

AN ANALYSIS OF STUDENT ACCESS AND FINANCIAL
SUPPORT MEASURES IN HIGHER EDUCATION

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CHAPTER I

INTRODUCTION

Background and Origin of the Study

A major goal of states and the Federal Government in higher education has been to increase student access and equality of opportunity. Full and equal access to higher education is the right of every person capable of benefitting from some form of postsecondary education.¹

Most educational planners now agree that access to higher education for all students should be realized. Authors such as Cross go further and call not for access, but also for accommodation. They hold that the past decade was devoted primarily to removing barriers to admission and to offering remedial programs throughout elementary, secondary, and postsecondary education so that students could fit into the existing system. According to Cross:

The emphasis will change from moving students toward higher education to moving education toward students. The 1970s have brought the realization that success at academic tasks in the past is not an infallible predictor of success in the future, especially when past opportunities for learning have not been equal for groups at differing locales, ethnic backgrounds, and socio-economic status . . . Both access and accommodation are designed to narrow the gap between

¹ National Task Force on the Accountability of Higher Education to the States, Accountability and Academe (Denver, Colorado: Education Commission of the State, July, 1979).

educational opportunities and students, and both are important.²

(Superficially, there appear to be few financial problems facing most college students today, as students in large numbers are attending college. But contradicting these superficial appearances are certain facts. (There is a high correlation between college attendance and family income.) Although there has been argument whether the principal factor has been lack of motivation or lack of money, there has been little doubt that money is an important factor.³)

The nation has been aware that equal opportunity is not available to all. The participation of students from low income families in postsecondary education is considerably lower than those from higher income levels. Participation of minority group students in college has increased in recent years but is still below the participation of minorities in the population, and many high ability students do not go to college.⁴

The Committee for Economic Development⁵ indicated that there was a need to equalize educational opportunity for students from different

² Patricia Cross, Planning for New Students to Higher Education in the 70s (Berkeley, Calif.: The Center for Research and Development in Higher Education, 1971b), p. 5.

³ Nicholas C. Brown, Higher Incentives and Obstacles (Washington, D. C.: American Council on Education, 1959).

⁴ U. S. Department of Health, Education and Welfare, Office of Education, Trends in Postsecondary Education (Washington, D. C.: U. S. Government Printing Office, 1970).

⁵ Committee for Economic Development, The Management and Financing of Colleges (New York: Committee for Economic Development, 1973).

income levels. The second Newman Report⁶ recommended that postsecondary education should be made available to all segments of the population, minorities, women, students beyond the traditional college age, and students with limited income.

The Coleman Report⁷ noted that equal opportunity was an evolving idea not subject to easy definition. It has many facets and is subject to many conflicting frames of reference. Nevertheless, one important barometer of equal opportunity is the accessibility of higher education to its potential clients. Historically, higher education in the United States until 1940 was largely for the elite. From 1940 to 1970, the country moved to mass higher education, and from 1970 to the year 2000, it will move to universal access.⁸

Financing of higher education institutions in the United States has always been a significant part of the budget of the individual states. The general court of the Massachusetts Bay Colony provided the first such financing almost three hundred and fifty years ago, on October, 1636, when it passed the legislative act that founded Harvard College.⁹ The States and the colonies before them, have been involved

⁶Special Task Force to the Secretary of Health, Education and Welfare, The Second Newman Report: National Policy and Higher Education (Cambridge: The M.I.T. Press, 1973).

⁷James S. Coleman et al., Equality of Educational Opportunity, U. S. Department of Health, Education and Welfare, Office of Education (Washington, D. C.: U. S. Government Printing Office, 1966).

⁸Carnegie Commission on Higher Education, New Students and New Places (New York: McGraw-Hill Book Co., October, 1971).

⁹Center for the Study of Higher Education, Financing Postsecondary Education in the 1980s (University of Arizona, August, 1979).

in the development of higher education since the founding of Harvard. This involvement sometimes has been relatively passive and sometimes very active as, for example, in the period after the Civil War with the development of Land-Grant universities.¹⁰

Today, the financing of postsecondary education is a responsibility shared by students and their families, government at all levels, philanthropic organizations and individuals, and the institutions themselves.¹¹ State and local governments are the single most important source of financial support to American higher education. The significant role of state and local governments in financing higher education presents an incentive to understand and evaluate that support. The differences and complexities of financing among the states is a consequence of state education tradition and objectives, including such factors as the role of the private sector, government taxing capacity, college preparation and high school graduation rate. Analyses of differences in influences of these factors on postsecondary education financing and comparisons between states and analyses of the factors in each state are inevitable.¹²

From the perspective of statewide planners, two major goals of

¹⁰The Carnegie Foundation of the Advancement of Teaching, The States and Higher Education, a Proud Past and a Vital Future (San Francisco: Jossey-Bass, 1976).

¹¹National Commission on the Financing of Postsecondary Education, Financing Postsecondary Education in the United States (Washington, D. C.: U. S. Government Printing Office, December, 1973).

¹²U. S. Department of Health, Education and Welfare. Higher Education Financing in the Fifty States, Interstate Comparisons, Fiscal Year 1976 (Washington, D. C.: U. S. Government Printing Office, 1979).

higher education were equality of access, particularly for disadvantaged, minority, and other nonparticipant students and availability of a variety of educational opportunities, including vocational, technical, geographical, and other considerations.¹³

Purpose of the Study

All states which have identified state goals for higher education have included a goal or goals related to improving access for the population. Thus, through a variety of financial patterns the states are attempting to fulfill the goal of access. Since goals should be reflected in financial support patterns, one would expect to find a relationship between these patterns and the goal of access.

The purpose of this study was to explore the relationships among selected variables related to state finance and access to higher education at the state level. Specifically, a factor analysis of selected variables was completed in order to identify major factors which would help to explain patterns of finance and access at the state level.

¹³National Center for Higher Education Management Systems, State-wide Planning for Postsecondary Education: Issues and Design (Boulder, Colorado: Western Interstate Commission for Higher Education, September, 1971).

CHAPTER II

A REVIEW OF RELATED LITERATURE

In order to bring the present study into better focus, review of scholarly works in the field was important. The review of literature helped to identify variables for study, and also resolve some problems encountered in earlier studies.

The current study was concerned with the analysis of access and financial support measures, and the initial section of this review includes a discussion of literature related to state level finance and access to higher education. The latter portion is restricted to literature related to factor analysis methodology employed as the principal analytical technique in this study. This included an outline of the background of the method and referenced the more widely used texts on the subject. Some examples of the employment of the technique were included.

Literature Related to State Level Finance and Access to Higher Education

Wilkinson¹ investigated the effect of state and federal financing on the equality of educational opportunity using cross-section data

¹Steven P. Wilkinson, "The Effect of State and Federal Funding on the Equality of Educational Expenditure" (Ph.D. Dissertation, Southern Illinois University, Carbondale, 1977).

from 21 states. He concluded that the greater the degree of centralized funding (the greater the portion of educational funds provided by state and federal government) within a state, the less the dispersion of levels of expenditures per pupil among educational districts within a state, had insignificant correlation.

Noonan² introduced a theoretical model relating cognitive output of school system to school and student inputs. School resources can be allocated in different ways among students with different levels of background inputs. According to the elitist mode of resource allocation, schools serving higher achieving students receive more resources than do schools serving lower achieving students. According to the egalitarian mode, provision of school inputs is independent of background input and achievement. According to the efficient mode, resources are allocated so as to maximize cognitive outcomes over all schools.

Noonan applied multivariate analysis for the data from ten countries: England, West Germany, Finland, France, Israel, Japan, The Netherlands, Scotland, Sweden, and the United States. Multiple correlation was calculated over the whole sample using expenditure per student as the criterion and achievement and SES as predictors. In six countries, the correlations were significant, but in Israel, Japan, Scotland, and Sweden they were not significant. Modes of resource allocation were defined at the national level. The former countries were defined as elitist and the latter as egalitarian. He

²Richard D. Noonan, "Equality and Efficiency in the Allocation of Resources Among Schools in Ten Countries" (Ed. D. Dissertation, Columbia University, New York, 1975).

concluded that the mode of resource allocation was not an isolated phenomenon, but part of a larger pattern. Egalitarian countries tended to have higher national mean levels of achievement after adjusting for curriculum differences. In egalitarian systems, schools tended to be heterogenous in SES, while the elitist tended to be more homogenous. Egalitarian systems were all comprehensive and the elitist systems were all selective, except for the United States.

Cardenas'³ study was addressed to the issue of equality of educational opportunity as it concerned higher education for Mexican-Americans. The concept of equality of educational opportunity suggested that schools and universities and all levels of government must take into account the economic, social, and cultural characteristics of the students' families, neighborhoods, and communities and provide relevant resources and attention to their particular needs.

The problem was diagnosed through the review of literature demonstrating a case of severe underrepresentation of Mexican-Americans in higher education in relationship to their population in southwestern United States. The conceptualization of this study was a direct result of the investigator's four-year experiential base with one of the college access programs in San Antonio, Texas. The findings of this study derived through a case study analysis resulted in the conclusion that the problem of Mexican-American underrepresentation in colleges and universities is complex and that there are many interlocking social, economic, and political forces affecting educational results.

³Isaac Cardenas, "The Equality of Educational Opportunity: A Descriptive Study on Mexican-American Access to Higher Education" (Ed. D. Dissertation, University of Massachusetts, Amherst, 1974).

The National Commission on Financing Postsecondary Education⁴ expressed concern that the participation rate in higher education for students from families with an annual income under \$10,000 is about 50 percent of that of students from families with an income over \$10,000. Students from families with incomes ranging from \$6,000 to \$7,500 are most underrepresented. The participation rates of Blacks, American Indian, and Mexican-Americans are exceptionally low. The participation rate of women would have to be increased by 25 percent to be equal to that of men. (The Commission identified eight major objectives for postsecondary education, three of which related directly to access: student access, student choice, and student opportunity. They suggested that the method of measuring access was to compare the distribution of students by income, race, and other characteristics with the distribution of the college age population according to those same characteristics to the extent that low-income students are underrepresented in the student population.) There was reason to believe that the objective of equal access was not being achieved.

The Commission also concluded that nearly 30 percent of the total local, state, and federal expenditures for postsecondary education were directed at the problem of access. These included talent search, upward bound, Basic Educational Opportunity Grant, college work-study and National Direct Student Loan, intended for low and middle-income students; and social security and veterans' benefits which, though not directed specifically at low-income students, nevertheless had a major

⁴National Commission on the Financing of Postsecondary Education, Financing Postsecondary Education in the United States (Washington, D. C.: U. S. Government Printing Office, December, 1973).

impact on access.

Another report of the National Commission⁵ defined the dimensions of student access, student choice, and student opportunity, and identified the initial measures of student access as income level, racial composition, ethnic group, sex, and family income. The measures for student choice were the extent to which persons from all income groups are enrolled in institutions with high, medium, and low student charges, and the distribution of low-income students among the various institutional types. Finally, the measures for student opportunity were the degree to which aptitude and educational achievement are correlated, and the extent to which students complete the program in which they enroll.

The International Encyclopedia for Higher Education⁶ gave examples of two temporary factors that include certain long-standing problems of educational access: equalization of opportunities and competition for limited public resources. It was implied that evidence of differential selectivity by social class and by racial, sex, or language group is still present and is used to challenge the legitimacy of selection procedures. Expansion and improvement of lower-level education are critical steps in relieving this problem. In the meantime, special recruitment procedures and supportive education programs are providing

⁵National Commission on the Financing of Postsecondary Education, A Framework for Analyzing Postsecondary Education Financing Policies, A Staff Report (Washington, D. C.: U. S. Government Printing Office, May, 1974).

⁶Asa S. Knowles, The International Encyclopedia for Higher Education, Vol. 2 (Washington, D. C.: Jossey-Bass Publishers, 1977).

short-range solutions in some countries. On the other hand, expanded higher education, particularly in times of inflation, is a costly venture. Arguments for education investment value, both for the state and for the individual, may still be valid but are now somewhat weakened.

In another volume of The International Encyclopedia of Higher Education,⁷ it was reported that the main goals of financial aid policies are similar throughout the world and usually include the social goal of equalization of access to higher education in terms of social, racial, or religious background, and economic goals such as the training of manpower needed for the nation's economic development or the redressing of regional imbalances in educational provision. Equalization of access is used as a means of equalization of opportunity and government financial aid attempts to redistribute income by opening access to higher income professions for students from social groups that have not previously had access to these professions.

Much of the financial literature of higher education in the 20-year period following World War II has been concerned with the financial problems created by a rapid increase in enrollment. A listing of college financial data was presented by Millet in 1952.⁸ This publication resulted from Millet's direction of the massive studies by the Commission on Financing Higher Education. He reported data for 1930, 1940, and 1950 on matters of cost analysis, source of income, student-faculty

⁷Asa S. Knowles, The International Encyclopedia of Higher Education, Vol. 4 (Washington, D. C.: Jossey-Bass Publishers, 1977).

⁸John D. Millet, Financing Higher Education in the United States (New York: Columbia University Press, 1952).

ratios, and dollars per student.

A similar effort during this period resulted in a publication entitled Financing Higher Education 1960-1970, edited by Keezer.⁹ This book contained twelve essays on various facets of financing higher education, the primary concern of which was toward projecting needs to 1970.

Chambers' work, Higher Education in Fifty States,¹⁰ was followed by a survey of financial practices in each of the fifty states. In each chapter, he gave a tabulation of appropriation, several relevant statistics reported on a unit basis, an analysis of state revenue structure, an analysis of the degree of political control of higher education, a description of the degree of political control of higher education, and a description of the statewide top echelon structures.

The Carnegie Commission also focused on these issues. In 1968, William Bowen¹¹ analyzed the economic pressure on the major private universities and attempted to indicate the nature and the magnitude of financial problems they faced.

The Carnegie Commission on Higher Education published recommendations in June, 1972, which were designed to lead to a more effective use of the resources available to higher education.¹²

⁹Dexter M. Keezer, Financing Higher Education 1960-1970 (New York: McGraw-Hill Book Company, 1959).

¹⁰M. M. Chambers, Higher Education in Fifty States (Denville, Illinois: The Interstate Printers and Publishers, 1970).

¹¹William G. Bowen. The Economics of Major Private Universities (Berkeley, Calif.: Carnegie Commission on the Future of Higher Education, 1968).

¹²Carnegie Commission on Higher Education, The More Effective Use of Resources (New York: McGraw-Hill Book Company, 1972).

With respect to equity, most of the recent literature has been concerned with who should pay for education, and how financial aid programs should be administered. The Carnegie Commission has recommended that the states continue to be the primary supporters of public higher education.¹³ The Commission suggested that the states should broaden the scope of their responsibility to encompass the whole range of postsecondary education.

Another Carnegie Commission study published its own recommendations under the premise that further federal support was necessary to achieve the goals of quality and equality.¹⁴

Caruther's study¹⁵ focused on the use of financial support ratios in comparing states' efforts in providing for public higher education. In particular, an attempt was made to determine which of these measures were most meaningful in assessing the adequacy of such report.

The main theme of this project revolved around the practice of using financial support information to assess the adequacy of funding for public higher education in the United States. The central topic considered included the identification of patterns of support measures and the selection of the "best" measures to fit each pattern. Factor analysis was employed as the principal technique. The data

¹³Carnegie Commission on Higher Education, The Capital and The Campus (New York: McGraw-Hill Book Company, 1971).

¹⁴Carnegie Commission on Higher Education, Quality and Equality: New Levels of Federal Responsibility for Higher Education (New York: McGraw-Hill Book Company, 1968).

¹⁵John K. Caruthers, "An Analysis of Higher Education Financial Support Measures" (Ed. D. Dissertation, Oklahoma State University, Stillwater, 1973).

for 1960 and 1970 and the differential data to identify change patterns over the ten-year span were used. He concluded from the original set of twenty-four variables chosen to assess the level of financial support for higher education within a state and it appears that as few as five measures can describe most of the data variation. Further, it seems that these five measures apply equally well to all fifty states with no regional adjustments being necessary. The five measures were appropriation per student, expenditures per student, appropriation per college age population, the proportion of college age population, and personal income per capita. Generally speaking, these are measures of operating support, total support, effort, need, and ability.

Little has been done in the areas above because data have been relatively scarce until recently. New sources of information in state financial patterns have recently become available for the first time. Higher Education Financing in the Fifty States: An Interstate Comparison, Fiscal Year 1976¹⁶ was jointly sponsored by the National Center for Higher education Management Systems (NCHEMS), and the National Institute of Education (NIE), and has identified various indices related to higher education financing and the socio-economic status of states that are used in the study. The state-by-state format is particularly useful in bringing together the complexity of factors that influence appropriations in each state. This publication, by including the most comprehensive set of statistics yet available about funding in the fifty states, is the primary data source for the current study.

¹⁶U. S. Department of Health, Education and Welfare, Higher Education Financing in the Fifty States, Interstate Comparisons, Fiscal Year 1976 (Washington, D. C.: U. S. Government Printing Office, 1979).

The four editions of the State Postsecondary Education Profiles Handbook (1976, 1977, 1978, 1979)¹⁷ present information about post-secondary education in the fifty states and the District of Columbia and they are cosponsored by the Commission, The National Center for Higher Education Management Systems (NCHEMS), and The State Higher Education Executive Officers Association (SHEEO).

Higher Education in the States¹⁸ published by the Education Commission of the States, contains the annual reports from 47 states, the District of Columbia, and two Canadian provinces focusing on problems, activities, achievements, and other areas of interest to the post-secondary education community.

The initial section of this review suggested that equality of opportunity could be attained by centralized funding, fiscal inequalization and greater financial support. Thus, equality of opportunity could be attained when financial supports are adequate.

A review of the literature also indicated measures which were used to define "access," and these included access measures were the family income, race, ethnic group, and sex. These could be attained by percentage enrolled classified by income, sex, age, and ethnic group.

Literature Related to Factor Analytic Methodology

Factor analysis is a branch of multivariate analysis that is

¹⁷ Education Commission of the States, State Postsecondary Profiles Handbook (Denver, Colorado: ECS, August, 1979).

¹⁸ Education Commission of the States, Higher Education in the States, Vol. 7, No. 4 (Denver, Colorado: ECS, 1979).

concerned with the interval relationship of a set of variables. Initially, it was developed mainly by psychologists, with Spearman¹⁹, Thurstone²⁰, and Burt²¹ as the most prominent pioneers, and was primarily concerned with hypotheses about the organization of mental ability suggested by the examination of correlation or covariance matrix for sets of cognitive test variates. Factor analysis is a familiar multivariate procedure in use by behavioral science researchers.

Factor analysis is a least square method which forms a linear space that minimizes the deviation of actual values from around this linear space. From this linear space, factors are formed (fewer in number than the set of variables) which describe the intercorrelation of the variables within the factors. The proportions which describe the variables are called factor loadings. The loadings reduce the number of concepts needed to characterize the relationship between the variables.

Factor analysis assumes that the observed variables are linear combinations of some underlying (hypothetical or unobservable) factors. Some of these factors are assumed to be common to two or more variables and some are assumed to be unique to each variable. The unique factors are then assumed to be orthogonal to each other. Hence, the unique factors do not contribute to the covariation between variables. In other words, only common factors (which are assumed much

¹⁹Charles Spearman, The Abilities of Man (New York: MacMillan, 1927).

²⁰Louis L. Thurstone, Multiple-Factor Analysis (Chicago: University of Chicago Press, 1947).

²¹Cyril L. Burt, The Factors of Mind: An Introduction to Factor-Analysis in Psychology (New York: MacMillan, 1941).

smaller in number than the number of observed variables) contribute to the covariation among the observed variables.

The statistical model of factor analysis is

$$(1) \quad Y = A X + \epsilon$$

$P \times 1$ $(P \times K)$ $(K \times 1)$ $(P \times 1)$

where Y = random vector of observation

X = vector of unobserved factors

ϵ = a random error vector

A = a matrix of regression weights with the $R(A) = K \leq P$

$$E(Y) = E(X) = E(\epsilon) = 0, \quad V(Y) = \Sigma, \quad V(X) = I, \quad \text{and} \quad V(\epsilon) = \psi$$

a diagonal matrix with elements greater than 0, then (1) implies that the matrix Σ has the structure

$$\begin{aligned} \Sigma = V(Y) &= V(AX + \epsilon) \\ &= AV(X)A' + V(\epsilon) \\ &= AA' + \psi \end{aligned}$$

By expanding (1), the linear factor analysis model equations become

$$Y_1 = \lambda_{11}X_1 + \lambda_{12}X_2 + \dots + \lambda_{1K}X_K + \epsilon_1$$

$$Y_i = \lambda_{i1}X_1 + \lambda_{i2}X_2 + \dots + \lambda_{iK}X_K + \epsilon_i$$

$$Y_p = \lambda_{p1}X_1 + \lambda_{p2}X_2 + \dots + \lambda_{pK}X_K + \epsilon_p$$

where the correlation among all pairs of errors is 0, for $i \neq j$, and the λ_{ij} are regression weights. For psychologists, the Y_i usually represents test scores, the λ_{ij} are termed factor loadings, and the

residuals ϵ_j are unique factors. Thus, each test is divided into a common part and a unique part:

$$Y_i = C_i + \epsilon_i$$

Factor analysis is used to investigate the unobservable C_i 's.

Corresponding to (1), a specific structure is given for Σ that partitions the variance of a random observation, Y_i , as

$$\sigma_i^2 = \lambda_{i1}^2 + \lambda_{i2}^2 + \dots + \lambda_{iK}^2 + \psi_i = V(C_i) + V(\epsilon_i)$$

where the variance of the common part of Y_i is called the common variance or communality of the response, and $V(\epsilon_i) = \psi_i$, the diagonal element of ψ is termed the unique variance or uniqueness of ψ_i . The uniqueness is that part of the total variance not accounted for by the common factors, while the communality is that portion of the variance attributed to the common factors.²²

Factor analysis has been used in economics to derive a set of uncorrelated variables for further analysis when the use of highly intercorrelated variables may yield misleading results in regression analysis. Political scientists have compared the attributes of nations on a variety of political and socio-economic variables in an attempt to determine what characteristics are most important in classifying nations (e.g., wealth and size)²³; sociologists have determined "friendship

²²Neil H. Timm, Multivariate Analysis With Application in Education and Psychology (Monterey, Calif.: Brooks/Cole Pub. Co., 1975).

²³R. J. Rummel, The Dimensions of Nations (Beverly Hills, Calif., Sage Publications, 1972).

groups" by examining which people associate most frequently with each other (and not with other individuals). Psychologists and educators have used the technique to determine how people perceive different "stimuli" and categorize them into different response sets, e.g., how different elements of language are interrelated.

Factor analysis, although subject to some misunderstanding by skeptics, has proven to be a reliable research tool. For data reduction and description application as required in this study, factor analysis has been an extremely effective tool.

CHAPTER III

METHODOLOGY OF THE STUDY

This chapter provides the details of the design and execution of this study of financial support and access measures for higher education in the United States. Initially, the data requirement and selection of variables relevant to the research are described; then emphasis is directed toward defining these variables in operational terms. The latter portion of the chapter is devoted to a discussion of operationalization of the factor analysis models.

Data Requirement and Selection

Any factor analysis research question requires a specification of entities and the variables to be analyzed. Generally, entities could be considered as any separable phenomenon which could be described, such as individuals, governmental units, business organizations, or physical items. In this particular study, the governmental units known as states in the United States were treated as the entities. The second dimension defines characteristics, attributes, or behaviors of these entities, such as abilities, physical size of individuals, or population characteristics. (The entities (states) in this study were described by measures of financial support and access for higher education.)

Selection of Entities

As discussed above, the entities to be used in this study were the fifty states and the District of Columbia comprising the United States of America. In this study, the term "state" applies to a geographical area circumscribed by political boundaries and including the major governmental unit within those boundaries.

Selection of Characteristics

(Attributes of a state which described 1) the level of financial support for higher education; 2) the level of access to higher education; 3) the ability to pay for services, and 4) other socio-economic characteristics that might be related to financial support or access) within a state were the relevant characteristics chosen for this study.

(In selecting the characteristic to be included in this study from an infinite set of possibilities, two criteria were employed. First, the related literature review (Chapter II) identified measures that had been previously proposed for comparing states on their ability and effort to support higher education and the socio-economic character of the states. A second criterion was that of data availability.)

Using these two criteria, twenty-eight measures or characteristics were defined; Table I lists the measures that were included in this study. The measures are described in Appendix A. (The major source of data was the Higher Education Financing in the Fifty States,¹

¹U. S. Department of Health, Education and Welfare, Higher Education Financing in the Fifty States, Interstate Comparisons, Fiscal Year 1975 (Washington, D. C.: U. S. Government Printing Office, 1979).

TABLE I
SELECTED VARIABLES RELATED TO FINANCIAL SUPPORT AND ACCESS
TO HIGHER EDUCATION

-
1. Entrance rate to public institutions
 2. First-time resident enrollment in public institutions/1000 population
 3. Retention factor in public institutions
 4. State and local tax capacity
 5. State and local tax effort
 6. State and local tax revenues
 7. State and local appropriation to public higher education
 8. State and local appropriation/student - public
 9. Tuition revenues/student - public
 10. Government grants and contracts/student - public
 11. Private gifts, grants and endowment income/student - public
 12. Other revenues/student - public
 13. Total E and G revenues/student - public
 14. Student aid/capita - public
 15. Institutional support/capita - two year public
 16. State and local appropriations/student - two year public
 17. Tuition revenues/student - two year public
 18. Total E and G revenues/student - two year public
 19. Institutional support/capita - independent
 20. Total E and G revenues/student - independent
 21. Student aid/capita - independent
 22. Geographic cost index
 23. Ratio: percent women in college/women in population
 24. Percent minorities in population
 25. Federal student aid/FTE student
 26. Other federal institutional aid/FTE student
 27. Percent students in private institutions
 28. Median income
-

which includes variables 1 through 22. Variables 23 and 27 come from The Digest of Education Statistics 1977-1978;² the source for variables 24 and 28 is the U. S. Bureau of the Census;³ and finally, the source of variables 25 and 26 is the Annual Report of the Commissioner of Education, Fiscal Year 1976.⁴ All data were for the year 1976. (The sources from which the necessary statistical information was collected and the computed values for each state discussed in the following section are described in Appendices B and C.)

Among these 28 characteristics of the states, the variables, entrance rate to public institutions, first-time resident enrollment, ratio percent women in college/women in population and federal student aid/FTE student, appear to be related to access to higher education.

Limitations

(The most significant limitation was the lack of data at the state level on college attendance by socio-economic levels. Other limitations included the necessity of utilizing proxy measures of access, the recency of data) (the latest available data of corresponding financial support and access measures was that of 1976).

²National Center for Education Statistics, Digest of Education Statistics 1977-1978 (Washington, D. C.: U. S. Government Printing Office, 1978).

³U. S. Bureau of the Census, Current Population Reports, Demographic, Social, and Economic Profile of the States - Spring, 1976 (Washington, D. C.: U. S. Government Printing Office, 1979).

⁴U. S. Department of Health, Education and Welfare, Annual Report of the Commissioner of Education: Fiscal Year 1976 (Washington, D. C.: U. S. Government Printing Office, 1978).

Definitions

Financial Support Measures. Measures that describe the amounts, ratios and categories of state financial support to higher education institutions.

Student Access. Each individual should be able to enroll in some form of postsecondary education appropriate to that person's need, capability, and motivation.⁵

Proxy Measures of Access. Measures that intuitively describe access or appear logically related to access. In this study, the variables identified as proxy measures are listed on page 23.

Operationalization of Factor Analysis

Factor analysis is a multivariate statistical technique used to study the interrelationships among a set of observed variables. Factor analysis assumes that the observed variables are linear combinations of some underlying latent and hypothetical set of factors. In this study, factor analysis was employed to identify fundamental and meaningful dimensions of a multivariate domain. The technique employed in this research was the R-technique.

R-Factor Analysis

The factor analysis most often reported in research articles has

⁵National Commission on the Financing of Postsecondary Education, Financing Postsecondary Education in the United States (Washington, D. C.: U. S. Government Printing Office, December, 1973).

been the R-technique. This technique indicates the extent to which the factors covary over a series of states under one condition. Using this method, the entities are the states and the characteristics become the variables. By factor analyzing the resulting 28 x 51 matrix, one can obtain a grouping of the variables (financial and access measures) in terms of the entities (states).

Steps in Factor Analysis

Factor analyses were originally devised to discover the factors underlying individual differences as measured by some criterion. The technique is applied to determine whether the states' differences are attributable to a single source of variation or whether they represent the operation of a combination of traits. In factorial investigation of financial and access measures, we proceeded on the assumption that these measures are structured somehow; that they are not a patternless mosaic of an infinite number of elements without functional groupings.

One might speculate why this information cannot be obtained from just looking at the correlation matrix (see Appendix D). If one is talking about a single correlation coefficient, it can be interpreted relatively easy. If the correlation is high, it can be assumed that there is considerable overlap between the performance of the two variables, and if the correlation is low, it can be assumed that there is little correlation between the two sets of variables. However, if one is faced with a large correlation matrix, it becomes almost impossible to explain all of the complex interrelations by looking at the values of the correlation coefficients. Factor analysis is one method of summarizing these relationships so that it is easier for the analyst to interpret and explain them.

By finding the factor loadings, the original data can be interpreted. The factor loadings can be interpreted to show three things: 1) they show the relative importance of each factor on each of the variables; 2) they show the net correlation coefficient between each factor on each factor and each observed variable. Finally, by squaring each of the factor loadings for the variables, we can tell how much of the variance of the variables is explained by the extracted factors.

The factor loadings can also be used to combine the variables into common groups by grouping the variables which have high loadings on a factor. The next step is to identify each factor by giving it some meaningful interpretation. This is accomplished by finding a common bond between each variable in the factor. In summary, factor analysis involves a number of steps: 1) gathering data on the important variables; 2) finding the correlation coefficients of each of the variables; 3) extracting the factors from the correlation matrix; 4) rotating the factor matrix to an orthogonal simple structure, and 5) interpreting the results from the rotated factor matrix.

Methods of Extracting Initial Factors

The main objective of the extraction step in explanatory factor analysis is to determine the minimum number of common factors that would satisfactorily produce the correlations among the observed variables. If there are no measurement and sampling errors and the assumption of factorial causation is appropriate for data, there is an exact correspondence between the minimum number of common factors responsible for a given correlation matrix and the rank of the matrix.

Rotation of Factor Matrix

The problem of selecting the "best" matrix of loading to reproduce the covariance or correlation is known as the rotation or transformation problem. Rotation allows the researcher using the factor analysis to transform the axes representing the common factors to form "meaning." The rotation step involves two major options--the orthogonal rotation and oblique rotation. Thurstone⁶ proposed the idea of simple structure as a means for finding interpretable factors. Various graphical and analytic techniques have been proposed to provide simple structure. Transforming for meaning is called exploratory factor analysis. In this study, both orthogonal (varimax, quartimax, and equimax) and oblique (Kaiser normalization) rotations were performed. Unless otherwise specified, data were reported from the reference structure oblique rotation. Generally, the factor loading matrices yielded by the various rotation techniques were highly similar, although the reference structure of the oblique rotation better defines the cluster of variables.

Orthogonal Rotation: Quartimax

The guiding principle of quartimax rotation is to make the complexity of a variable a minimum; that is, to rotate the initial factors in such way that a variable loads high on one factor but almost zero on all others.

⁶Louis L. Thurstone, Multiple-Factor Analysis (Chicago: University of Chicago Press, 1947).

Orthogonal Rotation: Varimax

In contrast to quartimax, which centers on simplifying the rows of a factor matrix, the varimax criterion centers on simplifying the columns of a factor matrix. In quartimax, many variables can load high or near high on the same factors as one with only 1s and 0s in the column.

Orthogonal Rotation: Equimax

Equimax follows the general line of reasoning of the quartimax and varimax criteria. It can be thought of as a compromise solution of the preceding two.

Oblique Rotation: Oblique

Oblique rotation is more general than is orthogonal in that it does not arbitrarily impose the restriction that factors be uncorrelated. In principle, the initial factor axes are allowed to rotate freely to best summarize any clustering of variable. Such rotation, however, can be achieved adequately only with some visual or graphical aid and the discerning eye of the researcher. The idea is to maximize the cross products of the factor loading on reference axes in order to simplify the primary factor loading.

Factor Loading, Factor Scores, and Percent

Variance Explained

"Factors" are intervening variables which can be related to a combination of measures of state characteristics. They are functional units or "structures" independent of each other, and when with

different degrees occurring together, explain the difference between one state system and another. They are the basic functional units that emerge from state interactional processes.

A "factor loading" is a number which describes the closeness of relationship between a measured variable and the factor. A higher loading shows a greater degree of involvement, and when two or more variables each have high loadings in the same factor pattern, this indicates that these variables are closely related to each other and to the factor. If the factor loading is squared, the resulting number is the percentage of variables that is accounted for by the factor. For the purpose of screening for the important variables in a factor, a criterion score ± 0.5000 for the factor loading was used.

The factor score illustrates the relationship of each case in a factor. In an R-analysis, the factor score identifies the states which had a major influence in determining a factor.

Knowledge of state policy would gain similarly if a set of essential elements could be found in terms of which differences between states could be explained. To paraphrase Thurstone: "What is the smallest number of components or factors which will account for the regular or persistent differences in states?" or "What is the least number of independent factors which will explain the correlation between the different measures or variables?" The distribution of communality coefficient (h^2), the proportion of variance explained by the seven factors is indicated in Table II. It will be seen that a very substantial proportion of the variance was explained by seven factors. Five variables or 18 percent of the items had 90 to 95 percent of their variance explained by the factors.

TABLE II
 DISTRIBUTION OF COMMUNALITY COEFFICIENT (h^2)*

Percent of Variance Explained	Number of Variables	Percent of Variables
90-95	5	18
80-89	9	32
70-79	7	25
60-69	6	21
50-59	1	4
	Total	28
		100

* h^2 is the communality of a variable or the proportion of variation in a variable explained by the seven factors.

CHAPTER IV

ANALYSIS OF THE RESULT

Factor analysis was employed as the principal technique to examine the 28 descriptors of the fifty-one states included in this study. As suggested in the previous chapter, two types of rotations, orthogonal (Varimax, Quartimax, Equimax) and oblique (Kaiser normalization) were available for the analysis.) Although the results from each analysis were similar, oblique rotation will be discussed in detail.

First, the analysis of the rotations using the R-technique will be reported, and the oblique rotation will be described in detail. Then each of the factor patterns along with the results of the groupings of the states based on the factor scores will be reported; then the characteristic patterns will be summarized.

Patterns of Characteristics Using the R-Techniques

All orthogonal rotations (Varimax, Quartimax, and Equimax) of the data matrix resulted in seven factors before satisfying the eigenvalue criterion of 1.00.¹ These seven factors, however, cumulatively explained 78.4 percent of the total variance of the 28 original variables. Likewise, the Kaiser normalization (oblique) rotation also

¹In a factor analysis model, the simple rule for the number of common factors is to extract and rotate factors with eigenvalues greater than one.

resulted in seven factor patterns under a similar rotation criterion and accounted for the same proportion of cumulative variance (78.4). Table III shows the percentage of variation as explained by each factor both in orthogonal and oblique rotations. An examination of the factor correlation matrix for the oblique rotation (Table IV) indicates that the orthogonal and oblique rotations are highly similar.²

Orthogonal versus Oblique Rotation

There has been some controversy over whether orthogonal or oblique rotation is a better approach. Burt,³ for example, has argued for orthogonal rotation, while Thurstone⁴ and Cattell⁵ have been among the chief proponents of oblique rotation. The advantages of orthogonal rotation are simplicity, clarity, and amenability to manipulation and analysis. Oblique rotation has the advantage that it generates additional information from the analysis. The clusters of variables will be better defined, the possibility of confusion as to variables involved in a cluster is less, and the central members of the cluster can be identified by their high loadings. In

²For the obliquely rotated solution to be congruent with the orthogonal solution, the correlation between patterns (except the principal diagonals) would be 0.000.

³Cyril L. Burt, The Factor of the Mind: An Introduction to Factor-analysis in Psychology (New York: Macmillan, 1949).

⁴Louis L. Thurstone, Multiple-Factor Analysis (Chicago: The University of Chicago Press, 1947).

⁵Raymond B. Cattell, Factor Analysis: An Introduction and Manual for the Psychologist and Social Scientist (New York: Harper and Row, 1952a).

TABLE III
 PERCENTAGE OF VARIATION EXPLAINED BY EACH FACTOR, BOTH
 ORTHOGONAL AND OBLIQUE ROTATIONS
 (R-FACTOR ANALYSIS)

Factor	Eigenvalues	Percentage of Variation	Cumulative Percentage
1	7.16814	25.6	25.6
2	4.38091	15.6	41.2
3	3.74301	13.4	54.6
4	2.41864	8.6	63.3
5	1.73327	6.2	69.4
6	1.38651	5.0	74.4
7	1.11424	4.0	78.4
8	0.97054	3.5	81.8
9	0.88088	3.1	85.0
10	0.75934	2.7	87.7
11	0.57873	2.1	89.8
12	0.56639	2.0	91.8
13	0.48674	1.7	93.5
14	0.39191	1.4	94.9
15	0.31215	1.1	96.0
16	0.27295	1.0	97.0
17	0.21203	0.8	97.8
18	0.16656	0.6	98.4
19	0.14984	0.5	98.9
20	0.10139	0.4	99.3
21	0.07712	0.3	99.5
22	0.06147	0.2	99.8
23	0.03011	0.1	99.9
24	0.02535	0.1	100.0
25	0.00591	0.0	100.0
26	0.00391	0.0	100.0
27	0.00202	0.0	100.0
28	0.00000	0.0	100.0

orthogonal rotation, the major clustered variables may not have very high loadings on the relevant factor.

TABLE IV
FACTOR CORRELATION MATRIX, OBLIQUE ROTATION

	1	2	3	4	5	6	7
1	1.0000						
2	0.03386	1.0000					
3	0.13113	-0.02180	1.0000				
4	0.16346	-0.04039	-0.11102	1.0000			
5	-0.19834	0.17323	-0.20413	0.05942	1.0000		
6	0.10361	0.05044	-0.08689	0.03956	0.09099	1.0000	
7	-0.00284	-0.17873	-0.20544	-0.03862	-0.02892	0.04961	1.0000

Another advantage of the oblique rotation is that it is unrealistic to expect factors to be uncorrelated in a sample. Verification of this belief can be seen in artificial experiments. Thurstone's famous box experiment,⁶ for example, has shown that an oblique solution gives the best definition of the length, width, and height dimension of the boxes.

With computer facilities, both options, orthogonal (Varimax, Quartimax, and Equimax) and oblique (Kaiser normalization) were tried

⁶Louis L. Thurstone, Multiple-Factor Analysis (Chicago: The University of Chicago Press, 1947).

and the examination of the factor correlation matrix for the oblique rotation indicated that both rotations were highly similar. The obliquely rotated factors and their loadings are reported below. This selection was based on the slightly better definition of clusters generated from the oblique rotations. In some factors, the items that are exceptionally significant in orthogonal rotations are included and mentioned in oblique rotation.

Factor I: Support of Public Higher Education

Factor I comprises 25.6 percent of the total variation. This is 33 percent of all that was explained by the factor analysis. Thus, Factor I is by far the most important factor in the states today. Using a factor loading criterion of ± 0.5000 , this factor had significant loadings on nine of the 28 measures. The significant loadings in order of magnitude are shown in Table V, which lists each of the nine variables in the pattern with their factor loadings. As will be recalled from Chapter III, these loadings can be considered an approximation of the correlation coefficient between the variable and the concept expressed by the factor.

Variables which loaded on Factor I are those which denote a high degree of financial support of public higher education. These variables constitute government grants and contracts/student - public, total E & G revenues/student in two year public institutions, total E & G revenues/student - public institutions, state and local appropriation/student - public institutions, and state and local appropriation/student - two-year public institution. Variables such as geographic cost index and median income suggest state wealth may be related to support of public

higher education. Also, ratio of women in college/women in population suggests one access factor is related to financial support.

TABLE V
FACTOR I: SUPPORT OF PUBLIC HIGHER EDUCATION
(KEY VARIABLES)

Variables	Factor Loadings
10 Government grants and contracts/student - public	0.93072
18 Total E & G revenues/student - two-year public	0.92988
13 Total E & G revenues/student - public	0.91133
8 State & local appropriation/student - public	0.85913
16 State & local appropriation/student - two-year public	0.83945
23 Ratio percent women in college/women in population	0.61518
7 State & local appropriation to public higher education	0.54806
22 Geographic cost index	0.45175*
28 Median income	0.41225**

*This item is more than ± 0.5000 in the Varimax and Quartimax rotations.

**This item is more than ± 0.5000 in the Varimax and Quartimax rotations.

However, since there are many variables (19 out of 28) which do not have significant loading on this factor, it cannot be considered "general" in the strict sense of the word. It is thus incorrect to assume that variation in states can be traced to a single cause. It will be seen from the following discussion that there are other factors

besides public support which are crucial and basic in accounting for state variability.

Table VI lists the factor scores for the cases most heavily involved in Factor I. Alaska and Nevada are the most extreme points in the pattern of public support.

TABLE VI
KEY CASES

Cases	Factor Scores	Ranking of States on Reference Variables								
		10	18	13	8	16	23	7	22	28
2) Alaska	6.454216	1	1	1	1	1	1	1	1	1
51) Wyoming	0.744717	17	7	5	3	4	22	2	35	17
8) Delaware	0.678841	38	4	6	32	2	3.5	16	4	7
29) Nevada	-0.980001	41	49	45	34.5	49	50	21	5	15
42) S. Dak.	-0.830534	31	50.5	24	39.5	50.5	44	37	31	42
37) Oklahoma	-0.786658	46	45	50	49	43	34.5	34.5	44	41

The map of this factor in Figure 1 shows the regionalization of the states according to their factor scores in Factor I. The first top ten states are high ranking; the bottom ten states are the low ranking, and the other states are in the middle. As is shown on the map, the top ten states which have high factor scores on Factor I are Alaska, Wyoming, Delaware, Maine, Iowa, Wisconsin, Hawaii, Maryland, New Mexico, and Idaho. All of the significant factor loadings of these

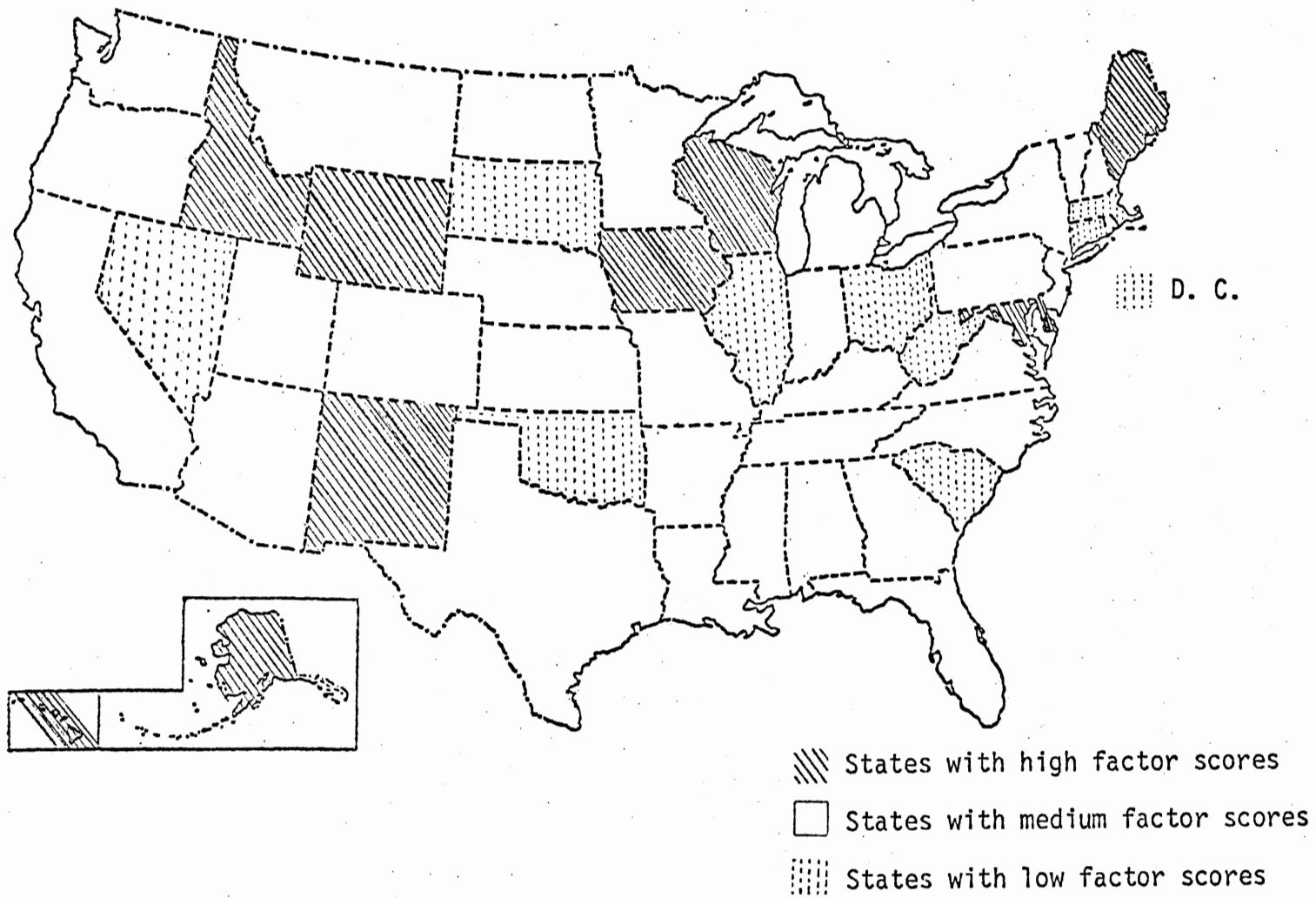


Figure 1. Factor I: Support of Public Higher Education

states are positive, which means that these states are highly oriented to support public higher education. The bottom ten states are Ohio, S. Carolina, W. Virginia, Connecticut, D. C., Illinois, Massachusetts, Oklahoma, S. Dakota, and Nevada.

Factor II: Access to Public Institution

Factor II explains 15.6 percent of the total variation. This is 20 percent of all of the variation explained by the factor analysis. This factor explained much less than did Factor I, but it is still of great importance in explaining the variation of the states. The significant loadings on this factor in order of magnitude are shown in Table VII.

TABLE VII
FACTOR II: ACCESS TO PUBLIC INSTITUTIONS
(KEY VARIABLES)

Variables	Factor Loadings
2 First-time resident enrollment in public institution/1000 population	0.93413
1 Entrance rate to public institutions	0.90141
3 Retention factor in public institutions	-0.81038
15 Institutional support/capita - two-year public	0.56112
27 Percent of students in private institutions	-0.49930*
7 State & local appropriation to public higher education	0.44505**

* This item is more than ± 0.5000 in the Varimax and Quartimax rotations.

** This item is more than ± 0.5000 in all of the other three rotations.

The second factor resulting from the oblique rotation of the data included six variables from the original data set. The first two variables can be described as access variables. Thus, this dimension was identified as "public access." The two measures of first-time resident enrollment in public institution/1000 population and entrance rate to public institutions best defined this cluster; however, institutional support/capita in two year institutions and state and local appropriations to public higher education are also associated with this factor. The variables of retention in public institutions and the percent of students in private institutions also helped to define the cluster although they were inversely related to the first two variables. The inverse relationship on retention suggests that the states with high loading on Factor II tend to have greater proportions of students in the lower levels of higher education relative to the upper levels, thus implying large proportions of freshmen or other first-time students. Also, the inverse relationship on percent of students in private institutions suggests that states with high access to public institutions also have relatively fewer students attending private sector institutions.

Table VIII lists the principal cases and their scores, and the ranks for the cases on several reference variables for Factor II. Also the map in Figure 2 shows the regionalization of the states in Factor II according to the magnitude of their factor score. The top ten states having high scores in this factor are Oregon, Arizona, Nevada, Washington, Mississippi, California, Wisconsin, Illinois, N. Dakota, and N. Carolina, which means they have high access to public institutions. The bottom ten states on this factor are S. Dakota,

New Hampshire, New Mexico, Vermont, Minnesota, Virginia, Georgia, Delaware, D. C., and Rhode Island. The other states are in the middle.

TABLE VIII
KEY CASES

Cases		Ranking of States on Reference Variables					
		2	1	3	15	27	7
38) Oregon	2.766546	1	1	50.5	5	40	8
3) Arizona	2.207674	4	3	43.5	4	48	5
29) Nevada	2.144482	2	2	49	21	50	21
40) Rhode Island	-1.795794	49.5	50	1	25	3	31
9) D. C.	-1.582757	51	34.5	33.5	50	1	32
8) Delaware	-1.286066	34.5	41	6	12	27	16

Factor III: Tax Support

Factor III explains 13.4 percent of the total variation. Although this is a small percentage compared to Factors I and II, it is important in explaining the financial support of the states in the makeup support for higher education. Table IX lists the measures of state dimensions with significant loadings in order of magnitude.

The two variables which emerged in Factor III indicate that this dimension was related to the tax support of a state. These measures, state and local tax effort and state and local tax revenues,

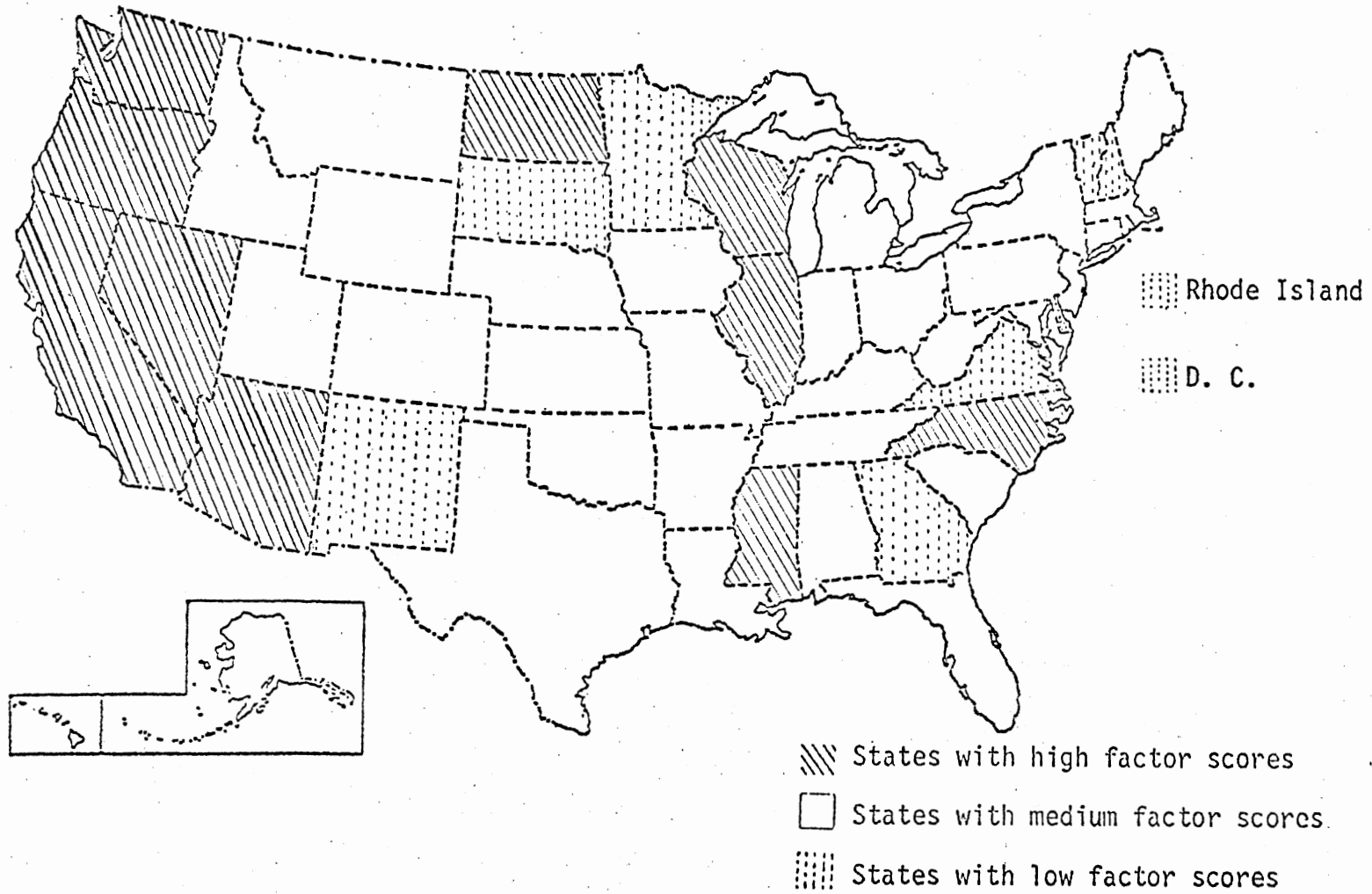


Figure 2. Factor II: Access to Public Institutions

essentially identifying the extent to which states have used taxation for support of public services. This factor is likely related to state wealth. Then New York is the "richest" and Texas the "poorest," in terms of tax support, as shown in Table X.

TABLE IX
FACTOR III: TAX SUPPORT
(KEY VARIABLES)

Variables	Factor Loadings
5) State and local tax effort	0.95496
6) State and local tax revenues	0.75161

TABLE X
KEY CASES

Cases	Factor Scores	Rankings of States on Reference Variables	
		5	6
33) New York	3.352530	1	1
5) California	2.242498	5	2
22) Massachusetts	1.881891	2	4
44) Texas	-1.455116	51	42
37) Oklahoma	-1.230036	49	45
4) Arkansas	-1.171618	46	50

Figure 3 shows the map of Factor III, according to the factor scores. The top ten states which use a large amount of taxation for support of public services are New York, California, Massachusetts, Vermont, Hawaii, Minnesota, Wisconsin, Rhode Island, New Jersey and Washington. The bottom ten states are Tennessee, Ohio, Florida, Kentucky, Alabama, Nevada, New Hampshire, Arkansas, Oklahoma, and Texas.

Factor IV: Other Revenues

Factor IV explains 8.2 percent of the total variation. While this is a small amount, it is important in explaining the financial and access measures of certain states. The loading of this factor in order of magnitude is shown in Table XI.

TABLE XI
FACTOR IV: OTHER REVENUES
(KEY VARIABLES)

Variables	Factor Loadings
11) Private gifts, grants and endowment income/student - public	0.77117
20) Total E & G revenues/student - independent	-0.74493
12) Other revenues/student - public	0.64635
24) Percent minorities in population	-0.58310

This factor indicates that these states which rank high on the factor loadings depend more on private gifts and other revenues for

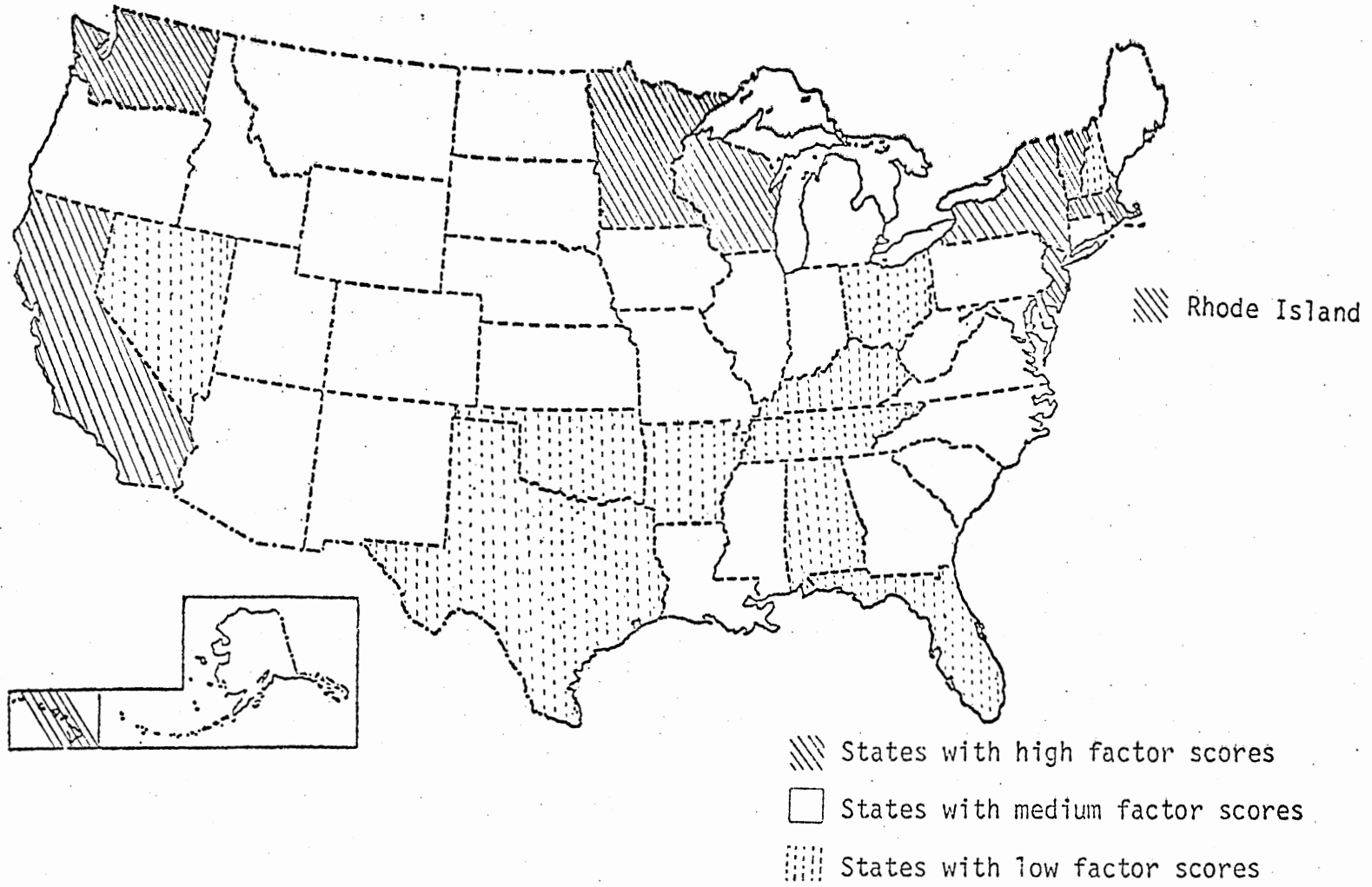


Figure 3. Factor III: Tax Support

the support of public higher education than most states. The fact that the factor loading is negative on total E & G revenues/student in the independent sector may indicate that the states have a relatively small (in numbers and finances) private sector, and perhaps the bulk of private support in these states is given to public institutions. The interpretation of the high negative loading on percent minorities in the population is uncertain.

Table XII indicates that Delaware and D. C. represented the extreme points on the distribution cases.

TABLE XII
KEY CASES

Cases	Factor Scores	Rankings of States on Reference Variables			
		11	20	12	24
8) Delaware	3.059812	1	50	12	23
51) Wyoming	2.319457	4	51	6	39
9) D. C.	-3.462504	37	3	51	1
7) Connecticut	-1.428415	40.5	2	47	1
22) Massachusetts	-1.349053	47	5	50	36

The map for Factor IV in Figure 4 shows the regionalization of the states according to their factor scores. The top ten states are Delaware, Wyoming, Minnesota, Vermont, N. Dakota, Idaho, S. Dakota, Iowa, Utah,

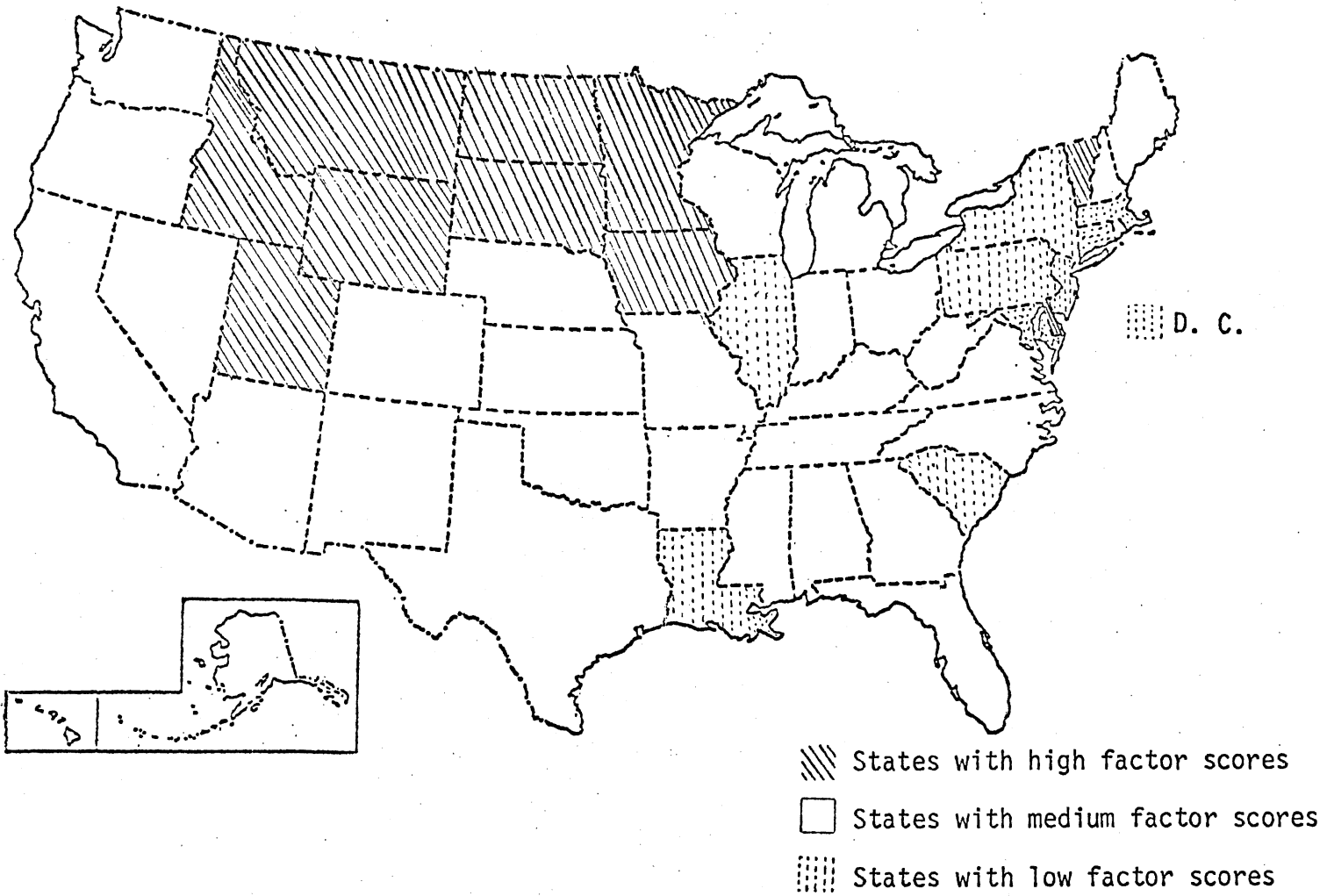


Figure 4. Factor IV: Other Revenues

and Montana, which means these states are highly supported in public higher education by private and other revenues. The bottom ten states are New Jersey, Pennsylvania, S. Carolina, Louisiana, New York, Maryland, Illinois, Massachusetts, Connecticut, and D. C.

Factor V: Federal Dependence

Factor V comprised 6.2 percent of the total variation. The very high positive loading on Federal Student Aid/FTE student seems to indicate the nature of this factor, and equally significant but negative loadings on the four additional variables in this cluster lead one to assume that the relatively "poor" states depend more on the Federal Government for support of students in higher education. This also suggests that these states have more students from lower socio-economic backgrounds who are dependent on the Federal Government for support in order to be able to attend a college or university. Table XIII lists the loading of this factor in order of magnitude. Also included in Table XIV are the factor scores for the cases most heavily involved in Factor V, showing Maine and Nevada as the most extreme points in this factor.

Figure 5 shows the map for Factor V. In this map the top ten states are relatively "poor" states which show a high score on the factor of Federal dependence. These states are Maine, Mississippi, Vermont, Alabama, Arkansas, S. Dakota, New Mexico, Tennessee, Georgia, and S. Carolina. The bottom ten states which are not that much dependent on the Federal government for support of students in higher education are New Jersey, Connecticut, California, Delaware, D. C., Illinois, Wyoming, Hawaii, Alaska, and Nevada.

TABLE XIII
 FACTOR V: FEDERAL DEPENDENCE
 (KEY VARIABLES)

Variables	Factor Loadings
4) State and local tax capacity	-0.86376
25) Federal student aid/FTE student	0.85821
28) Median income	-0.64659
22) Geographic cost index	-0.53647
6) State and local tax revenues	-0.44276*

*This variable is accompanied with the other items of this factor in both Varimax and Quartimax rotations.

TABLE XIV
 KEY CASES

Cases	Factor Scores	4	25	28	22	6
22) Maine	2.564235	31	23	8	22.5	4
25) Mississippi	2.320272	51	4	51	48.5	47
46) Vermont	1.791354	44	2.5	38	35	17
29) Nevada	-2.142959	1	49	15	5	15
2) Alaska	-1.754495	3	23	1	1	5
12) Hawaii	-1.643283	11	50	2	2	3

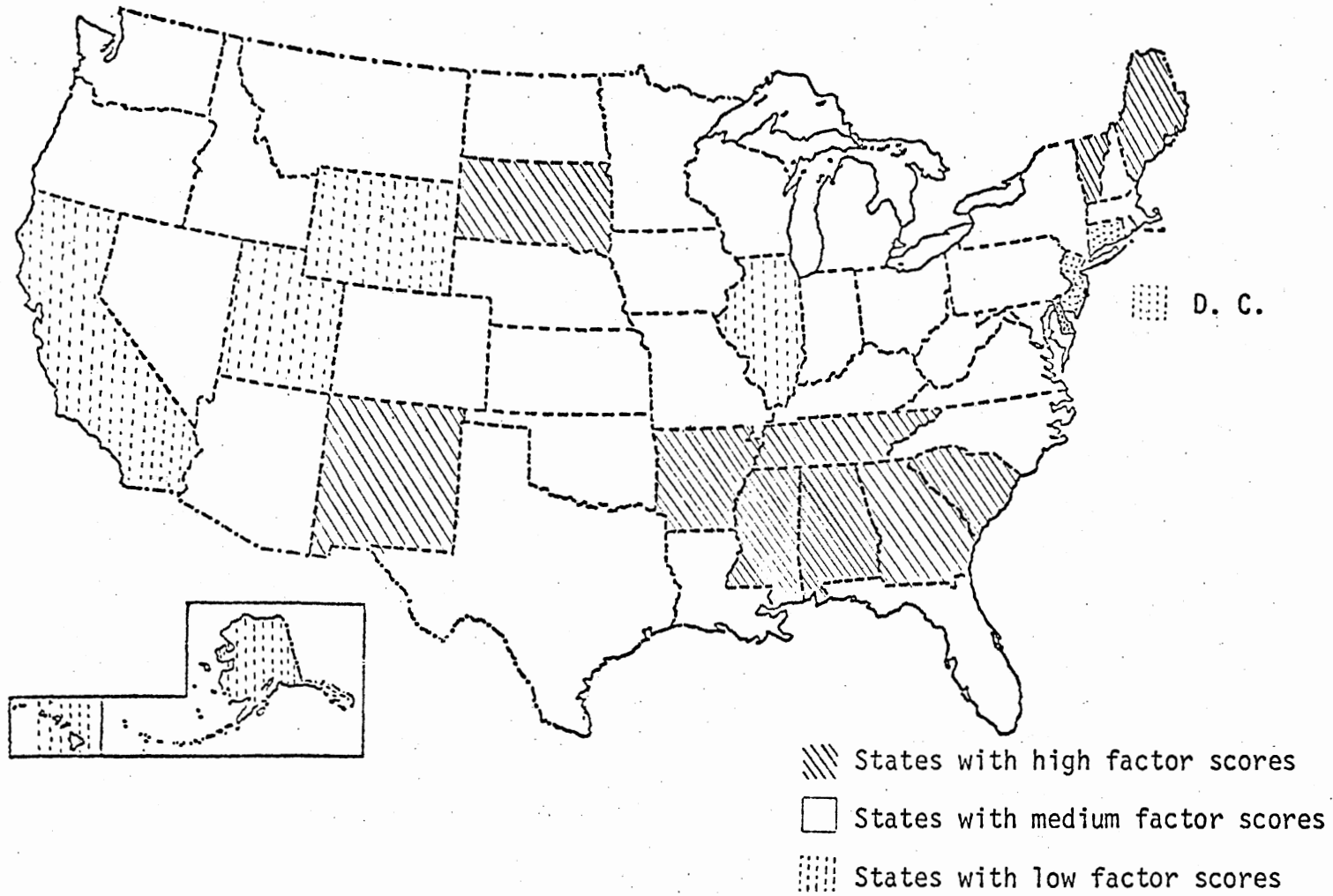


Figure 5. Factor V: Federal Dependence

Factor VI: Public Support of Independent
Institutions

Factor VI explained 5.0 percent of the total variation and had high loadings on only one variable generated in this factor--institutional support/capita-independent. This variable was defined as the state and local tax revenues per capita appropriated for current operating expenses. Thus, the factor expressed public support of independent institutions. Table XV illustrates the key variable of this factor.

TABLE XV

FACTOR VI: PUBLIC SUPPORT OF INDEPENDENT INSTITUTIONS
(KEY VARIABLES)

Variable	Factor Loading
19) Institutional support/capita - independent	0.79914

A significant aspect of this measure is that it did not cluster with the other state and local revenue-based measures in support of public higher education dimension, thereby indicating that this variable indeed provided a unique measure. However, the variable had a very uneven distribution as 29 states had no program of public support for independent institutions and, thus, received a score of zero on the variable. In addition, one state (Rhode Island) had a score

which was significantly higher on this variable than all of the other states. The factor score of Rhode Island was +5.400134, and the next highest factor score was that of +1.085245. Because of this, Rhode Island was the only extreme case which described a high positive correlation with the factor. The inclusion of Rhode Island as the highest ranking state on this measure meant that it was the state which provided the largest proportion of support to the independent sector of higher education. Table XVI illustrates the most extreme cases of this factor.

TABLE XVI
KEY CASES

Cases	Factor Scores	Rankings of States on Reference Variables
		19
40) Rhode Island	+5.400134	1
46) Vermont	-1.739494	37
8) Delaware	-1.686468	37
9) D. C.	-1.590481	37

Unfortunately, because of the uneven distribution of the single variable which correlated highly with the factor, the validity of the

factor itself was questionable. The lack of definitiveness of this factor suggested that a map of the factor scores showing the top ten and bottom ten states would be misleading. The map of this factor would be based not only on the single variable of institutional support/capita independent, but also on all of the other intervening variables which were not significant (less than $\pm .50$). It was decided not to include a map of Factor VI.

Factor VII: Tuition/Student Aid

Factor VII, the final factor extracted above the eigenvalues of 1.0000 explained 4.0 percent of the total variation and could be termed as a "tuition/student aid" dimension. The significant loading on this factor in order of magnitude is shown in Table XVII.

TABLE XVII
FACTOR VII: TUITION/STUDENT AID
(KEY VARIABLES)

Variables	Factor Loadings
17) Tuition revenues/student - two year public	0.73922
9) Tuition evenues/student - public	0.66863
14) Student aid/capita - public	0.62886
21) Student aid/capita - independent	0.60805

Included among these four variables are tuition revenues/student in two-year institutions, tuition revenues/student in public institutions, student aid/capita in public institutions and student aid/capita in independent institutions. This suggests that states which depend more on tuition revenues for support of public higher education also tend to provide greater amounts of student financial aid. This pattern gives reinforcement to the notion that states which charge higher tuition should also provide increased amounts of student aid to ensure access for those who cannot afford the higher tuition. According to the factor scores, D. C. and Pennsylvania represented the extreme points on the distribution of cases in this dimension. Table XVIII illustrates the principal cases, their scores, and the ranks for the cases on four reference variables for Factor VII.

TABLE XVIII
KEY CASES

Cases	Factor Scores	Rankings of States on Reference Variables			
		17	9	14	21
39) Pennsylvania	3.107471	1	3	3	2
46) Vermont	2.494402	16	1	1	6
16) Iowa	1.566648	2	12	34	3
9) D. C.	-1.873058	50.5	51	46.5	44.5
12) Hawaii	-1.708423	48	42	25.5	44.5
5) California	-1.588287	49	50	15	7

Figure 6 shows the map for the final factor according to the magnitude of their factor scores. The top ten states are Pennsylvania, Vermont, Iowa, Ohio, Illinois, New York, New Jersey, Indiana, and Wisconsin. These states are depending more on tuition revenues for support of public higher education and also they are providing greater amounts of student financial aid. The bottom ten states are Washington, Wyoming, Virginia, Louisiana, South Dakota, Alabama, Arizona, California, Hawaii, and D. C.

Summary of Characteristic Patterns

Modern social science, like other sciences, seeks simplicity in its explanation of the phenomena it observes. The multiplicity of variables found within modern financial and access measures of states makes for a vast complexity of relationships that require simplification if states are to be understood and their essential factors discovered. This research sought to find a small number of functional unities or factors which would account for the variance in 28 dimensions of 51 state systems. The R-technique factor analysis, using both the orthogonal and oblique rotations, explained the correlation matrix of 28 variables, seven factors of which accounted for most of the variance in the dimensions of the interactional systems under observation. These seven factors were identified and, on the basis of their significant factor loadings on certain indicative variables, named as follows: support of public higher education, access to public institutions, tax support, other revenues, Federal dependence, public support of independent institutions, tuition/student aid. Table XIX lists the seven dimensions for the data under study along with the highest loading

variables within each dimension. This group might serve tentatively as the most parsimonious set of variables to describe the entire data set.

TABLE XIX
VARIABLES CONTAINED IN THE SEVEN DIMENSIONS
(R-FACTOR ANALYSIS, OBLIQUE PATTERNS)

Dimensions	Variables
Factor I	
Support of public higher education	10, 18, 13, 8, 16, 23, 7, 22, 28
Factor II	
Access to public institutions	2, 1, 3, 15, 27, 7
Factor III	
Tax support	5, 6
Factor IV	
Other revenues	11, 20, 12, 24
Factor V	
Federal dependence	4, 25, 28, 22, 6
Factor VI	
Public support of independent institutions	19
Factor VII	
Tuition/student aid	17, 9, 14, 21

While these factors were predominantly independent (orthogonal), there was some overlapping resulting undoubtedly from the inherent

nature of the phenomena involved. A state system characterized by support of public higher education, for example, cannot escape being related to tax support or Federal dependence; also, one characterized by a high rate of access to public institutions invariably gives evidence of other revenues or tuition/student aid. Thus, the overlapping that does exist is the result of intrinsic relationships. Support of public higher education emerged as the most general of all factors, but cannot be considered a "general factor" in the strict interpretation of the term because a number of variables are apparently not significantly related to it. Consequently, state variation cannot be attributed to this factor alone, and an explanation of state differences must take into account the other factors demonstrated to be comparatively independent of support of public higher education.

Access to public institutions appeared as an important and largely independent source of state variation. An index of this factor should prove useful in locating states possessing this factor to a high or low degree. Case studies of states displaying much or little access to public institutions might then be made to find why there is such variation in the extent of access to public institutions observed.

The isolation of a public support of independent institution factor suggests that there is a fundamental difference between the states showing a high or low degree in this factor, and further investigation is needed.

Federal dependence was revealed as a strong factor indicative of the degree to which a state is able to obtain federal assistance in higher education. Its composition and measures should provide valuable empirical and quantitative material for evaluating the

effectiveness of state and Federal relationships through programs and policies.

Two notions which seem to be related to more than one of the factors are those which might be described as 1) state wealth/support, and 2) public/private juxtaposition. This group might serve tentatively as the most parsimonious set of variables to describe the entire data set. Under such a proposal, one could argue that by knowing:

- 1) the state government grants and contract/student in public institutions;
- 2) the first-time resident enrollment in public institutions;
- 3) the state and local tax effort;
- 4) the private gifts and grants/student in public;
- 5) the state and local tax capacity;
- 6) the Federal student aid/FTE student;
- 7) the tuition/student in two-year institutions,

a person would have essentially all of the information that is vital to assessing the adequacy of the financial support and, literally, access to higher education in a state.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Earlier chapters contained the rationale for the study, a review of related literature, the method of analysis, and the findings. This chapter provides a summary of the study, summarizes the findings, presents the conclusions, and makes recommendations for future research.

Summary

The study was an exploratory attempt to identify relationships and patterns among access and financial support variables in post-secondary education in the fifty states and the District of Columbia. The literature suggested a relationship between access and financial support, but little study of the nature of the relationship had been done. With relatively new data available, it was possible to identify significant variables and factors which explained the underlying characteristics of access and support patterns.

The major approach undertaken to study the current problem was the R-technique analysis. This attempt is summarized in the following sections. First a brief review of the patterns of characteristics will be presented. Then the interpretation of the factors will be discussed. Finally, several propositions will be suggested as an expansion of the current study into situations tying qualitative assessment of output with these quantitative measures of input.

Characteristic Pattern

R-Analysis. Both orthogonal and oblique rotation were performed on the R-format data. Seven major dimensions emerged in each rotation, accounting for 78 percent of the total data variation. Further, the factors from each rotation were highly similar. The following seven factors, extracted through the oblique rotation, describe the data in a more parsimonious manner:

1) Support of public higher education: a dimension composed of nine variables, most being characterized as dollars available to public higher education expressed on a per-student basis;

2) Access to public institutions: a pattern of six variables describing access to public institutions among the states, also including institutional support/capita in two-year public institutions and state and local appropriation to public higher education;

3) Tax support: a factor described by two variables, namely, state and local tax effort and state and local tax revenues;

4) Other revenues: a dimension composed of four variables, private gifts, grants, and endowment income/student in public institutions, total E&G revenues/student in independent institutions, other revenues/student in public institutions and percent minorities in the population;

5) Federal dependence: a measure of federal student aid/FTE student, including state and local tax capacity, median income, geographic cost index, and state and local tax revenues;

6) Public support of independent institutions: a factor described by a single variable, namely, institutional support/capita for

independent institutions of higher education;

7) Tuition/student aid: a pattern of four variables describing tuition/student aid, including tuition revenues/student in two-year public institutions of higher education, tuition revenues/student in public institutions, student aid/capita in public institutions, and student aid/capita in independent institutions of higher education.

Interpretation of the Factors

In order to utilize the results drawn from the various factor analysis rotations, additional interpretation of the dimension is necessary. It is not sufficient merely to select the highest loading variables within each factor and apply them indiscriminately in measuring a state's efforts in educational support. Rather, these quantitative findings must be meshed with a certain amount of subjective reasoning in order that their meaning will have a constructive validity. The following sections thus analyze the primary findings suggested from the application of the R-technique results.

Characteristic Factor Patterns

The seven patterns emerging from the R-analysis have been discussed above and were listed in Table XIX along with the highest loading in each factor. Each of the dimensions will be discussed, and the determination of the appropriate measure will be made.

While the seven factors described 78.4% of the variance, the first three factors explained 54.6% of the variance, and these included a factor which was described as access to public institutions. Thus, the first three are the most significant statistically.

Support of Public Higher Education. There were nine variables which correlated highly with this factor. All of the variables except one focussed on financial support/student in the public sector, and those states which had high factor loadings on this factor were those which had made significant contributions/student to the public sector. Only one access variable correlated highly with this factor and that was the ratio of percent women in college/percent women in the population, which indicated that women tended to be better represented in post-secondary education in those states with the high commitment to support of public higher education.

The variable government grants and contracts/student was the measure with the highest loading in this dimension, thus indicating its ability to measure the pattern. Such a measure of "dollars per student" has been previously used in several studies.

Access to Public Institutions. This factor was described as "access" because two access variables correlated highly with the factor: 1) first-time resident enrollment in public institutions/1000 population, and 2) entrance rate to public institutions. Only two financial measures correlated highly with the factor, institutional support/capita in the public two-year institutions and state and local appropriations to public higher education. This indicated that while there was a relationship between major access and financial variables, it is not as high as might have been expected. Also, it suggests that access is greater in those states which have provided heavy support/capita in the public two-year colleges. The fact that the variable of retention had a high negative correlation with this factor was evidence

that access tended to be limited to the first year of college. Thus, retention as a variable related to access deserves further study.

Tax Support. This factor was described by the two variables of state and local tax effort and state and local tax revenues. The states with the high factor scores on this factor are those which have high relative taxation. It is worth noting that other access and financial variables did not correlate above $\pm .50$ on the factor, thus casting doubt that the level of taxation is a significant explanatory factor in access to postsecondary education.

Other Revenues. This dimension depends highly on private gifts and grants/student and other revenues/student in public institutions, thus indicating their ability to measure the pattern.

Federal Dependence. This dimension highly and negatively depends on state and local tax capacity and highly and positively is related to Federal student aid/FTE student.

Public Support of Independent Institutions. This factor correlated highly with only one variable, public support/capita to independent institutions of higher education. Since this variable was very unevenly distributed across the states, the validity of the factor was questionable.

Tuition/Student Aid. This dimension was created largely by tuition revenues/student in two-year and public institutions and student aid/capita in public and independent institutions.

Characteristics Pattern Summary. It appears that as few as seven

of the original twenty-eight measures can describe the patterns of the financial support and access to higher education as well as the entire set. These measures are: government grants and contracts/student; first-time resident enrollment in public institutions; state and local tax effort; private gifts and grants/student; state and local tax capacity; Federal student aid/FTE student, and tuition revenues/student in two-year institutions.

Conclusions

The study found that there was a relationship between access and financial support variables, but the diversity of the factors which emerged indicated that there was not always an expected correlation between access and financial variables. There are, then, other state characteristics which explain access, and the assumption that financial support is always a factor in access is faulty. There are other goals to which states may be committed, and financial support may serve these goals as well as that of access.

There were some regional groupings of states which emerged on some of the factors. For example, a cluster of Western states ranked high on access to public institutions. Clusters of Southern states ranked low on the factor of tax support and high on the factor of Federal dependence, and a cluster of upper Mid-western states ranked high on the factor of other revenues. Still, there were enough exceptions to suggest care in grouping states and describing them by region.

From the original set of 28 variables chosen to investigate the financial measures supporting access to higher education, it appears that as few as seven measures can explain most of the data variation.

These seven measures apply to all 50 states and the District of Columbia without any regional relevance. These seven measures were government grants and contracts/student, first-time resident enrollment in public institutions, state and local tax effort, private gifts and grants/student - public, state and local tax capacity, Federal student aid/FTE student, and tuition revenues/student in two-year institutions.

Recommendations for Further Study

This examination may be replicated in order to establish greater confidence in the use of the findings of this study. The findings of this study suggested several modifications in future efforts. For instance, more measures of state wealth and socio-economic characteristics of students such as personal income/population and median income of college age population should be taken into consideration.

The findings of this study also suggest that follow-up studies should be made of selected states to investigate reasons why they have certain patterns of finance. Further investigation of commonalities and differences among states are recommended. In further attempts, additional studies using other measures of access, including information on participation of students from lower socio-economic backgrounds should be employed.

Studies similar to the current study should be conducted on changes in patterns over time. Timely information is now available to assess trends in financial patterns.

Ultimately, along with the alternatives suggested above, study of the effects of state financial patterns on other state goals for higher education, like diversity, equality, and efficiency, is recommended.

The current problem is only a part of a larger set of problems facing the social scientist. Many social problems would benefit from analyses similar to the present study, through better understanding of the phenomena for future plans.

Application of the factor technique to financial support and access of states' analyses may be one of the more valid uses of the method since the large number of established relationships eliminates much of the criticism directed toward the subjectivity of the rotational process utilized in arriving at a simple and logically tenable factor structure.

The emergence of these structures is an indication of the reliability of the units of measurement. The combinations involved in the interrelationships of 28 variables present a meaningful picture of state systems within an established framework of state relationships and processes.

Factor analysis can reveal only relationships among variables included in the correlation matrix. In this research, some important dimensions may have been left out. The addition of more variables might produce other factors or might only reveal other facets of the factors extracted in this study. In addition, the relationships adduced may be peculiar to the time and place of the research, and different relationships might emerge if data from another area and time were used. Using large numbers of variables with relatively high factor loadings increases the probability that the relationships demonstrated have high generality. A comparison of the results of this study with the findings of other researchers in this area may lead to increasingly definitive statements about the essential dimensions of such interactional systems.

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APPENDIX A

INTERPRETATION OF MEASURES

Entrance Rate to Public Institutions

Entrance rate or the college attendance ratio measures the degree to which a state provides attractive public higher education opportunities to both resident and non-resident students, relative to its high school graduates (its primary enrollment source). It also suggests the preparedness of high school graduates for college and student, parental, and community disposition toward attendance at state institutions.

First-time Resident Enrollment in Public Institution/1000 Population

Head count of resident students enrolled for the first time at public institutions of higher education/1000 population. First-time students, mostly beginning freshmen, are individuals who have never been previously enrolled at any institution of higher education. Only state residents are included in this measure.

Retention Factor in Public Institutions

It reflects the proportion of students that continue their education beyond first enrollment. State systems that emphasize upper division graduate and professional education show high retention patterns. Those that focus on two-year terminal programs have lower values. In addition, the selectivity of admissions and success of the institutions in meeting student needs also affect retention.

State and Local Tax Capacity

This index measures the ability or potential of state and local government to obtain revenues for public purposes through various kinds of taxes. The wealth of local residents is only one contributing source of tax revenues; therefore per capita personal income is not equivalent to this tax capacity measurement.

State and Local Tax Effort

Tax effort measures, in percentage terms, how much of state and local government tax capacity is actually used.

State and Local Tax Revenues

Collected tax revenues represent the wealth available to state and local government for public use. The index essentially identifies "rich" versus "poor" states according to the size of their bank accounts.

State and Local Appropriation to Public Higher Education

This index parallels FTE enrollment/capita. It indicates the relative financial load on the state's population represented by public higher education. Only appropriations for operating expenses are included and thus the total cost of public education is understated by the amount of per capita support.

State and Local Appropriation/Student - Public

This index reflects the current status of the state's contribution to institutional support on a student unit basis.

Tuition Revenues/Student - Public

Tuition and fees assessed against students for current operating purposes including amounts which are remitted to the state as an offset to the state appropriation.

Government Grants and Contracts/Student - Public

Revenues from Federal, state, and local governmental agencies which are for specific research projects and training programs under terms of a grant or contract.

Private Gifts, Grants and Endowment Income/ Student - Public

Private gifts and grants from donors for which no legal consideration is involved. Private contracts include those funds for which specific goods and services must be provided. Included also is income of endowment and similar funds expended for current operating purposes.

Other Revenues/Student - Public

Includes Federal government appropriations (mostly to land grant institutions) and sales and services of educational activities, such as film rentals, scientific literary publications, testing services, university presses, and dairy products per student. Also includes revenues from other sources not covered elsewhere.

Total E & G Revenues/Student - Public

Total revenues from all sources for current operating expenses of institutions of higher education per student in public.

Student Aid/Capita - Public

The student aid amounts represent need-based grants from states for public institutions. They do not include non-need based financial aid, student tuition and fee waivers, state financial work-study, or aid to graduate students; therefore, total state student financial aid is understated by these non-reported amounts.

Institutional Support/Capita - Two-year Public

Consists of the state and local tax revenues per capita appropriated for current operating expenses of two-year public institutions. This index parallels FTE enrollment per capita. It indicates the relative financial load on the state's population represented by two-year institutions of higher education. Only appropriations for operating expenses are included and thus the total cost of two-year institution education is understated by the amount of capital support. Appropriations per capita is a state level measure of the commitment of residents to support higher education; it is not a measure of adequacy of support at the institutional level.

State and Local Appropriations/Student - Two-year Public

State and local government appropriations per student for current

operating expenses of higher education in two-year public institutions. This index reflects the current status of the state's contribution to the institutional support on a student unit basis in two-year institutions.

Tuition Revenues/Student - Two-year Public

Tuition and fees assessed against students for current operating purposes including amounts which are remitted to the state as an offset to the state appropriation in two-year public institutions.

Total E & G Revenues/Student - Two-year Public

Total revenues from all sources for current operating expenses of institutions of higher education per student in two-year public institutions.

Institutional Support/Capita - Independent

Consists of state and local tax revenues per capita appropriated for current operating expenses of independent institutions. This index parallels FTE enrollment/capita. It indicates the relative financial load on the state's population represented by independent institutions of higher education. Only appropriations for operating expenses are included and thus the total cost of independent institutions' education is understated by the amount of capital support. Appropriation per capita is a state level measure of the commitment of residents to support higher education; it is not a measure of adequacy of support at the institutional level.

Total E & G Revenues/Student - Independent

Total revenues from all sources for current operating expenses of institutions of higher education per student in independent institutions.

Student Aid/Capita - Independent

The student aid amounts represent need-based grants from the states at independent institutions. They do not include non-need based financial aid, student tuition and fee waivers, state financial work-study or aid to graduate students. Therefore, total state student financial aid is understated by these non-reported amounts.

Geographic Cost Index

This index is a proxy measure of differences due to location in the prices of goods and services purchased by colleges and universities. The index may be used to adjust state and local government appropriations to reflect equivalent value in purchasing goods and services for higher education, to establish common purchasing power for interstate comparisons, such price differences should be taken into account. The index uses the average earnings of clerical workers to reflect these differences and it is expressed as an index relative to the U. S. average, which equals 100.

Ratio: Percent Women in College/Women in Population

This ratio is used to indicate the ability of a state to provide access for women to higher education.

Percent Minorities in Population

This measure is another which serves to illustrate the demand of a state to provide equal opportunity.

Federal Student Aid/FTE Student

Consists of state student incentive grants, supplemental educational opportunity grants, college work-study, and basic educational opportunity grants per FTE student.

Other Federal Institutional Aid/FTE Student

Consists of university community services, aid to land grant colleges (annual and permanent), NSDL Federal capital contribution, cooperative education, teacher military cancellation, loans to institutions, talent research, upward bound, special services, educational opportunity centers, strengthening developing institutions, long wage training centers, fellowships and research, Fullbright Hays training grants, state post-secondary education and communication, veterans' cost of instruction, college teacher fellowships, fellowships for disadvantaged (CELO) per FTE student.

Percent of Students in Private Institutions

This measure illustrates the percentage of students in private institutions.

Median Income

This measure indicates the median amount of income of the family in the population.

APPENDIX B
SOURCE OF DATA

<u>Source</u>	<u>Variables</u>
1. U. S. Department of Health, Education and Welfare. <u>Higher Education Financing in the Fifty States, Interstate Comparisons, Fiscal Year 1976</u> . Washington, D. C.: U. S. Government Printing Office, 1979.	1 - 22
2. National Center for Education Statistics. <u>Digest of Education Statistics 1977-78</u> . Washington, D. C.: U. S. Government Printing Office, 1978.	23, 27
3. U. S. Bureau of the Census. <u>Current Population Reports, Demographic, Social, and Economic Profiles of the States - Spring, 1976</u> . Washington, D. C.: U. S. Government Printing Office, 1979.	24, 28
4. U. S. Department of Health, Education and Welfare. <u>Annual Report of the Commissioner of Education: Fiscal Year 1976</u> . Washington, D. C.: U. S. Government Printing Office, 1978.	25, 26

APPENDIX C

VALUES AND RANKS FOR VARIABLES

	Entrance Rate to Public Institutions		First-time Resident Enrollment		Retention Factor in Public Institutions		State and Local Tax Capacity		State and Local Tax Effort	
	Value	Rank	Value	Rank	Value	Rank	Value	Rank	Value	Rank
Alabama	63	12.5	8.8	16	4.0	37	501	48	79	46
Alaska	59	18.5	7.3	26	5.1	5	917	3	84	39
Arizona	125	3	15.5	4	3.6	43.5	598	35.5	109	10
Arkansas	43	34.5	5.6	45.5	4.2	28.5	504	47	79	46
California	101	6	14.1	5	4.8	10	709	10	120	5
Colorado	56	21.5	8.2	21	4.8	10	671	13	92	24
Connecticut	43	34.5	6.9	31	4.1	33.5	727	7	95	20.5
Delaware	41	41	6.7	34.5	5.0	6	763	4	86	35.5
D. C.	43	34.5	4.0	51	4.1	33.5	773	5	90	27.5
Florida	60	16.5	6.6	36	4.6	15	628	28	79	46
Georgia	41	41	5.2	48	4.8	10	567	40	87	33
Hawaii	59	18.5	9.2	15	4.7	13.5	699	11	120	5
Idaho	43	34.5	6.8	32.5	4.5	17	557	41	93	23
Illinois	68	10	10.2	10	3.6	43.5	735	6	97	16.5
Indiana	37	44	5.5	47	4.8	10	629	27	92	24.5
Iowa	41	41	6.8	32	3.9	40	665	14.5	95	20.5
Kansas	62	14	9.5	13	4.4	21	676	12	87	33
Kentucky	42	38.5	5.7	44	4.7	13.5	575	39	81	41.5
Louisiana	49	27	7.3	26	4.3	24.5	655	14.5	82	40
Maine	36	45.5	5.6	45.5	4.5	17	476	50	118	7
Maryland	59	24	8.3	20	4.4	21	654	19	104	12
Massachusetts	44	31	7.1	29	3.9	40	505	31	131	2
Michigan	61	15	10.0	11	4.3	24.5	649	20	105	11
Minnesota	35	48	6.3	38	5.5	4	632	24	115	8.5
Mississippi	109	4	12.7	7	2.8	50.5	448	51	97	16.5
Missouri	45	30	6.7	34.5	4.5	17	603	32	85	37.5
Montana	43	34.5	7.8	23	4.2	28.5	630	25.5	96	18.5
Nebraska	54	24	8.7	18	4.0	37	660	16	86	35.5
Nevada	128	2	16.2	2	2.9	49	970	1	70	50
New Hampshire	30	51	4.7	49.5	4.1	33.5	627	29	80	43.5
New Jersey	46	29	7.1	29	4.2	28.5	716	9	99	14.5
New Mexico	35	45.5	6.0	41	5.6	3	600	33	83	30
New York	54	24	7.6	24	4.4	21	634	23	152	1
N. Carolina	73	8	9.6	12	3.5	45	538	45	88	30
N. Dakota	63	12.5	11.4	8	3.3	47.5	635	22	94	22
Ohio	43	34.5	7.1	29	4.2	28.5	657	18	80	43.5
Oklahoma	56	21.5	8.0	22	4.8	10	658	17	71	49
Oregon	132	1	18.6	1	2.8	50.5	630	25.5	99	14.5
Pennsylvania	35	48	5.8	43	4.0	37	606	30	96	18.5
Rhode Island	33	50	4.7	49.5	6.3	1	553	42	115	8.5
S. Carolina	60	16.5	8.7	18	3.9	40	494	49	87	33
S. Dakota	35	48	6.3	38	4.4	21	582	37	90	27.5
Tennessee	48	28	6.0	41	4.9	7	530	46	81	41
Texas	69	9	9.3	14	4.4	21	725	8	68	51
Utah	64	11	10.5	9	3.8	42	550	43	91	26
Vermont	38	43	6.3	38	4.2	28.5	542	44	121	3
Virginia	42	38.5	6.0	41	6.0	2	599	34	88	30
Washington	101	5	15.8	3	3.4	46	640	21	101	13
W. Virginia	52	26	7.3	26	4.2	28.5	577	38	85	37
Wisconsin	75	7	12.8	6	3.3	47.5	598	35.5	120	5
Wyoming	58	20	8.7	18	4.1	33.5	942	2	73	48

	State and Local Tax Revenues		State and Local Appropriation to Public Higher Education		State and Local Appropriation Student - Public		Tuition Revenues/Student - Public		Government Grants and Contracts Student - Public	
	Value	Rank	Value	Rank	Value	Rank	Value	Rank	Value	Rank
Alabama	395	51	61.2	22	19.26	26	541	30	665	15
Alaska	770	5	130.2	1	70.03	1	938	5	4369	1
Arizona	651	18	88.5	5	17.72	38	444	39	404	42.5
Arkansas	397	50	45.5	41	21.44	13.5	484	35	578	23.5
California	851	2	101.5	3	21.55	12	224	50	447	37
Colorado	617	23	67.0	17	15.75	48	789	11	795	10
Connecticut	690	11	40.3	45	18.66	34	469	36	348	49
Delaware	673	16	67.5	16	18.73	32	1099	4	438	38
D. C.	695	10	50.1	32	36.55	2	159	51	803	9
Florida	496	40	49.6	34.5	20.10	19	549	28	450	36
Georgia	493	41	45.3	42	19.97	22	611	22	557	29
Hawaii	838	3	93.7	4	23.49	8	389	42	913	4
Idaho	517	36	74.8	9	25.61	6	363	45	457	35
Illinois	712	8	58.3	27	21.29	15	490	34	404	42.5
Indiana	578	28	50.0	33	21.44	13.5	853	7	641	16
Iowa	631	21	68.5	15	27.04	5	745	12	793	11
Kansas	588	26	72.7	12	20.00	21	542	29	507	32
Kentucky	465	46	55.7	29	22.86	10	653	17	594	22
Louisiana	545	31	48.2	36	16.85	43	388	43	353	48
Maine	562	30	39.8	45	17.81	37	708	14	872	5
Maryland	680	14	56.5	28	19.25	27	850	8	555	30
Massachusetts	792	4	35.5	50	16.19	47	339	46	262	51
Michigan	681	13	63.3	20	18.83	30	827	9	578	23.5
Minnesota	727	6	59.1	26	20.76	17	633	20	849	7
Mississippi	434	47	59.3	25	18.67	33	536	31	622	19
Missouri	512	37	47.1	38	18.53	35	573	26	367	45
Montana	604	24	54.9	30	17.03	41	458	38	564	26.5
Nebraska	567	29	71.0	13	23.18	9	646	18	560	28
Nevada	678	15	62.0	21	17.42	39.5	465	37	405	41
New Hampshire	501	38	31.0	51	13.18	50	1318	2	613	20
New Jersey	708	9	40.7	44	18.83	30	684	16	354	47
New Mexico	528	32	59.6	24	18.02	36	529	32	869	6
New York	994	1	69.7	4	28.14	4	601	23	397	44
N. Carolina	473	44	60.7	23	20.63	18	420	41	564	26.5
N. Dakota	596	25	74.3	10	19.00	28	505	33	623	18
Ohio	525	34	39.7	47	16.65	44	928	6	411	40
Oklahoma	456	45	46.8	39	13.29	49	381	44	364	46
Oregon	623	22	80.1	8	19.33	25	577	25	741	13
Pennsylvania	582	27	37.2	48	19.96	23.5	1124	3	604	21
Rhode Island	635	20	51.9	3	21.11	16	794	10	781	12
S. Carolina	429	48.5	64.0	19	21.69	11	437	40	468	33
S. Dakota	523	35	47.9	37	17.42	39.5	730	13	550	31
Tennessee	429	48.5	42.4	43	16.90	42	582	24	566	25
Texas	492	42	65.5	18	20.04	20	323	48	433	39
Utah	500	39	73.4	11	18.83	30	555	27	1286	2
Vermont	656	17	35.9	49	12.29	51	1622	1	1202	3
Virginia	526	33	49.6	34.5	16.36	46	645	19	463	34
Washington	646	19	83.4	7	19.96	23.5	337	47	813	8
W. Virginia	490	43	46.1	40	16.58	45	287	49	347	50
Wisconsin	717	7	86.2	6	24.56	7	702	15	680	14
Wyoming	687	12	102.7	2	28.21	3	617	21	624	17

	Private Gifts Grants and Endowment Income Student - Public		Other Revenues Student - Public		Total E&G Revenues/ Student - Public		Student Aid/ Capita - Public		Institutional Support/Capita Two-year - Public	
	Value	Rank	Value	Rank	Value	Rank	Value	Rank	Value	Rank
Alabama	80	34	302	16	3516	28	0.00	46.5	7.9	30
Alaska	58	43.5	258	24	12631	1	0.00	45.6	36.4	2
Arizona	111	26	153	41.5	2883	46	0.00	45.5	28.7	4
Arkansas	195	9	263	23	3664	20	0.13	32	3.7	42
California	59	42	177	34	3063	43	0.67	15	48.2	1
Colorado	149	16	265	22	3572	26	3.09	3	12.2	20
Connecticut	63	40.5	118	47	2865	47	0.42	18	7.7	31
Delaware	83	1	320	12	4414	6	0.03	37.5	17.1	12
D. C.	74	37	30	51	4725	4	0.00	46.5	00.0	50.5
Florida	94	32	120	46	3224	38	0.29	20	17.8	10.5
Georgia	128	20	157	40	3449	31	0.16	29	5.3	39
Hawaii	78	35.5	238	26	3967	15	0.20	25.5	21.7	8
Idaho	200	7	318	13.5	3899	16	0.10	35.5	7.2	33
Illinois	58	43.5	153	41.5	3235	37	2.27	5	16.8	13
Indiana	153	14	321	11	4112	9	1.37	9	2.4	49
Iowa	199	8	423	5	4864	2	0.12	34	14.5	17
Kansas	91	33	286	18	3425	32	0.19	27	11.1	22.5
Kentucky	202	6	371	7	4106	10	0.24	22	2.8	47
Louisiana	40	48	130	43	2597	48	0.13	32	2.5	48
Maine	123	23	271	20.5	3754	18	0.06	40.5	3.0	46
Maryland	50	46	200	30	3579	25	0.21	24	16.2	14
Massachusetts	41	47	94	50	2354	51	0.49	17	6.6	35.5
Michigan	168	12	163	38	3519	23	0.85	12	15.4	15
Minnesota	371	2	318	13.5	4247	8	1.97	8	7.4	32
Mississippi	71	38	290	17	3385	34	0.10	35.5	14.3	18
Missouri	66	39	223	29	3082	42	0.20	25.5	6.6	35.5
Montana	119	24	283	19	3127	40	0.15	30	3.2	44
Nebraska	141	18	316	15	3981	14	0.18	28	12.4	19
Nevada	124	22	173	37	2909	45	0.00	46.5	11.3	21
New Hampshire	33	51	348	9	3631	22	0.00	46.5	5.4	38
New Jersey	78	35.5	122	45	3120	41	2.12	6	9.5	26
New Mexico	133	19	356	8	3689	19	0.00	46.5	4.4	41
New York	108	28	107	48	4027	12	3.29	2	17.8	105
N. Carolina	157	13	271	20.5	3456	30	0.06	40.5	20.3	9
N. Dakota	178	10	451	2	3656	21	0.35	19	10.7	24
Ohio	170	11	229	27	3404	33	1.10	10	6.7	34
Oklahoma	38	49	254	25	2366	50	0.08	37.5	8.0	29
Oregon	103	29	185	33	3538	27	1.03	11	27.8	5
Pennsylvania	127	21	162	39	4013	13	2.67	4	5.5	37
Rhode Island	54	45	105	49	3845	17	0.81	13	10.0	25
S. Carolina	63	40.5	195	32	3332	36	0.00	46.5	9.3	27
S. Dakota	117	25	441	3	3580	24	0.13	32	0	50.5
Tennessee	96	31	224	28	3157	39	0.00	46.5	5.2	40
Texas	150	15	452	1	3362	35	0.07	39	14.7	16
Utah	212	5	336	10	4272	7	0.23	21	8.9	28
Vermont	323	3	426	4	4803	3	3.30	1	3.5	43
Virginia	101	30	176	35	3021	44	0.22	23	11.1	22.5
Washington	147	17	174	36	3468	29	0.74	14	26.6	6
W. Virginia	36	50	197	31	2524	49	0.50	16	3.1	45
Wisconsin	110	27	128	44	4077	11	2.04	7	24.4	7
Wyoming	244	4	393	6	4699	5	0.00	46.5	32.4	3

	State and Local Appropriations/ Student - Two-year - Public		Tuition Revenues/ Student - Two-year - Public		Total E&G Revenues/Student Two-year - Public		Institutional Support/Capita - Independent		Total E&G Revenues/Student - Independent	
	Value	Rank	Value	Rank	Value	Rank	Value	Rank	Value	Rank
Alabama	737	48	239	42	1210	48	0.8	7	3516	29
Alaska	4523	1	609	4	8145	1	0.3	18	5559	7
Arizona	1252	23	227	44	1847	31	0.0	37	2079	48
Arkansas	1403	15	350	26	2378	11	0.0	37	2694	44
California	1653	12	41	49	1897	28	0.0	37	5777	6
Colorado	1191	30	374	22	1965	26	0.0	37	5015	11
Connecticut	1069	38	262	40	1460	44	0.4	14	7061	2
Delaware	2330	2	497	12	3063	4	0.0	37	1949	50
D. C.	0	50.5	0	50.5	0	50.5	0.0	37	6266	3
Florida	1314	18	473	14	2026	22	0.5	11	4073	23
Georgia	925	41	417	19	1573	40	0.0	37	4963	13
Hawaii	1253	22	104	48	1836	32	0.0	37	2375	45
Ieaho	2074	5	363	25	2991	5	0.0	37	2057	49
Illinois	1295	19	349	27.5	1854	30	0.9	6	5218	9
Indiana	1207	28	507	10	1917	27	0.1	22	3603	27
Iowa	1695	9	660	2	3217	2	0.3	18	3470	30
Kansas	1320	17	368	23	2301	14	0.0	37	3177	35
Kentucky	774	47	400	20	1267	47	0.0	37	3143	36
Louisiana	1078	36	313	34	1550	41	0.3	18	4919	15
Maine	2000	7	537	8	3141	3	0.0	37	4313	20
Maryland	1501	14	580	5	2311	13	0.7	8	8772	1
Massachusetts	896	44	341	29	1484	43	0.0	37	5822	5
Michigan	1276	20	482	13	2022	23	0.3	18	3391	31
Minnesota	1339	16	500	11	2090	17	0.3	18	3554	28
Mississippi	1182	31	263	39	1765	35	0.0	37	3324	34
Missouri	922	42	444	17	1672	37	0.0	37	5236	8
Montana	1251	24	238	43	1882	29	0.0	37	2719	43
Nebraska	2026	6	349	27.5	2750	8	0.0	37	3783	24
Nevada	725	49	172	46	1103	49	0.0	37	2107	46
New Hampshire	1243	25	364	24	1803	34	0.0	37	4993	12
New Jersey	1269	21	540	7	2166	16	1.3	4	4818	17
New Mexico	1203	29	558	6	2434	9	0.0	37	3090	39
New York	1715	8	517	9	2430	10	4.0	2	5970	4
N. Carolina	1656	11	165	47	2008	25	0.4	14	5073	10
N. Dakota	1106	35	463	15	2056	20	0.0	37	3326	33
Ohio	1140	33	619	3	2019	24	0.5	11	4163	21
Oklahoma	904	43	244	41	1347	45	0.0	37	2871	40
Oregon	1537	13	384	21	2336	12	0.4	14	3722	25
Pennsylvania	977	40	796	1	2064	18	3.2	3	4923	14
Rhode Island	1673	10	441	18	2297	15	29.7	1	3361	32
S. Carolina	796	45	298	37	1494	42	0.0	37	2748	42
S. Dakota	0	50.5	0	50.5	0	50.5	0.0	37	2767	41
Tennessee	1024	39	302	36	1609	39	0.0	37	4634	18
Texas	1217	26	283	38	1808	33	1.1	5	4406	19
Utah	1168	32	331	30	2058	19	0.0	37	2089	47
Vermont	1117	34	455	16	2045	21	0.0	37	3690	26
Virginia	1077	37	316	33	1638	38	0.2	21	4085	22
Washington	1209	27	193	45	1735	36	0.0	37	3062	38
W. Virginia	777	46	326	31	1283	46	0.7	8	3092	37
Wisconsin	2319	3	308	35	2970	6	0.5	11	4843	16
Wyoming	2170	4	322	32	2861	7	0.0	37	0	51

	Student Aid/ Capita - Independent		Geographic Cost Index		Ratio: Percent Women in College/ Women in Population		Percent Minorities in Population		Federal Student Aid/FTE Student	
	Value	Rank	Value	Rank	Value	Rank	Value	Rank	Value	Rank
Alabama	0.00	44.5	91	39	0.91	34.5	31.0	7	0.29	8
Alaska	0.00	44.5	145	1	1.21	1	2.6	40	0.21	23
Arizona	0.00	44.5	89	44	0.92	29.5	17.4	18	0.17	42
Arkansas	0.09	30.5	87	48.5	0.96	15.5	21.0	13	0.29	8
California	1.74	7	105	6.5	0.97	11.5	26.5	10.5	0.15	47
Colorado	0.00	44.5	96	22.5	0.87	44	15.4	20	0.18	36
Connecticut	1.40	14	101	13	0.98	7.5	10.7	27	0.15	47
Delaware	0.18	25.5	112	4	1.01	3.5	13.0	23	0.16	45
D. C.	0.00	44.5	105	6.5	0.87	44	77.5	1	0.17	42
Florida	0.26	23	95	26	0.92	29.5	26.5		0.17	42
Georgia	0.08	32	93	19	0.96	15.5	32.5	6	0.25	16
Hawaii	0.00	44.5	131	2	0.95	19.5	2.8	38	0.12	50
Idaho	0.02	36	84	51	0.98	7.5	3.7	37	0.15	47
Illinois	3.55	1	104	8.5	0.78	51	20.7	14	0.18	36
Indiana	1.63	8.5	95	26	0.92	29.5	8.2	30	0.18	36
Iowa	3.23	3	93	31	0.93	24.5	2.0	43	0.18	36
Kansas	1.32	15	96	22.5	0.93	24.5	7.9	31	0.19	29
Kentucky	0.27	22	96	22.5	0.97	11.5	10.8	26	0.26	13
Louisiana	0.02	36	91	39	0.95	19.5	30.4	8	0.29	8
Maine	0.48	20	89	44	0.92	29.5	0.00	48.5	0.49	1
Maryland	0.12	28.5	103	10	0.96	15.5	21.5	12	0.19	29.5
Massachusetts	1.46	12	96	22.5	0.98	7.5	3.9	36	0.21	23
Michigan	0.38	21	117	3	0.91	34.5	13.1	22	0.19	29.5
Minnesota	1.47	10.5	94	28.5	0.96	15.5	1.0	45	0.25	16
Mississippi	0.02	36	87	48.5	0.98	7.5	40.3	2	0.38	4
Missouri	0.60	18	99	16	0.99	5	14.6	21	0.19	29.5
Montana	0.00	44.5	90	41	0.90	39	00.0	48.5	0.27	11
Nebraska	0.00	44.5	95	26	0.86	47	5.1	32	0.18	36
Nevada	0.00	44.5	107	5	0.81	50	11.7	24	0.13	49
New Hampshire	0.00	44.5	92	35	0.86	47	00.0	48.5	0.28	10
New Jersey	1.44	13	102	11	0.97	11.5	16.2	19	0.19	29.5
New Mexico	0.00	44.5	89	44	0.90	39	37.2	3	0.36	5
New York	3.03	4	104	8.5	0.95	19.5	20.4	15	0.21	23
N. Carolina	0.09	30.5	91	39	0.93	24.5	27.4	9	0.22	20
N. Dakota	0.03	34	92	35	0.92	29.5	00.0	48.5	0.31	6
Ohio	0.80	16	99	16	0.90	39	11.5	25	0.19	29.5
Oklahoma	0.12	28	89	44	0.91	34.5	9.2	29	0.22	20
Oregon	0.20	24	99	16	0.91	34.5	2.5	41.5	0.26	13
Pennsylvania	3.25	2	98	19	0.90	39	10.6	28	0.23	18
Rhode Island	1.63	8.5	86	50	0.86	47	2.5	41.5	0.17	42
S. Carolina	2.63	5	89	44	0.92	29.5	34.6	4	0.26	13
S. Dakota	0.18	25.5	93	31	0.87	44	00.0	48.5	0.39	2.5
Tennessee	0.00	44.5	88	47	0.95	19.5	18.9	16	0.25	16
Texas	0.66	17	93	31	0.88	42	33.6	5	0.20	25.5
Utah	0.00	44.5	92	35	0.84	49	4.4	33.5	0.11	51
Vermont	2.49	6	92	35	1.09	2	00.0	48.5	0.39	2.5
Virginia	0.05	33	94	28.5	1.01	3.5	17.7	17	0.17	42
Washington	0.16	27	101	13	0.93	24	4.4	33.5	0.18	36
W. Virginia	0.49	19	101	13	0.97	11.5	1.6	44	0.22	20
Wisconsin	1.47	10.5	98	19	0.90	39	4.3	35	0.20	25.5
Wyoming	0.00	44.5	92	35	0.94	22	2.7	39	0.18	36

	Other Federal Institutional Aid/ FTE Student		Percent Students in Private Institutions		Median Income	
	Value	Rank	Value	Rank	Value	Rank
Alabama	0.15	4	12.5	36	11.785	47
Alaska	0.17	2.5	2.6	49	22.432	1
Arizona	0.06	35	2.8	48	13.569	31
Arkansas	0.09	15	14.0	30	10.106	50
California	0.04	49	10.1	42	15.069	11
Colorado	0.07	27	9.1	44	14.992	13
Connecticut	0.05	43	38.5	8	16.244	5
Delaware	0.17	2.5	15.4	27	15.734	7
D. C.	0.08	20	82.7	1	14.001	27
Florida	0.07	27	17.8	24.5	12.205	39
Georgia	0.18	1	18.4	23	12.441	37
Hawaii	0.07	27	7.1	46	17.770	2
Idaho	0.05	43.5	20.1	22	12.844	34
Illinois	0.05	43.5	23.5	16	16.052	6
Indiana	0.07	27	24.6	14	14.411	22
Iowa	0.08	20	30.4	10	14.464	21
Kansas	0.08	20	11.1	38	13.412	32
Kentucky	0.01	51	17.1	26	11.019	49
Louisiana	0.12	10	14.1	29	12.576	36
Maine	0.14	5	26.0	13	11.839	44
Maryland	0.07	27	13.8	31	17.556	3
Massachusetts	0.08	20	54.5	2	15.531	8
Michigan	0.06	35	12.7	34	15.385	9
Minnesota	0.05	35	20.6	21	14.740	18
Mississippi	0.10	12	10.9	39	9.999	51
Missouri	0.05	35	30.1	11	13.011	33
Montana	0.07	27	10.3	41	13.608	30
Nebraska	0.08	20	17.8	24.5	14.209	25
Nevada	0.06	35	0.6	50	14.961	15
New Hampshire	0.10	12	41.7	5	14.258	24
New Jersey	0.05	43.5	24.2	15	16.432	4
New Mexico	0.13	7.5	7.8	45	11.798	46
New York	0.05	43.5	42.2	4	15.288	10
N. Carolina	0.08	20	21.2	19	11.834	45
N. Dakota	0.13	7.5	6.5	47	13.626	29
Ohio	0.05	43.5	22.3	18	14.822	16
Oklahoma	0.06	35	14.7	28	12.172	41
Oregon	0.08	20	10.8	4	13.854	28
Pennsylvania	0.05	43.5	39.3	7	14.153	26
Rhode Island	0.05	43.5	47.9	3	14.530	20
S. Carolina	0.07	27	21.1	20	12.188	40
S. Dakota	0.13	7.5	28.1	12	12.051	42
Tennessee	0.09	15	22.9	17	11.341	48
Texas	0.04	49	12.6	35	12.672	35
Utah	0.04	49	36.4	9	14.329	23
Vermont	0.10	12	40.5	6	12.415	38
Virginia	0.06	35	12.2	37	14.579	19
Washington	0.05	35	9.8	43	14.962	14
W. Virginia	0.13	7.5	13.4	32	12.007	43
Wisconsin	0.06	35	12.9	33	15.064	12
Wyoming	0.09	15	00.0	51	14.784	17

APPENDIX D

INTERCORRELATIONS MATRIX ON 28 VARIABLES FOR
50 STATES AND THE DISTRICT OF COLUMBIA

VITA

Mahindohkt Sadaghiani

Candidate for the Degree of

Doctor of Education

Thesis: AN ANALYSIS OF STUDENT ACCESS AND FINANCIAL SUPPORT MEASURES
IN HIGHER EDUCATION

Major Field: Higher Education

Biographical:

Personal Data: Born in Tehran, Iran, May 25, 1946, the daughter of Mr. and Mrs. Ebrahim Sadaghiani; married Mohamad Moadab Shabestari in Tehran, February 25, 1969; mother of Anoosh, born July 22, 1972.

Education: Graduated from Shahrzad High School, Tehran, in May, 1965; received the Licentiate degree from Tehran University, Tehran, in May, 1969; received the Above Licentiate degree from the Institute of Advanced Statistics, Tehran, in 1974; completed requirements for the Doctor of Education degree at Oklahoma State University, Stillwater, in December, 1980.

Professional Experience: Research Analyst, Institute for Research and Planning in Science and Education, Tehran, from 1970 to the present time.