of the projection are essential to determine the appropriate

mathematical models to be applied. Modules to produce certain basic information on which to make these choices would be helpful, but a complete package would eliminate the opportunity for decision-making within the process unless a great deal of expense and effort is expended.

A future study using the current projections as input should be instituted to relate these fall enrollments to total annual credit hours. Investigation of cyclical trends for individual institutions might be informative. Given the restrictive time frame of the current study and the lack of compatible information concerning credit hours, such an investigation could not be included.

More complete information needs to be obtained from the Indiana Vocational Technical College. As this type of institution attracts more postsecondary students, their impact should be investigated. The casual student must be differentiated from the student pursuing a program of some length. Enrollments must be reported with some consistency in order to include this group with the other postsecondary ins,itutions. The new reporting form recommended should be useful in this area.

APPENDIX

Abstracts of Enrollment Studies

These abstracts are in alphabetical order according to the state for which the study was conducted. Within a state, they are in alphabetical order by author. National studies are in the front.

The Carnegie Commission on Higher Education. *New Students and New Places.* McGraw-Hill. 1971.

This study was concerned with the direction of higher education through the year 2000. It included a projection of total enrollment in the U.S. during that period. Projections were also given by various institutional types. Most projections were given at ten year intervals.

Methodology and Findings

No actual methodology or base period was given. However, numerous qualitative assumptions and conclusions were presented. The projections were based on the 18-21 and the 18-24 year old age groups. The underlying philosophy of the projection was that enrollment trends would be determined by changes in the rate of growth of the college age population and a continuation of the long run upward trend in enrollment rates. The commission concluded that the following factors influence enrollment.

A. Factors that increase enrollment

    1. Increased student grants and liberalized student loan policy
    2. More effective recruitment of minority and disadvantaged students
    3. Open access to public two year colleges
    4. New community colleges.

B. Factors that decrease enrollments

    1. Reduced time for baccalaureate degree
    2. More two year programs
    3. Reduced job market for some college majors. The commission felt that this would not discourage many but might affect a student's choice of major.

The study suggested. "Policies should be developed to preserve and strengthen the financial condition of the private institutions, so that they will be able to maintain a reasonably stable share of total enrollment." The assumptions and conclusions of the commission were:

A. Assumptions

    1. Adequate funds would be forthcoming from public sources.
    2. Growth would not be inhibited by a change in the demand for college graduates or by structural changes in higher education.
    3. The age distribution of students would not change.

B Conclusions for 1970-1980

1. The percentage of all students enrolled in two y-ar colleges would increase from 28 to 31%.
2. The percentage of all students enrolled in comprehensive colleges would increase from 31 to 32%.
3. The percentage attending doctoral-granting institutions would drop from 30 to 27%.
4. The percentage attending public institutions would rise from 75% to 79%. It will further rise to 81% by 2000.

The commission adjusted their projections based on the above factors and the beliefs that adult education would grow, graduate education would decline due to job markets and institutional policies, and retention rates in upper divisions would decline due to increases in two year colleges.

Lins, L. J. *Methodology of Enrollment Projections for Colleges and Universities*. AACRAO. 1960.

This was a general study on methodology commissioned by AACRAO. In addition to presenting fundamental graphing and arithmetic procedures, four basic methods were discussed:

1. Curve fitting—linear, logistic, parabolic. Lins limited this technique to the relationship of past enrollments to time only.
2. Ratio—defined as the technique used to determine the ratio between college age population and enrollments.
3. Cohort-survival—defined as the extent to which a group survives from 1st grade through college.
4. Correlational analysis—Lins excluded the relationship with time only and defined this as the relationship of enrollments with one or more independent factors, for example, the number enrolled related to the number of high school seniors and per capita income.

Johnson, Charles E., Jr. "Changing Trends in College Enrollment." *College and University*. Fall, 1973.

The author stated that previous changes in college enrollments were due to increased births 18 years earlier and the tremendous growth of 2 year colleges. Nationally, enrollments increased 133% between 1960 and 1972. Proportionately more Blacks and women are attending college with a decline recently in the rate for white men. The author stated that the enrollment rates are affected by the availability of colleges, the financial ability of students, the availability of financial aid, the desire for a college education, the felt need for a college education for an occupation, and high school graduation rates.

Parker. Garland. "High Tide-Low Tide: The Enrollment Projection. A Useful Tool." Paper delivered at the 60th Annual Meeting of the American Association of Collegiate Registrars and Admissions Officers. April, 1974.

This was a paper presented at the 1974 AACRAO meeting which gave some general methods of projection.

Methods discussed were:

1. Projections based on estimates of subunits of incoming students. Survival rates are then computed and projections made. It was suggested that headcount be established first and then FTE data obtained.
2. Projections based on a constant percentage change of enrollments.
3. Projections which assumed a constant percentage of some other data, for example, national enrollment data.
4. Projections based on subjective judgment.
5. Projections based on the relationship of enrollments to births, age groups, etc.
6. Projections based on the combination of any of the above.

The author recommended tempering all the methods with judgment.

Simon, Kenneth A. and Frankel. Martin M. *Projections of Educational Statistics to 1981-82.* U.S. Department of Health, Education, and Welfare. National Center for Educational Statistics. 1972.

Projections of enrollments for the U.S. (50 states and D.C.) were made by sex, control, attendance status. degree/non-degree credit, and type of institution to 1981 based on 1961-71 data using various variables and curves. Very detailed methodology was presented with models tailored to each category.

Methodology:

A. *General*

1. Data were taken from accredited institutions of higher education listed in the *Education Directory* of the Office of Education (72-73).
2. Projections were based on 18-21 year olds.
3. Projections were based on 1961-1971. This was considered better than a longer time span due to more recent policies and better recent statistics.
4. General equations were fitted to the data, depending on the situation, as follows:
   a. Enrollment was projected as some constant percentage of another variable.

b   Enrollment as a percentage of 18-21 year olds was projected as a linear function of time.

$$y = a + bt$$

   t = time
   y = enrollment as a percentage of 18-21 year olds
   (or 18 year olds for freshman enrollment)

c.   Enrollment as a percentage of 18-21 year olds was projected using a logistic growth curve.

$$y = \frac{k}{1 + e^{(-a+bt)}}$$

   y   enrollment as percentage of age group
   t   time
   k   value determined before fitting the equation

   This can be transformed to $Z = \log \frac{y}{k-y}$ and a straight line fitted to Z.

d.   Enrollment was projected as some constant. This was usually the 1971 value or an average of recent values.

5.   In cases 4b or 4c, the curve was used merely to establish the value of y at 1981, then a new curve or straight line was fitted between the last observed point (usually 1971) and the 1981 point. The dependent variable may be either a percentage of some age group or actual enrollments. In non-higher education cases, logarithmic functions were sometimes used for this "adjusted equation." For higher education a straight line was used. This adjustment was done to provide better agreement between the last observed points and first projected points. This is a subjective procedure.

B.   *Specific*

1.   For each category, projections were actually made by sub-category of men/women; 2 or 4 year; Public/Private, for example, men in 2 year private institutions. These sub-categories were then summed.

2.   Methods 4a, b, c, d (above) were used depending on their applicability but, in general, the methodology was usually:

   a.   Degree credit and non-degree credit: Sub-categories were projected assuming enrollment as a percentage of 18-21 year olds was a function of time. Part-time/full-time were projected separately in each category and for undergraduate and graduate based on the 1971 percentage that were full-time in each category.

   b.   FTE was obtained by summing categories in 'a" above as follows: For degree credit the number of FTE = the number of full-time + 33% of the number of part-time. For non-degree credit the number of FTE = the number of full-time + 28% of the number of part-time. The percentages were obtained from a 1964 survey of FTE's and credit hours.

c. First time degree credit was obtained the same as in "2a" above except the percentages were the percentages of 18 year olds.

d. Resident Graduate Students were obtained by assuming that the trends shown by Resident Graduates as a percentage of degree credit enrollment in 4 year institutions will continue. This was usually taken as a constant percentage, frequently the 1971 value.

e. Undergraduate and first professional degree credit enrollments in four year institutions were obtained by subtracting the resident graduate enrollments from the total enrollments in four year institutions.

Thompson, Ronald B. *Projections of Enrollment, Public and Private Colleges and Universities 1970-1987*. AACRAO. December, 1970.

This study projected total enrollments by state and by sector (public and private) for the years 1970 to 1987. It used the enrollment rates of the 18-21 year old age groups of the various states. The age group was the sum of the births from the appropriate years.

Methodology:

1. Two projections were made. One used a 1950-1969 data base, and the other used a 1960-1969 data base.
2. The study observed that more than 60% of those who were in college were part of the 18-21 year old age group.
3. The 18-21 year old age groups were obtained by summing births 18, 19, 20, and 21 years previous to the desired year. No correction was made for the differing mortality rates of the different ages.
4. The projected enrollment rate was obtained by connecting the two endpoints of the enrollment rates of the base period with a straight line and extending that line from the base period to 1987. This method increases the enrollment rate annually by the average annual increase during the base period. This projection method utilizes the data from only two years of the base period (the first and last years) and ignores the data of the other years.
5. Since the U.S. Office of Education first distinguished between public and private institutions in 1964, this study assumed the same control of institutions existed from 1950 to 1964 as existed in 1964.

Watkins. Beverly "Future Enrollments Now Seen Falling Far Short of Previous Projections." *Chronicle of Higher Education.* Vol. VIII-2, 1973.

The author reported that both the Carnegie Commission and the National Center for Educational Statistics have revised recent enrollment estimates downward. The Carnegie Commission reduced their estimates of total enrollments from 13 million to 11.4 million in 1980 and from 16.6 million to 13.7 million in the year 2000.

The author cited the demographic changes behind this revision as follows:

1. High school graduation rates are leveling off.
2. Fewer 18-21 year olds are going to college despite their increase in number.
3. The percentage of college age white males attending college is decreasing and the percentage of college age white females is leveling off.
4. While non-degree credit enrollments are rising. degree credit enrollments are leveling off or decreasing.
5. Graduate resident enrollment is leveling off and first professional degree enrollment is rising.
6. The United States birth rate is decreasing.

ALABAMA

Alabama State Commission for the Higher Education Facilities. *Alabama Institutions of Higher Education Enrollment Projections. 1971-1980*. 1971.

The purpose of this study was to develop a computer program to yearly update 10 year enrollment projections. Method 1 projected a pool of high school students (private schools were not included) which were used to project freshmen who in turn were used to project total enrollments by institution. These were then summed for the state. Sophomore. junior and senior data were not used. Method 2 was the same as method 1 but projected by the type of institution and then summed for the state. Method 3 used the ratio of first time students by type of institution to the college-age population for projection and then obtained the total. Method 4 projected the total and then obtained first time students. The college-age population was defined as 18-24. Data from 1962 were used as the base period. Linear regression was used but it was assumed that if a negative slope existed. the proportion would decrease at a slower rate each year and approach a steady state. The same assumption was made for an increase. The method was apparently subjective.

ARIZONA

Thomas. Alfred. *An Enrollment Forecast for Arizona State College at Tempe*. 1953.

This study was essentially a very detailed and in-depth summary of data about Arizona secondary education and enrollment at Arizona State College at Tempe. The study was divided into three parts. The first contained a review of national projections. Part two was concerned with data relevant to elementary and secondary enrollment in Arizona. Part three contained a large amount of information about Arizona State College at Tempe. Total enrollment was projected for only two years (1960 and 1970). No methodology was presented. Attempts were made to interpret past enrollment trends as results of various policies.

Brown, C. Harold. *Demographic Factors Associated with Higher Education in Delaware and Enrollment Projections from 1966 to 1975.* University of Delaware. 1966.

This study estimated college-age population by the census method to account for high migration. This method uses population data, births and deaths to estimate migration for a given pe. iod. Enrollments projected only full-time undergraduate students for the three state institutions. The base period was from 1960 to 1966. A linear regression model applied to the proportion of the college-age population (18-21) was used. Confidence intervals were given for the projections—a questionable procedure on extrapolations.

The following assumptions were made:

1. The trend of in-migration and out-migration of college-age youth will remain the same.
2. The basic policies of admission and retention will remain the same.
3. There will be no major wars. etc.
4. The proportion of high school graduates who attend out-of-state institutions will remain the same.
5. The availability of physical facilities and operating costs will keep pace with enrollments.

Rives. Norfleet W., Jr. *Delaware Population and Higher Education Enrollment: Current Estimates and Projections to 1990.* University of Delaware. 1973.

This study presented a method for estimating the population by age group in a state that has a heavy in-migration. An estimated college-age cohort group of 18-24 was used to project resident undergraduate enrollments which were converted to FTE.

Three projections were made under the following different assumptions:

1. A constant rate which was the average of the last 3 years was assumed. This rate was 16% of the age population.
2. An increase over the average of the last 3 years which was assumed to reach a rate of 20% of the age population by 1990.
3. An increase over the average of the last 3 years whicn was assumed to reach a rate of 25% by 1990.

The state totals obtained were distributed among institutions. The public sector was assumed to grow from 90% to 93%. One method assumed the same proportion would be in the individual institutions as that which currently exists. Another method assumed differential growth. All the decisions appeared to be subjective.

Froehlich, G. J. and Carey, R. C. *Higher Education Enrollment in Illinois 1960-2000.* University Bureau of Institutional Research, University of Illinois, Urbana. December, 1969.

This study projected enrollment in the State of Illinois by level from 1970-2000. The ratio of students to 18-21 year olds was used. Enrollment by level was obtained by applying the percentage of the total enrollment in 1969. No actual model was presented. Subjective judgment appears to have been used freely.

Methodology:

1. The study compared the 18-21 year old populations of Illinois and the U.S.
2. To obtain the Illinois population of 18-21 year olds previous to 1985, birth data were used. For 1985 to 2000, Census Bureau projections were used. Figures for Illinois were available at five year intervals. Figures for the intervening years were obtained by applying to national figures the percentage that the 18-21 year old population of Illinois would be of the U.S. 18-21 year old population. The percentages were arrived at by interpolating the figures given at five year intervals.
3. The enrollment rate of 18-21 year olds in Illinois was projected by applying its average annual increase experienced between 1960 and 1969.
4. This rate was then adjusted for the effects of the Viet Nam War and of new colleges. Methods of adjustment were not presented.
5. The enrollment rates for the latter part of the projection period were obtained by a different method which was not presented.
6. The enrollments by level (upper and lower divisions, professional and two graduate levels) were obtained by dividing the total enrollments by the proportions experienced in 1969.
7. A comparison of this projected enrollment to the sum of the projected enrollments made by the individual institutions showed the sum to be 5 to 15 percent higher for total enrollment. A comparison of enrollment projections by level showed great variation in the projections' differences.

Elliott, T. M. *College Attendance in Indiana*. August, 1969.

This study projected total undergraduate enrollment by level (freshman, sophomore, junior, and senior) in Indiana for 1969-1985. Linear regression was used to obtain freshmen, and advancement ratios were used to obtain the other categories. The study also included a census of Indiana freshmen from 1968. This included much county and regional data. Some of its highlights were:

1. Approximately 85% of the freshmen in public regional campuses were from the immediate geographic region of the campus.
2. There was a net in-migration of freshmen to Indiana.
3. The ratio of Indiana residents who were freshmen anywhere to Indiana high school graduates was 0.66. This compares to a value of 0.54 obtained for 1960.
4. Approximately 78% of the freshmen enrolled in Indiana were Indiana residents.

The census did not include Ancilla Domini, Frankfort Pilgrim, or Indiana Vocational Technical College. The projection apparently included the first two.

Methodology:

1. A 1950-1968 data base was used.
2. Freshmen were projected for Indiana by a multiple linear regression technique that used the ratio of freshmen to births 18 years previous as the dependent variable and time and the number of births 18 years previous as the independent variables. The former was found to be the dominant independent variable. A slight negative weight was found to be associated with the latter independent variable. This would lower abnormally high projections and could be due to the fact that a large number of college freshmen are not 18 years old.
3. Sophomores, juniors and seniors were obtained by using advancement ratios averaged over the most recent five years.
4. Total undergraduate enrollment was obtained by summing these four categories.

Gunderson, T. N. *Projections of Enrollment in Indiana Colleges and Universities, 1972-1982*. February, 1972.

This study projected enrollments in the state of Indiana by control (public, private, public-main campus and public-regional campus) and level (freshman, sophomore, junior, senior, graduate and other) for Indiana institutions through 1982. Projection was by means of linear regression on the enrollment rate to predict freshmen. Other levels were calculated by applying advancement ratios.

Methodology:

The projections included Indiana Vocational Technical College. The data base used was the fall enrollments as reported to IACRAO for 1967-1971. This short base period was thought better than a longer one due to changing policies. Linear regression was used with time as the independent variable and the ratio of freshmen to births 18 years previous as the dependent variable. First professional enrollment was included with graduate enrollment.

A. Projection of statewide enrollment

  1. Linear regression was used (as stated above) with state births to obtain freshmen.
  2. Sophomores, juniors, and seniors were projected using advancement ratios averaged over the ten most recent years.
  3. Graduate students were obtained by applying a five year average of the ratio of graduate students to the sum of freshmen of the year of interest and the seniors of the previous year.
  4. The number of "others" was set arbitrarily equal to 10.000.

B Projections by type of control (public. private. public-main campus and public-regional campus)

  1. Method I used the freshmen predicted for the state and allocated them to control type by the control type's percentage of state freshmen. This percentage was obtained by using linear regression on it as a function of time.
  2. Method II projected freshmen for each control type as they were projected for the state total.
  3. In both methods. categories other than freshmen were projected by methods similar to those used for the state.
  4. It was noted that the projections of methods I and II were very close. The statewide projection was slightly higher than the sum of the private and public projections.

Parkhurst. N M. and Suddarth. Betty. *Potential Enrollment For Indiana Colleges and Universities. 1955-1972.* Indiana Conference of Higher Education. 1955.

Projections of enrollments were made for Indiana from 1955 to 1972 based on 1933-1954 (including and excluding 1943-1950 as "atypical") data. Several models were used including one projecting by class and using advancement ratios. High school graduates and 12th graders were also projected. While detailed methodology and alternatives were presented. Model C was recommended.

Methodology:

1. The base periods were 1933-1954, 1933-1942 and 1951-1954.
2. Population and birth data comparing Indiana and the United States were presented. Birth data were obtained and corrected for underregistration. Mortality rates were applied to obtain the 18-21 year old groups.
3. Projections
   a. Undergraduate projections using six models and two different bases were made.
   Model A used past enrollment as a linear function of time.
   Model B used past enrollment as an exponential function of time: $Z = ae^{bt}$.
   Model C used enrollment as a percentage of the college age population assumed to be a linear function of time.
   (1) Total enrollment of undergraduates for the state was obtained using 18-21 year olds. The same model was applied to individual colleges and the results summed to obtain the state total.
   (2) Freshman as a percentage of 18 year olds was projected for the state. Average advancement ratios were used to obtain other classifications. The same model was applied to individual colleges and the results summed to obtain the state total.
   Model D used enrollment as a percentage of 18-21 year olds assumed to be an exponential function of time: $W = ae^{bt}$.

   Model E used enrollment as a percentage of 18-21 year olds as a constant using the value in 1954. Model F used enrollment as a percentage of 18-21 year olds assumed to be a linear function of time until 30% was reached. Then the constant 30% was used. (This was the same as Model C until 30% was reached.)
4. Twelfth grade enrollment projections were made using three models.
   Model 1 used the ratio of those born 17 years earlier considered as a constant. The constant was obtained by applying mortality rates through age 12 and then advancement ratios for the 8th, 9th, 10th, 11th, and 12th grades. A 5% in-migration factor was also applied.
   Model 2 applied average advancement ratios (1948-55) to the enrollments in grades 1-12.
   Model 3 used the percentage of 17 year olds in the 12th grade as a linear function of time.
5. Graduate enrollment projections were made using two models.
   Model X assumed the ratio of graduate enrollment to the freshmen for the same year and the seniors for the previous year to be a linear function of time.
   Model Y assumed the number of graduates was a linear function of the freshmen for the same year and the seniors for the preceding year.

Parkhurst, Nelson and Suddarth, Betty. *Potential Enrollment for Indiana Colleges and Universities*. Higher Education in Indiana: Needs and Resources: 1968-1985. Indiana Advisory Commission on Academic Facilities. 1968.

Linear regression was used to project undergraduate and graduate enrollments for various institutions, the state and by men/women as a percentage of the college-age population. A mathematical summary is included.

Methodology:

1. Population and birth data were obtained. Births were corrected for underregistration and mortality rates applied to get 18-21 year olds.
2. Base period used was from 1950 to 1967.
3. Undergraduate projections were based on past enrollment expressed as a percentage of the college-age population. The percentage was projected as a linear function of time.
   a. Model UPM-1 was based on total undergraduate enrollment as a percentage of 18-21 year olds. The total enrollments were divided into classes based on average percentages for the last five years.
   b. Model UPM-2 was based on freshman enrollment as a percentage of the 18 year olds. Average advancement ratios were applied to obtain other classes.
   c. Model UPM-3 and Model UPM-4 were the same as Model UPM-1 and Model UPM-2 but were obtained by institutions and then totalled for the state.
   d. Additional categorizations by men and women, size of institution, and public/private were obtained by various linear regressions.
4. Graduate projections were made by using a linear relationship between time and the ratio of graduate students to the sum of the freshmen for the same year and the seniors for the preceding year. This ratio was applied to both Model UPM-1 and Model UPM-2.
5. Regional campus enrollments were projected also as a percentage of the 22-35 year olds for the appropriate county.

Cresap. McCormick and Paget, Management Consultants. *An Enrollment Projection Study.* Iowa Coordinating Council for Post High School Education. August, 1968.

This study. prepared by management consultants, projected headcount and FTE enrollment by sex. student origin, attendance status (full and part time), and institution. Projections were made for 39 private colleges. 3 Regents' institutions, and 15 area schools in the State of Iowa. Proprietary vocational-technical schools were excluded. No model was presented. Projections were made through 1980.

Methodology:

No actual methodology was presented although references were made to numerous interviews and questionnaires which were used. Mention was made that college enrollment rates were forecast using population projections. Several adjustments were made to the projections. These included:

1. Iowa resident enrollment in private colleges was adjusted downward.
2. Projections of area schools were scaled downward on the basis of tax bases and demographic bases.
3. The growth of the Regents' institutions was adjusted to reflect out-of-state recruiting efforts.

Some of the factors considered were:

1. For private schools

   a. The effect of tuition aid programs in neighboring states on Iowa's in-migration.
   b. The developing system of area schools.
   c. Enrollment ceilings.
   d. Out-of-state recruiting policies.

2. For area schools

   a. Major demographic trends of the district.
   b. The district's level of industrial development.
   c. Proximity to Regents' and private institutions.
   d. Emphasis to be placed on the arts and sciences curriculum.

3. For Regents' institutions

   a. The number of expected transfers from junior colleges.
   b. The effect of area schools on lower division enrollments.
   c. The demographic base of the college age population.

Midwest Research Institution. *An Enrollment Projection Study*. For Norman Kladstrup, Higher Education Facilities Commission of the State of Iowa. 1973.

This study, initiated by the Higher Education Facilities Commission for the State of Iowa, projected enrollments by Regents' (public universities), private, and area (community) schools. Projections were subdivided also by graduate and undergraduate, male and female, full-time, and part-time, and resident and non-resident.

Methodology:

Estimates were made to obtain the 18-24 year old population for Iowa. A "propensity" factor, the percentage of college-age population (18-24) going to college, was projected using a first order autoregression equation. The equation was given but a subjective factor added was not given. The specific base period was not mentioned but the figures indicate the period started with 1960.

The "propensity" factor projection was used as follows:

1. Total headcount for the state was obtained using the estimated 18-24 year olds.
2. Second degree polynomial regression analyses were used on the propensity factor to portion out the type and institutional share. The same technique was used for other subdivisions but no equations or base period were presented.

Additional factors considered were:

1. Adult education was difficult to define and almost impossible to predict. Data were not available for the University of Iowa. No adult education projections were made.
2. Migration was eliminated as a factor.
3. No predictions were made for specialized schools such as business or nursing.
4. Projections were adjusted subjectively by a factor called a "shock" factor.

Anderson, Kenneth E. and Smith, George B. *A Study of Enrollment Trends in Higher Education in Kansas*. State Education Commission. February, 1973,

This study projected total headcount enrollment from 1973-82 by institution for the State of Kansas. Total state enrollments were projected using linear regression on the sum of the 12th graders of the previous four years. Enrollments were assigned to an institution by applying its percentage of the Kansas enrollment. This percentage was obtained by using linear regression, from 1951-1972. The actual equations and coefficients used are given.

Methodology:

1. The study excluded vocational-technical colleges.
2. Enrollment in Kansas elementary and secondary schools was compiled.
3. Survival rates were calculated to project the number of 12th graders.
4. The sum of the 12th graders of the previous four years was used as the population base to project total headcount enrollment.
5. These data (1954-55 to 1971-72) and the total headcount enrollment (1955-56 to 1972-73) were used as the two variables in a linear regression equation.
6. The percentage each school's enrollment is of the state total was tabulated for 1963 to 1972 and a projection of percentages obtained by linear regression for 1973 to 1982.
7. These percentages were applied to the projected total enrollments.
8. In cases of short histories, an average percentage increase was used to project the desired percentages.
9. The standard error of the fitted line was calculated and upper and lower limits on the projected numbers were obtained by adding and subtracting one standard error. By the author's admission, the application of a standard error to an extrapolation is of dubious value.

Thompson, Ronald B. *Projected Enrollments, Colleges and Universities, Commonwealth of Kentucky, 1972-1985*. 1972.

This study projected headcount and FTE enrollments by institution for all colleges and universities in the State of Kentucky by level (graduate and undergraduate) through 1985.

Methodology:

The methods used are virtually identical to the 1973 Ohio study by the same author which has been reviewed in more detail in this report. The demographic base used was a one to three county area for those institutions drawing at least 70% of their enrollment from that area. For those with more geographically dispersed enrollments, the state as a whole was used. The FTE figures were obtained by using a five year (1967-1971) average of the percentage FTE enrollment was of headcount enrollment.

Louisiana Coordinating Council for Higher Education. *Enrollment Estimations for Twenty-Four Public and Private Institutions of Higher Education, State of Louisiana.* 1973.

This study utilized births for each parish (county) to estimate first grade enrollments. Grade to grade enrollments were then generated from there. Thus, the number of 12th graders graduating from high school was estimated. A two year average of the ratio of high school graduates to college freshmen the following year was used and increased by ': of 1 percent each year starting in 1971 to obtain statewide freshman projec: ·ns. These were allocated to individual schools on the basis of their average for the last two years. Also, two year average advancement ratios were used for other classes. Unclassified. law and evening division students were estimated on the basis of a two year average ratio with the total undergraduates. Masters degree enrollments were based on previous senior enrollments. Doctoral degree enrollments were based on masters degree enrollments. No additional methodology was given.

The following assumptions were given:

1. The live birth *rate* will continue to decline. (The authors used the term "birth rate" but they were referring to live births.)
2. The percentage of high school graduates entering college will remain the same.
3. Attrition rates will remain stable.
4. Institutions will attract the same percent of high school graduates, transfer students and out-of-state students.

Nebraska Higher Education Facilities Commission. *Nebraska Enrollment Projection System 1972-1977.* 1973.

This study included the traditional postsecondary institutions subdivided by public and private. The vocational technical schools were not included because of definitional problems and lack of data. A computerized system was developed for long range planning. It was not intended for direct use in the budgetary process. The study stated that the projection depends on the accuracy of the historical data and the continuation of current trends. The projections used the previous year's data although some use was made of historical trends for incoming students.

The following subsystems were described:

1. The Statistical Enrollment Projection Subsystem
   a. This system decides, using historical data, how many students will move into postsecondary institutions from the twelfth grade. In-state freshmen are estimated by county.
   b. Out-of-state freshmen, new graduate students and new professional students are also obtained from this system.
   c. State-wide projections are distributed to the institutions on the previous year's percentages.
2. Student Flow Subsystem
   a. Inputs include incoming students from 1 above, transfers and continuing students. The University of Nebraska could not provide transfer data which could affect the projections.

Springer. Colby H. and Strumwasser. Michael J. *Nebraska Enrollment Projection System. An Overview.* Systems Research Inc. 1972.

This report discussed the development of "The Nebraska Enrollment Projection System". The system depends on a data base representing historical data that can be revised each year and allows for feedback. It included all the institutions of the state. Projections are made in the aggregate to preclude over-projection by institutions. Problems involved in the definitions of categories were discussed.

The following four methods were discussed:

1 Survey-sampling techniques which identify representative samples and question these individuals about institutional preferences and enrollment plans.
2 Demographics defined as projections based on population estimates and participation rates.

3. Ratio techniques defined as techniques utilizing the probabilities of moving from one "state" to another.
4. Markov process which is similar to 3 but can represent more subdivisions, for example. transfers, beginners, exits, etc.

Methodology:

A. The Student Flow Model was based on a Markov process which utilized the following information:

1. First time entering freshmen from Nebraska high schools, by county, were distributed according to institutional tradition.
   a. A regression or "relationship" was utilized between new freshmen in a given year and the average number of freshmen for the previous four years and the number of 12th graders from the previous year. Other variables were tried but they did not add anything.
2. First time entering freshmen from outside the state.
   a. Out-of-state freshmen were projected as a fraction of in-state freshmen for each institution using the latest observation.
3. Students entering graduate school.
4. Students entering professional schools.
   a. New students for graduate and professional schools were based on the average increase for the last three years if it was monotonically increasing. Otherwise the average of the last three years was used.
5. Other student categories, such as, continuers, transfers, etc., were based on prior year distributions. It is possible to override these probabilities if desired.

Educational Research and Services Corporation. *New Hampshire Higher Education Enrollment Projections, 1969-1970 Report.* New Hampshire Higher Education Facilities Commission. 1970.

This study projected first time undergraduates from New Hampshire by high school and contrc; of postsecondary institution attended (four year institutions and other institutions). The study included a review of a few other studies.

Methodology:

No actual methodology was presented. The nember of high school graduates from each New Hampshire high school was projected for ten years. These were categorized as those going on to four year postsecondary institutions, those going on to other postsecondary institutions and those not going on to postsecondary institutions. Projections were "based on current education patterns of high school graduates as reported by the New Hampshire State Education Department".

Shea, Thomas H. *Enrollment Projections: 1968-1980—New York State Higher Education.* State Education Department, Office of Planning in Higher Education. 1968.

This study projected enrollment by year until 1980, by control (State University of New York, City University of New York, private schools) and by level (associate, baccalaureate, first professional, graduate) using high school graduates and increasing trends. It assumed a positive change in the in-migration of students. No mathematical model was presented although one was apparently used. Subjective factors were allowed to influence the projections.

Methodology:

A. Planning Projection

The specific mathematics were not presented. The study provided an update and an incorporation of a 1967 "historical trend" model. Certain other factors were used to modify the 1967 projection. Specific aspects included:

1. The historical trend projection was based on the ratio of undergraduates to the sum of the four preceding years' high school graduates averaged over the last three years. The categories—undergraduate, graduate, and first professional—were projected on a statewide basis.
2. "A growth factor projection" projected enrollments in 12 categories of a 3x4 "matrix": State University of New York, City University of New York, and private institutions versus associate, baccalaureate, first professional, and graduate. Assumed constraints on expansion of facilities were incorporated. The "best fit" for the data was obtained by applying projection factors to the base year 1964, and projecting also 1965, 1966, and 1967 enrollments.
3. An "attractiveness index" was applied to each category. It assumed an increasingly positive change in the in-migration of students. This was based on the belief that New York colleges would become more attractive to students. Graduate students were projected as an increasing ratio to undergraduates.
4. A "composite projection" was arrived at by incorporating all of the above.

B. Potential Projection

This predicted the number of students that "should" attend college if all financial restrictions were removed. It assumed that a certain percentage of high school graduates aged 18-24 "should" attend. Attrition rates were arrived at by intuition to project enrollments beyond the freshmen level.

OHIO

Thompson, Ronald B. *Projected Enrollments, Institutions of Higher Education, State of Ohio 1973-1982.* June, 1973.

This study projected headcount enrollments by campus and level (undergraduates and graduates) for all institutions in Ohio by year through 1989. The projection utilized county births, first grade enrollments, and high school graduates. Specific projection models were not presented.

Methodology:

A. For each county the following was done:

 1. Births were tabulated (1942-1971).
 2. First grade enrollment was tabulated (1948-1972). Data on enrollments in private elementary schools previous to 1968 were not available. Therefore, an estimate was made based on the ratio of total enrollment to public enrollment for 1968-1972.
 3. The ratio of first grade enrollment to births six years previous was calculated. Based on this data, the first grade enrollment was projected for 1973-1977. No specific method was given.
 4 High school graduates were tabulated (1969-1972). Data from private schools were created by decreasing fall 12th grade enrollments by 2% for 1968-1972. Data previous to 1968 for private schools were estimated as in 2 above.
 5. The ratio of high school graduates to first graders twelve years previous was calculated. This ratio was projected and applied to first grade enrollments to obtain projected high school graduates. No method was presented although it was noted that comments from school superintendents were used to modify the projections.
 6 Four and two year "potential college attendance" pools were obtained by summing the number of high school graduates for the appropriate years.

B. The enrollment of each campus in each county was established. An area consisting of the counties from which the campus drew at least 70% of its enrollment was then found The potential four and two year enrollment pools for each area were calculated by summing the respective pools over the counties of the area.

C Campus projections

 1 For undergraduates. enrollment as a percentage of the potential pool was projected through 1989.
 2 For graduate students. the two year potential pool of four years earlier was used. Enrollment as a percentage of this pool was then projected through 1989. This assumed that most graduate students are enrolled for two years and begin immediately after receiving a baccalaureate degree.

3. The projection technique was not presented. However, most campuses were projected to have a constant percentage of their pool after slight dips or rises. Schools having professional students whose enrollment is arbitrary were allowed to make their own projections. Institutional enrollment ceilings and plans to expand from two year to four year programs were used as guidelines.

VIHGINIA

State Council of Higher Education for Virginia. *Higher Education And Projected Enroll-ment 1960-1982.* October, 1972.

This study projected headcount and FTE enrollment as a total in Virginia public and private colleges. It included Virginia students goi..g out of the state and out-of-state students coming into Virginia. The projection used 18-21 and 18-24 year old age groups.

Methodology:

A general description rather than an actual model was presented. The use of several assumptions was not clearly defined. Historical bases were not always presented. Three series of projections were made. The assumptions made included:

A. General assumptions

1. A minor decrease in net out-migration. (This was based on a planned develop-ment of community colleges.)
2. Retention rates woulo remain the same.
3. A significantly larger number of transfer students would add to junior class enrollments of senior colleges.

B. Series 1 assumptions

1. There would be a rapid increase in enrollments in the first half of the 1970's due to the expansion of community and regional colleges. A more moderate increase in the enrollment rate would occur in the latter part of the decade. The decade's average annual increase in the enrollment rate would be 75% of the average an-nual increase from 1960 to 1970. However, 89% of the increase would be between 1970 and 1976, and after 1976, the enrollment rate will increase but at a decreasing rate.
2. There would be no major financial aid changes.
3. Tuition and fees wou,d remain essentially unchanged in constant dollars.
4. Virginia would not reach the national average in terms of the percentage of students graduating from high school.

C. Series 2 assumptions

1. Community colleges would exert a greater influence on increasing the enrollment rate beyond 1976 than in series 1.
2. Increased financial aid would increase the enrollment rate.
3. The percentage of students who would be graduating from high school was higher than that assumed for series 1.

D. Series 3 assumptions

This was a projection of a goal and reflected what the authors believe should but not necessarily would occur. The desired goal was for Virginia to achieve the national enrollment rate by 1980.

E. Specific methods used

1. The enrollment rates of 18-21 and 18-24 year olds were used. The study did not specify which age group was used with which projection series.
2. Comparisons of projections based on four different age groups from 18-34 years old showed no significant differences.
3. Projections for students in the private sector, going out of the state, and coming from out of the state were common to all series.
4. Private sector enrollment was assumed to increase at an annual rate of 2% through 1978 and more slowly after that.
5. The number of out-of-state students attending public colleges in Virginia was found by assuming that their percentage of total public enrollment would be 16.4% in 1980, a figure slightly less than the figure at the time of the projection.
6. The number of out-of-state students attending Virginia private colleges was obtained by assuming their percentage of total private enrollment to be constant.
7. FTE enrollment was projected based on its historical ratio (not presented) to headcount enrollment. The ratio was projected to dip until 1976 and remain constant afterwards.

WASHINGTON

Office of Planning and Fiscal Management. *Higher Education Enrollment Projections.* Olympia, Washington. 1970.

This study provided a software package utilizing Markov and student flow techniques designed to project undergraduate enrollments by class level by institution for the State of Washington for as many years as desired. No actual projections were presented. The study included a good overview of several enrollment projection techniques. It also reviewed the flow model of the National Center for Educational Statistics which was similar to the one developed in the study.

Methodology:

Projections could be obtained by this model year by year with the previous year's projection needed before the next can be made. Two types of input are needed: the enrollments from the previous year and various demographic data. Probabilities of students moving between various categories are applied to these inputs, and the enrollment is projected for the next year. This can then be used as input data for the succeeding year's enrollment projection. Specific aspects include:

1. Undergraduate students are kept track of by class level and by institution.
2. The demographic inputs include:
   a. The number of high school graduates in Washington (This must be obtained independent of this model.)
   b. The number of 18-29 year olds in Washington (This is used to project those in the military, "other in-state", and "other out-of-state" categories. These three categories and the number of high school graduates are the inputs from which new entrants are calculated.)
3. A matrix which contains the probabilities of students moving from one category to another is applied to the enrollment and demographic inputs. The result is the succeeding year's enrollment classified by level and institution.
4. The probabilities of the transition matrix are constant throughout the projection period, and thus no trends can be incorporated. The model might be modified to allow for the inclusion of trends. No attempt was made to do this, however.
5. Within the transition matrix, students are categorized as entrants, continuers, transfers, and exiters.
6. The student classifications of first professional, graduate and special are projected by the individual institutions and added on.
7. FTE's are generated by applying a ratio by level and institution to the headcount.