A MULTIPLE REGRESSION ANALYSIS OF FACTORS RELATED TO SUCCESS IN THE OKLAHOMA STATE UNIVERSITY MASTER OF BUSINESS ADMINISTRATION PROGRAM

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PREFACE

The number of applicants to graduate programs of Business Administration is steadily increasing. With an increased number of applicants, a need arises for admission standards that are useful in distinguishing potentially successful students and those who would be unsuccessful. The establishment of such standards is dependent upon an ability to predict success by examining characteristics of an applicant.

This report is an attempt to determine which factors are most highly correlated with success in the Oklahoma State University Master of Business Administration program. A knowledge of the relationships of various characteristics of an individual with his performance in the program could be of definite value in predicting success for future applicants.

Special gratitude is expressed to Dr. Kent Mingo, whose guidance and assistance made this report possible. Indebtedness is acknowledged to Mr. Ronald Rosenbaum for his work in the data collection.

A very special appreciation is expressed to my wife, Ruth, whose encouragement and support throughout my entire graduate program have been invaluable.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

INTRODUCTION

Background

In the past few years, increasing emphasis has been placed upon the necessity of a college degree as a prerequisite for success in many fields. From year to year the number of individuals receiving degrees has steadily increased, as has the percentage of degree recipients. With this trend toward college training for larger numbers of people has come an increased emphasis upon the importance of post-degree or graduate school education.

One of the fields in which the amount of graduate study has increased markedly is that of Business Administration. Organizations are now seeking at a faster-than-ever pace those individuals with Master's degrees in Business Administration (MBA). Due to the recognized value of the MBA, graduate schools of business are now finding that the number of applicants for MBA programs has risen. In many cases the number of applicants exceeds the available positions, necessitating the rejection of the admission requests of certain individuals.

As the number of applicants to MBA programs rises, it is apparent that, even if facilities are expanded, the number of individuals rejected or turned down must also increase. This points to an obvious need for admission standards that can be used in evaluating applicants. Such standards would differentiate between those students who would successfully complete the program and those who would be unable to do so. A method of evaluating and differentiating among applicants implies an ability to predict classroom performance of the individual.

Alfred Page and Richard West, in an article entitled "Evaluating Student Performance in Graduate Schools of Business,"[1] point out that the present ability of business schools to predict classroom success is very limited. This, of course, means that it is extremely difficult for business schools to devise and substantiate meaningful admission rules. Over the past few years several graduate schools of business have become aware of the fact that they cannot accurately predict success or that they have not used their ability to predict to set up standard criteria for judging applicants. Realizing the importance of accurate prediction, some schools are now statistically analyzing their ability to predict classroom performance. Page and West, in a selected sample of twenty-four graduate schools of

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[1] Alfred N. Page and Richard R. West, "Evaluating Student Performance in Graduate Schools of Business," Journal of Business, January, 1969, p. 36.

business administration, found that seventeen had attempted some type of analysis of grade records.[2]

The attemps being made by these schools point out their awareness of an important problem. Granting that the problem (prediction of success) is one without a definite answer, the objectives of this report will now be discussed.

Objectives of the Study

This study will deal with the topic of success prediction in the specific setting of the Oklahoma State University Master of Business Administration Program. The study will involve an analysis of certain variables and characteristics associated with the MBA candidate and will attempt to determine which variables or combinations of variables are most highly correlated with success in the program (as measured by grades).

By examining the correlation of various independent variables with grades, a better estimate can be made of which factors actually are the best predictors of success. This, in turn, should lead to certain implications concerning standards of admission and evaluation of applicants.

It is rather obvious that work in an area such as this must of necessity be somewhat exploratory in nature. For this reason, a

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[2] Ibid., p. 2.

list of specific objectives will not be established, but rather, the report will concern itself with the general objective of pointing out terms of importance in the area of grade prediction.

Significance of the Study

The first area of significance of the study will be in its applicability to the Oklahoma State University Business School. Since it is the most in-depth examination of the records of the OSU MBA program to date, it should be of some value to those administering the program.

A second area of significance of the study will be the contribution to the rather limited amount of work done in graduate business programs. The report will be one of the very few available examples of multiple linear regression analysis as a predicting device in business schools. Thus, it may be of value to others doing related study.

Limitations of the Study

There are certain limitations to this study that should be noted.

First, there is the problem of the time span involved. Since the study deals with success in the MBA program, it would be ideal if success today were exactly the same as success in the past and future. However, this is likely not the case since the emphasis of the program has shifted somewhat and may still be changing. The problem

of time span when dealing with grades is one of determining if a 3.60 grade average this year is the same as a 3.60 grade average last year or next year. An attempt was made to insure that this was the case by including in the sample only those individuals who entered the program since the last major change in administration (1966-67).

A second limitation was the availability of data. Although the sample was enlarged to include almost the entire population of entrants to the program during the time period covered, the records were incomplete for some individuals. Thus, certain bits of data were not available for everyone. This limitation was overcome by sorting the accumulated data to assure that no zero (unavailable) entries were included in the statistical computations. This caused the sample sizes to vary for different variables but was not a major problem.

A third limitation to the study may be the homogeneity of the students involved. A majority of the entrants to the MBA program also did their undergraduate work at Oklahoma State University. In a few cases there may be a larger than desired amount of inter-correlation among the independent variables. However, the previously mentioned increase in sample size seemed to handle most of this problem.

Organization of the Study

This paper is organized into six chapters. The present chapter has discussed the problem, the objectives, and certain limitations to the study. The second chapter will review some of the pertinent literature. Due to the importance of regression analysis in this paper, the third chapter will present a detailed look at some of the considerations of multiple linear regression. Chapter IV will describe the methodology employed and Chapter V will be a presentation of the data analysis and conclusions. Final remarks and implications of the study will be found in the last chapter.

CHAPTER II

LITERATURE REVIEW

The previous chapter indicated that there is a very definite need for more specific admission standards at most universities. This need now faces many graduate schools, and is especially beginning to be important to graduate schools of Business Administration. The necessity of more clearly defined admission standards is directly related to the ability to predict academic success. Through a review of pertinent literature, this chapter will present some of the approaches to academic success prediction that have been used. Also included will be the views of certain researchers as to the applicability of various techniques and the need for further research.

Although the emphasis of concern about grade prediction and selection criteria still appears to be at the undergraduate level, in most cases the statements and approaches are directly applicable to graduate schools. Most workshops or symposiums deal primarily with the area of entrance to college and then devote a lesser amount of time to the problem of selectivity among graduate school applicants. Speaking as the introductory speaker during a symposium on the coming crisis in selection, Dr. Robert Havighurst stated:

> Since selectivity requires some sort of value judgement as to what is desirable in the composition of the college population, increasing selectivity is likely to intensify the problem of choosing among competing values. Therefore, during the coming crisis the social goals of higher education will be examined more carefully and critically for guidance in deciding the most desirable selective procedures.[1]

Even though the need for admission standards, and thus predictive techniques, is probably more critical at the present than ever before, there are several studies in the area from quite some time ago. One of the oldest studies, and yet most pertinent to this report, is that done by Dr. Jospeh MacNeel of Columbia University. The study dealt with some problems encountered in the admission of students for the degree of Master of Arts in the Teachers College, Columbia University.

MacNeel's purposes were to determine the effectiveness of various types of undergraduate preparation and to establish relationships between undergraduate records and success in the Teachers College Master's degree program. He used the individual's undergraduate transcripts and General Examination (graduate school entrance test) as the sources of his data and used graduate grade average as his dependent variable. The independent variables which he related to graduate success were undergraduate grades, General

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[1] Robert J. Havighurst, "Introduction to the Symposium," The Coming Crisis in the Selection of Students for College Entrance, ed., Kenneth E. Anderson (Washington, D. C.: American Educational Research Association, 1960), p. 2.

Examination score, accumulated grade points in education courses, age at entry, and elapsed years between undergraduate and graduate school. He also classified undergraduate schools into categories dependent upon size in one case and type of institution in another. Limited by an absence of computer facilities to aid with involved calculations, MacNeel limited most of his analysis to a comparison of means and standard deviations for various classes of data. He did compute coefficients of correlation between graduate grades and undergraduate average (.33), General Examination score (.16), age (.29), and elapsed years (.10).[2] These coefficients of correlation are quite low and very likely not significant although MacNeel did use them in his discussion of recommendations to the Columbia University faculty.

Very likely the most thorough work done in this field is that compiled by a University of Chicago Staff under the direction of Floyd Reeves and John D. Russel. Especially significant is the extensive contribution by Roy Bixler on the topic of admission of graduate students. His study attempted to relate graduate grades to certain factors such as undergraduate training, age, elapsed time between undergraduate and graduate training, and a psychological examination administered to applicants. Although Bixler was very thorough and precise in his approach, he too was limited by the non-

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[2] Joseph R. MacNeel, Admission of Students As Candidates for Master's Degrees, (New York, 1932), p. 79.

availability of computer facilities. His classification of data such as undergraduate training is very extensive but, unfortunately, most of his results are expressed merely as percentages of students falling into different categories. He did compile certain correlation coefficients, including graduate record with undergraduate record (. 35), graduate record with score on psychological exam (. 50), and graduate record with undergraduate record and first quarter graduate record (. 54).[3] The author pointed out that practical use could be made of the correlations even though they might not be high enough to warrant use of the regression equation. This practical use would be in the differentiating of potentially inferior and potentially superior students rather than actually predicting grade averages.

G. T. Bushwell, as part of the same Chicago University program, made a similar study of the selective admission and retention of graduate students in the Department of Education. Bushwell's analysis involved a comparison of different data groups and, although similar to Bixler's, was not as revealing in its conclusions. He did find that for a group of nearly 300 students, the correlation between total undergraduate grade points and first quarter graduate grade points was only . 338.[4]

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[3]Roy W. Bixler, "The Admission of Graduate Students," Admission and Retention of University Students, ed., Floyd W. Reeves and John D. Russel (Chicago, 1933), p. 173.

[4]G. T. Bushwell, "A Study of Selective Admission and Retention of Graduate Students in the Department of Education," Admission and Retention of University Students, ed., Floyd W. Reeves and John D. Russel (Chicago, 1933), p. 241.

Most predictive techniques employed today, whether at the graduate or undergraduate level, employ the scores from a standardized test or battery of tests. The inclusion of such scores into the regression equation or some other predictive device is based on the assumption that such scores are valid indicators of ability in some area. Albert B. Crawford, in Measuring Promise for Graduate Work, deals with the practical utility of the Graduate Record Examination in the selection of students. His work dealt with the Graduate Record Examination scores of Ph. D. candidates. The findings show that there was usually a clear cut difference on the Graduate Record Examination between Ph. D. recipients and those who failed to complete the program at Yale University. His work also pointed to the importance of not only concentration areas (specific topic tests) but also other areas of the Graduate Record Examination in predicting graduate school success at Yale. Based upon Crawford's finding that the Graduate Record Examination did a remarkably good job of predicting success, the importance of similar valid tests is apparent.[5]

During the last ten years there has begun to be an increased awareness of the problem of selectivity of both graduate and undergraduate applicants in America's colleges and universities. As the necessity of more precise selection procedures increased, many

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[5]Albert B. Crawford, Measuring Promise for Graduate Work, (New Haven, 1942), p. 45

universities recognized the problem as a serious one that was affecting more than just the applicants. This was pointed out by Dr. Harold Webster's statement:

> Admissions research extends well beyond the more obvious functions of improving selection. Selection is initially very complicated, especially because it is markedly affected by self-selection among the potential applicants. But admissions policy may also affect the public image of the college, so that characteristics of the applicants change. For example, "easy" admissions reputation is quickly appreciated nowadays by youngsters who need to find a college that is not difficult.[6]

Webster's idea is especially applicable to graduate schools since the reputation of a graduate school is a significant factor in the determination of type of applicants. Since the graduate schools are able to screen their applicants more closely than the undergraduate colleges and since the heads of a graduate program normally have more freedom in establishing their admission criteria, selection procedures become especially important to the graduate program administrator. If the reputation of the program is to be maintained or improved, adequate selection procedures must be adopted.

One example of an attempt to make the admissions process more systematic is shown by the work of Sam C. Webb at Emory University. At Emory, the applicants are evaluated by means of a weighted equation that uses the verbal and mathematics scores from the

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[6]Harold Webster, "Problems of Studying Educational Growth in College Students," Research Related to College Admissions, ed., Kenneth M. Wilson, (Atlanta, 1963), p. 24.

Scholastic Aptitude Test and the individual's high school grade average. A certain degree of success has been found but in recent years the multiple correlation of the predictors with earned grades has been declining. Webb explains this by showing that the classes are becoming more homogeneous, and then indicating that earned grades can be predicted with less accuracy as the classes do become more homogeneous.[7]

Because of the homogeneity of student records, some educators feel that any selection technique should be supplemented with a personal interview whenever possible. Those favoring the inclusion of the personal interview in the selection procedure generally feel that it is helpful in obtaining an idea of the applicant's motivations and desires. Dr. George Donovan, speaking on the topic of admissions to graduate school, made the recommendation:

> Where possible a personal interview with the applicant as part of the admissions process should be arranged. The Dean or associate Dean and the department head or major professor should be encouraged to take part. The interview is in practice today, but it is rapidly disappearing as a technique of admission. With the expected accelerated growth in the number of applicants, the need for selective steps including the personal interview is apparent.[8]

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[7] Sam C. Webb, "Increased Selectivity and Institutional Standards," Research Related to College Admissions, ed., Kenneth M. Wilson, (Atlanta, 1963), p. 59.

[8] George F. Donovan, "Admissions and the Graduate Schools," Philosophy and Problems at College Admissions, ed., Catherine Rich and Thomas Garnet, (Washington, D. C., 1963), p. 121.

Almost all predictive techniques now employed use certain standard measures such as test scores and previous grade record. In addition, an attempt is usually made to incorporate additional information into the evaluation equation. John Hills has examined the usefulness of information such as personal or biographical data in assessing academic potential. He found that information about an individual's hobbies, family size, and order of birth failed to add substantially to accuracy of predictions of college grades when combined with test scores and high school grades.[9] Hills referred to the previously discussed work at Emory University and pointed out that a biographical inventory added practically nothing to the accuracy of assessment obtained from standard predictors.

Hills also examined the frequently used technique of adjusting high school grades or undergraduate college grades to account for the particular school involved. His conclusion was that there is no value in such adjustments, if one uses aptitude test scores along with high school grades, combined through multiple regression techniques, as predictors of college grades.[10] Hills' reasoning is that the test scores act as an adjustment of high school grades, with the test scores showing actual ability of individuals who attended either mediocre or very rigorous high schools.

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[9] John R. Hills, "Assessing Academic Potential," Research Related to College Admissions, ed., Kenneth M. Wilson, (Atlanta, 1963), p. 79.

[10] Ibid.

Hills makes reference to the work of Warren Willingham concerning the usefulness of knowledge of grade trends of an individual. In a study conducted at Georgia Institute of Technology he found that knowing the trend of a student's grades in particular college courses was of no help in predicting subsequent average grades. From his work, it would appear that the use of items such as grade point average for the last two years of undergraduate work should be more thoroughly examined.

As a summation of his extensive work in grade prediction and admission standards, Hills strongly recommends that admissions officers use multiple regression techniques with the predictors being an academic aptitude test, high school grade average, and other predictors available that add to the accuracy of the multiple prediction formula.

In a thorough study of academic success at Hollins College in Virginia, Paul Woods used eighteen variables which he correlated to success. Woods' analysis was limited by his definition of success, graduation from college, and by his method of presenting the results of his study. He divided his observations into those having a particular characteristic and those not having the characteristic, and then gave the percentage of each that graduated from Hollins. In defense of his approach, Woods explained that he did not use multiple regression analysis because he did not feel it would enable researchers to spot the particular kinds of poor risks or the highly successful

groups. He also felt that the results yielded by multiple regression techniques are not as readily understood.[11]

One of the most up-to-date, as well as most extensive and complete, studies of college admissions has been conducted by Dean K. Whitla and others at Harvard University. In estimating a given applicant's capabilities, the admissions personnel at Harvard rely on a combination of the student's College Board test scores and his secondary school rank-in-class, with the elements weighted to yield what they consider the best prediction of his academic standing.[12] The predicted grade average is based on an equation that is derived from the interrelationships that have been found to exist among certain independent variables and the dependent variable, college achievement.

Whitla has compiled the research done at Harvard and presents a summation of the correlations that have been found between certain variables used as predictors and college grades for individuals in the Liberal Arts and Engineering Colleges. Whitla points out that the multiple correlation coefficients obtained through regression analysis are very useful in prediction of success. He feels that the

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[11] Paul J. Woods, "Correlates of Attrition and Academic Success," Research Related to College Admissions, ed., Kenneth M. Wilson, (Atlanta, 1963), p. 105.

[12] Dean K. Whitla, "Evaluation of Decision Making: A Study of College Admissions," Handbook of Measurement and Assessment in Behavioral Sciences, ed., Dean K. Whitla,(Reading, Masschusetts, 1968), p. 457.

multiple correlation must be at least .41 for a formula to be very useful in predicting grades. If the correlation is not above that level, he believes that the errors would be large and little will be gained by the operation.[13] Correlation values lower than this level, and many of those in the Harvard studies were, can still be quite useful if used in the proper manner. Although the prediction formula could not be considered exactly correct, it could still be used for the majority of cases, especially when categorization rather than exact prediction is desired. Whitla's work also points out that the standard error of the estimate, a measure of the range of error that will be found in the predictions, is an indicator of the power of a regression equation.

Through a review of pertinent literature, this chapter has presented some of the previous work done in grade prediction and its relation to admission standards. The following chapters will discuss the methodology used to research the problem in this study.

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[13] Ibid., p. 16.

CHAPTER III

MULTIPLE REGRESSION ANALYSIS

Regression methods are techniques that are used to determine the functional relationship among two or more related variables. Such a functional relationship is generally represented by a function known as a regression function. In the regression function, the dependent variable is dependent upon the values of the independent variables and their corresponding parameters.

In more technical terms, Rulon, Tiedeman, Tatsuoka, and Langmuir define the regression equation as a linear combination of the predictor variables obtained by minimizing the sum of the squared differences between observed criterion scores and the estimated criterion scores computed by the linear computation. The regression equation describes a choice of axis rotation in the predictor test space that results in the reduction of the predictor test space to a one-dimensional space.[1] This rotation and accompanying reduction of the test space dimensionality causes the sum of the squared differences to be minimized.

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[1] Phillip Rulon et al., Multivariate Statistics for Personnel Classification, (New York, 1967), p. 321.

In any analysis it is hoped that the regression function will represent a causal mechanism associated with the experimental values under investigation. However, in many cases the basic variables and their parameters will not likely be known with certainty. Even when this is the case, the methods of regression analysis may still prove useful as analytic and predictive tools.[2]

Although the primary purpose of most analyses in which a regression equation is determined is to derive estimates of a dependent variable, other values may also arise from the regression technique. E. J. Williams, in Regression Analysis, points out that the value may lie in the ability of the regression equation to assess the magnitude of the effects of one or more factors, and to separate out the contributions of each factor.[3]

Another author, Joe H. Ward, views the value of the multiple linear regression model in a slightly different manner. In his discussion, the prediction problem is formulated as an effort to derive, from a given sample of observations, estimates of unknown parameters. These estimates will in turn enable the investigator to make accurate predictions of the criterion observations.[4]

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[2] Bernard Ostle, Statistics in Research, (Ames, Iowa, 1963), p. 160.

[3] E. J. Williams, Regression Analysis, (New York, 1959), p. 106.

[4] Joe H. Ward, "Multiple Linear Regression Models," Computer Applications in the Behavioral Sciences, ed., Harold Borko, (Englewood Cliff, New Jersey, 1962), p. 210.

Regardless of the specific use made of the regression analysis, the estimation of the parameters can be considered a major step in the analysis. As Ehrenfeld and Littauer point out, there are a number of methods available for estimating the parameters in the regression equation.[5] One such method is the Linear Unbiased Minimum Variance method. With this method of estimation, the requirement is made that the estimates be linear functions of the observed values of the dependent variable and that the estimates be unbiased. The criterion is to choose from those estimators which meet the requirements the estimator which minimizes the variance.

The Maximum Likelihood Estimates method is another approach to the estimation of the parameters. This approach assumes a normal distribution of the observed dependent variable values. It yields the same estimates as the most often used technique, the method of least squares. The method of least squares involves the use of a quadratic error function which includes the estimates of the parameters. The values of the parameter estimates are then determined by minimizing the sum of the squares of the deviations between the dependent variables and their estimates.

Before the advent of high speed computer facilities to handle the necessary manipulations, regression analysis was, in many cases, a

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[5]Sylvain Ehrenfeld and Sebastian Littauer, Introduction to Statistical Method, (New York, 1964), p. 452.

tool that could not be fully utilized. Now, however, there are almost no restraints to the complexity of the problem or the number of variables involved. Joe H. Ward explains the situation:

> In the past, the multiple regression model has been used primarily with very small groups of variables for the purpose of obtaining weights which, when applied to predictors, would yield optimal predictions of observed criteria. Given computer facilities, scientists are free to work with large numbers of variables -- expressed in either continuous or categorical form.[6]

The flexibility of the computer in handling the mechanics of multiple regression analysis is emphasized by the use of what Salzman and others term Dummy Variables. In many cases it may be impossible to give a specific measurement to one or more variables. In such cases, Dummy variables are a convenient way of injecting into the regression equation factors which cannot be measured in quantitative terms. It is appropriate in these situations to use binary variables, coded 0 or 1, to indicate membership in a category. The multiple regression techniques used in virtually all computer programs readily handle data in the binary-variable form. The ability of computer-oriented regression models to handle category membership data is especially important to the researcher in many of the social science areas. This advantage, as well as the advantage of having almost no restrictions on the complexity of the functions,

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[6] Joe H. Ward, "Multiple Linear Regression Models," Computer Applications in the Behavioral Sciences, ed., Harold Borko, (Englewood Cliff, New Jersey, 1962), p. 206.

point to an increased use of computer programs for multiple regression analysis.

Although there are obviously a great many benefits to be derived from multiple regression analysis and although it is a powerful tool, there are also limitations or drawbacks. Because of the uncertainty involved with the variables, caution must be exercised in the interpretation and analysis. Even when a particular functional relationship has been assumed and a specific computational procedure followed, it cannot be assumed that a causal relationship exists among the variables. Just because a function can be established that is a good fit to a set of observed data, it cannot necessarily be inferred that a change in one variable causes a change in another.[7]

Although the present chapter has provided only a very brief and general introduction to the technique of regression analysis, it does present a general understanding of the technique employed in this study. For a more extensive mathematical presentation of regression analysis the reader is referred to Ostle (1963), Rulon, Tiedeman, Tatsuoka, and Langmuir (1967), Borko (1962), Exekiel and Fox (1959), and Williams (1959).

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[7] Bernard Ostle, Statistics in Research, (Ames, Iowa, 1963) p. 160.

CHAPTER IV

METHODOLOGY

The previous chapters have pointed out the increased need for definite admission standards for graduate schools of business. It has also been shown that the ability of business schools to establish such standards is, in many cases, woefully inadequate. This chapter will discuss the methodology utilized to gather information to be used in the analysis of this problem.

Since the purpose of this study was essentially to determine which factors (independent variables) were correlated with success, it was necessary to obtain as much information about the independent variables as was possible and feasible. Before the data collection was begun, a list of desired variables was established. This list was then discussed with Dr. B. C. Hamm, Director of Graduate Studies in Administrative Sciences at Oklahoma State University. Through this discussion and an examination of a typical file or student record it was possible to determine which variables might be feasibly included in the study. This pre-collection discussion also helped to determine the sample size.

The previously discussed decision to include in the study only those individuals who entered the program during or after the 1966-

1967 academic year was the primary determinant of the possible sample size. Since this decision itself brought the population of observations down to a workable number, it was not considered necessary or beneficial to determine the sample by some random process. Rather, the entire population of observations (student records for the time period) was used, with certain exceptions. It was determined that those students who entered or were in the program on a part-time (less than full load) basis should be eliminated from the sample. Also eliminated were those who started the program but dropped out before finishing at least a full semester (11 hours) of course work. It was found that approximately 100 students met the criteria for inclusion in the sample.

Due to the confidential nature of the student records, it was determined by the Graduate Faculty that data collection should be done by an individual not in the Master of Business Administration program. For this reason, the records were examined and the data collected by Mr. Ronald Rosenbaum, a Wentz Scholarship employee of the College of Business Administration. For ease of collection and so that problems of interpretation might be avoided, a prepared data collection form was used (see Appendix A).

The information used in the study was obtained from each individual's application for admission to the Graduate College and from the application for an MBA assistantship if such an application had been made. Also obtained from each individual's file was his score on the

Admission Test for Graduate Study in Business. A transcript of all previous college work is also a part of each file and from the transcript were obtained two pieces of information not normally used in evaluation processes.

As an indicator of previous experience in mathematics, a computation was made of mathematics and statistics grade points accumulated in undergraduate work. By multiplying the course credit hours by the grade received in the course (A=4, B=3, C=2, D=1, F=0), the total number of grade points in mathematics and statistics courses was obtained. It was felt that the use of a grade points figure would be a better indicator of training or experience in the area than the computation of a mathematics grade point average, which would not take into account the number of hours taken.

A like method was used to compute the number of grade points accumulated in undergraduate English courses. In this area also, the grade points figure rather than an average figure was used in an attempt to indicate the amount of work completed. The use of this variable was based upon the hypothesis that English course background might be significantly correlated with success in the MBA program due in part to the amount of required writing in the program. The findings associated with the use of this variable will be discussed in a later part of this report.

Information was gathered from the application forms concerning each individual's rank in his undergraduate graduating class. The

rank in class is expressed on the application as two numbers, one for class standing and one for class size (i.e., 100 of 400). So that this information could be expressed in the same manner regardless of the individual's class size, the class standings were converted to a percentage figure. This figure expressed the percentage of the person's class which he was above. For example, a rank of 100 in a class of 400 would be expressed as 75.

The information available on the applicant's grade point averages was broken down into three categories. These categories were overall GPA, GPA in major field of study, and GPA for last two years of undergraduate work. In a like manner the scores for the Admission Test for Graduate Study in Business (ATGSB) was recorded as three separate scores. These were verbal score, quantitative score, and total score.

In order that the significance of an individual's undergraduate field and the university he attended could be examined, these variables were categorized into workable groups. The undergraduate universities were divided into three classifications according to the highest degree conferred by the university. In the first category were those smaller colleges and universities that confer only Bachelor's degrees. In the second category were universities with Master's programs but no Doctorate degrees. The third category contained those universities with programs of study in at least one area on all three degree levels. It was felt that by classifying the

undergraduate schools in this manner an indication of the type of undergraduate training could be obtained.

In a like manner, the Colleges of undergraduate work were classified. For this information it was merely a matter of indicating in which college, Arts and Sciences, Business, or Engineering, the individual had received his undergraduate degree. Although different universities used different names or descriptions for their Colleges no difficulty was involved in classifying colleges into one of these three major areas.

Also available in each individual's file was information about the individual's age at time of application, marital status, and years of permanent employment. Certain other pieces of information were gathered that were not used in the actual regression analysis but were considered to have possible value in the topic area.

At the time the data was collected, it was determined that as much potentially pertinent information as feasible be gathered. The first reason for this was so that the information would be available as the present study progressed. It was felt that any information that might be needed during the study should be collected during the initial collection process. A second reason was to make information in this subject area more readily available for further study in the area. The data collection form, showing all the types of information gathered, can be observed in Appendix A.

The completed collection forms were coded and entered on punched cards. Using the punched data, the technique of multiple linear regression analysis was the major statistical tool used in the analysis. The regression analysis was run on an IBM System 360/50, at the Oklahoma State University Computer Center. The program used was a Computer Center Library program written by Mr. David G. Simpson. The multiple regression analysis was employed since it contained all the information presented by a single regression analysis and was suited to the multivariable situations.

The regression analysis was conducted by using an individual's grades in the MBA program as the dependent variable and one or more of the previously discussed variables as the independent variables. In this manner, the influence of one factor or a combination of certain factors upon the individual's MBA grade point could be examined. By examining the correlation determined by different regression equations, the relative importance of the variables could be determined.

Since various pieces of information were unavailable for some observations, caution had to be exercised when dealing with such cases. Those variables which were missing in some of the observations were rank in class, the three GPA variables, and the ATGSB variables. Had individual observations with some of these variables missing been included in the sample, the means and standard deviations computed for those variables would have been in error. To

eliminate the inclusion of missing or zero value variables, the data was sorted before each regression analysis was made. For example, before any analysis involving overall GPA could be performed, the data had to be sorted to insure that all observations in the sample did have an overall GPA listed. In this manner, any analysis involving a particular variable (GPA, for example) could be assured of having actual values, thus actual means and a non-distorted regression analysis.

In a like manner, by sorting the data on one variable and then re-sorting upon other variables, those analyses involving combinations of variables were also freed from the distortion of missing values. Since various combinations were used, the sample sizes varied for different regression analyses. In all cases, however, the sample size remained large enough to not be a limiting factor.

After the regression analysis was conducted, the results were examined to determine their significance to the purpose of this study. The multiple correlation coefficients for various combinations of variables were examined to determine the contribution of each additional variable. Also, a Cumulative F-Distribution table was employed to determine the level of significance of various correlation coefficients.

This chapter has discussed the methodology used in the collection and analysis of data. The following chapters will discuss the results obtained from this data. The fifth chapter will present the

analysis of the data and conclusions that can be reached. The last chapter will contain certain interpretations and implications of the study.

CHAPTER V

ANALYSIS OF DATA

Introduction

The previous chapter briefly discussed the methodology employed in the collection and analysis of data. The analysis yielded a great deal of information about the various variables and their relationship with the dependent variable, grade point average, in the OSU MBA program. Included in the information were the means and standard deviations of the variables used in a particular regression run. The individual (simple) correlation of each variable with the dependent variable was available as was the multiple correlation coefficient, indicating the correlation of all the variables used in that analysis with the dependent variable. In addition, the regression coefficients and intercept were presented so that a regression equation might be formed.

Another important piece of information available was the standard error of the estimate, an indicator of the closeness with which values of the dependent variable can be estimated from the independent variables. Also available was a Table of Residuals. The residuals presented in this table are the differences between the

actual MBA grade point average for an observation and the estimated average determined by fitting into the regression equation the values of the independent variables for that observation.

The present chapter will be a presentation and analysis of the information obtained by the regression technique. The following chapter will then discuss some interpretations and implications of the analysis.

Analysis of Individual Variables

Table I presents an analysis of the five most significant individual variables used in the regression analysis. Since the multiple correlation in these cases involved only a single independent variable, the results are the same as would have been presented by a simple regression analysis, and can be represented in the same manner. By using the intercept and the regression coefficient, which in simple linear regression is the slope of the regression line, the regression equation can be formed. The equation is of the form $Y = A + B X$ with A being the Y axis intercept, B the slope of the line, and X the value of the independent variable.

The regression equations presented in Table I were formed by placing the A and B values into the standard form of the equation. For example, in Table I the A value for overall undergraduate grade point average can be read as 2.61931. This A value constitutes one point on the regression line and lies on the Y axis. The B value for

TABLE I

SUMMARY OF REGRESSION ANALYSIS FOR INDIVIDUAL VARIABLES

Variable	Mean	Standard Deviation	Correlation #16 V x MBA GPA	Regression Coefficient (B)	Standard Error of Regression Coefficient	Intercept (A)	Standard Error of Estimate
1. Rank in Class	74.41666	17.36679	.19050	.00408	.00276	3.07751	.36791
2. Overall GPA	2.84483	.40746	.25692	.25676	.10125	2.61931	.39570
7. ATGSB Total	488.56665	94.93091	.30636	.00120	.00049	2.79495	.35675
13. Math/Stat Grade Points	42.18332	25.32663	.42808	.00628	.00174	3.11589	.33870
14. English Grade Points	18.68332	8.54594	.26631	.01158	.00550	3.16448	.36124

this line can be read from Table I as .25676. By substituting these values into the previously mentioned standard form, the regression equation is obtained. By using an arbitrary value for undergraduate grade average (e.g. 3.60) in the regression equation a corresponding Y (MBA grade average) estimate can be obtained. Two values of the Y variable are now available, and the regression line can be constructed. Figures 1 through 5 show regression lines constructed by using the actual data presented in Table I.

From Table I and Figures 1 through 5 the following information can be obtained.

1. MBA GPA increases slightly as the rank in class increases.
2. MBA GPA increases as undergraduate overall grade point average increases.
3. MBA GPA increases as total score on the ATGSB increases.
4. MBA GPA increases as mathematics/statistics grade points increase.
5. MBA GPA increases as English grade points increase.

Since each of the five variables is an indicator of some type of academic achievement, even without the regression equations it would intuitively be suspected that as the values of these independent variables increase the value of the dependent variable would increase. This is, of course, borne out by an examination of the figures drawn

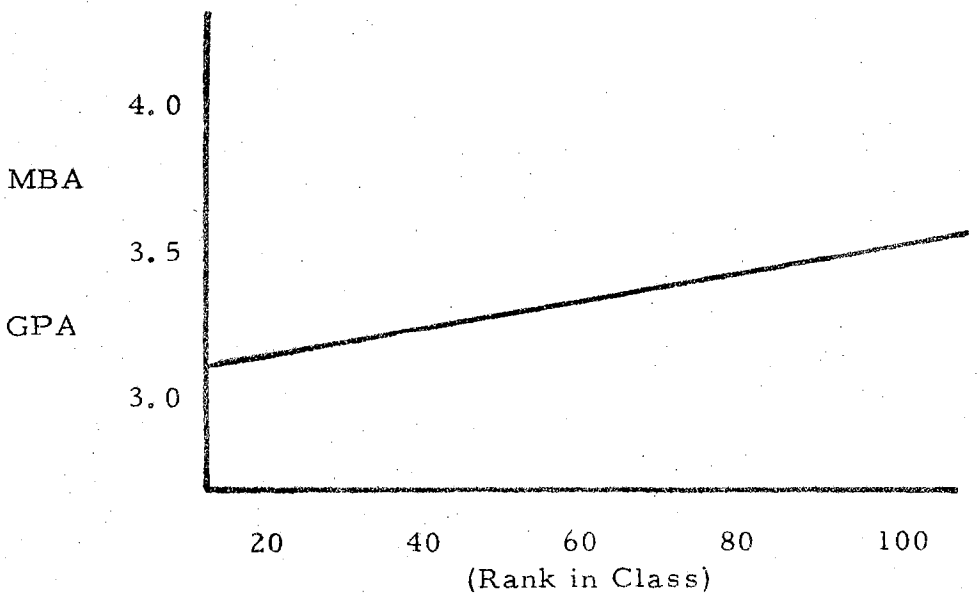

Figure 1. Effect of Rank in Class on MBA GPA

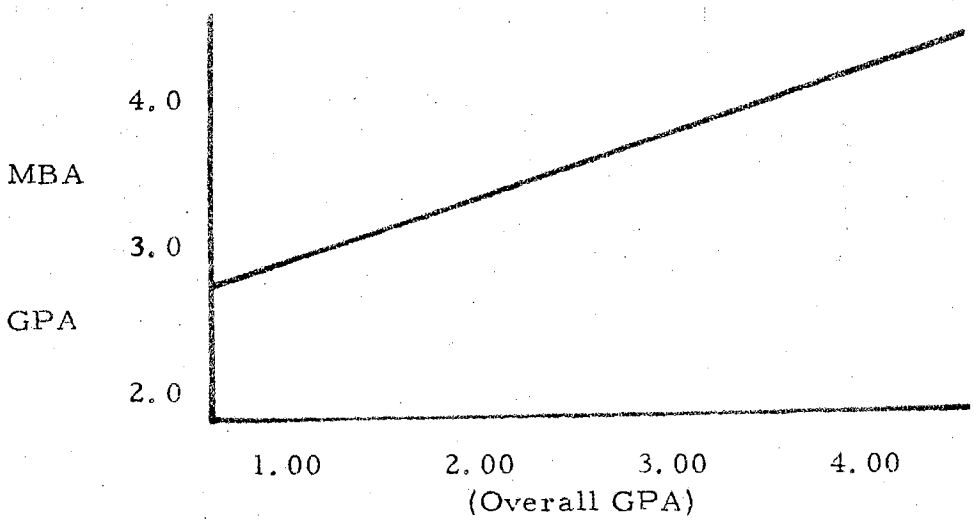

Figure 2. Effect of Overall GPA on MBA GPA

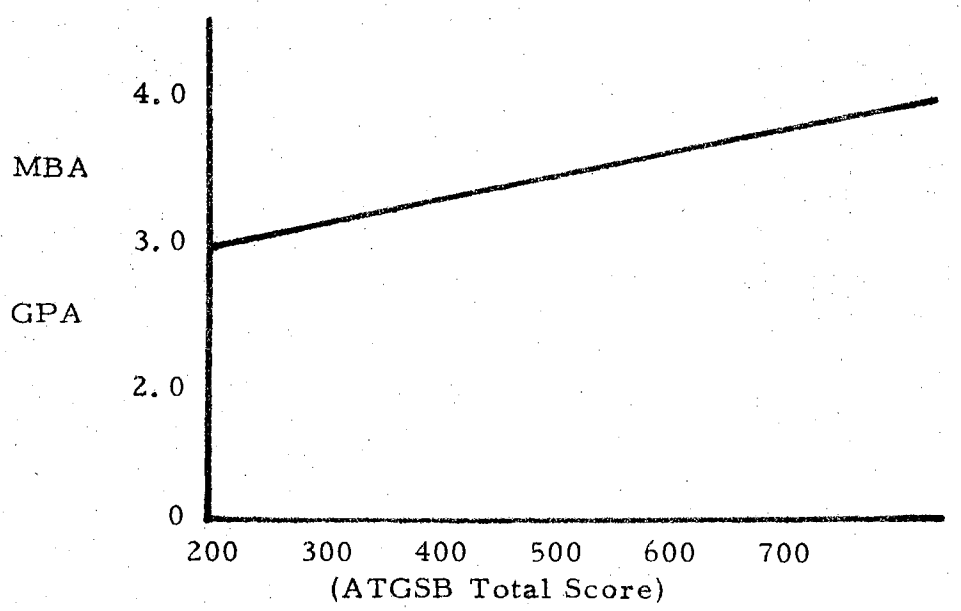

Figure 3. Effect of ATGSB Score on MBA GPA

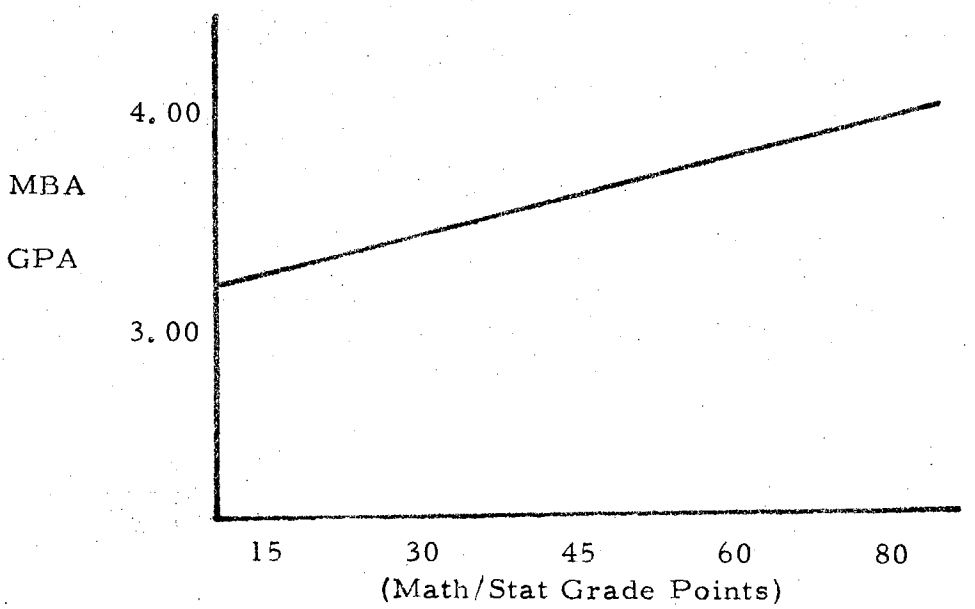

Figure 4. Effect of Math/Stat Grade Points on MBA GPA

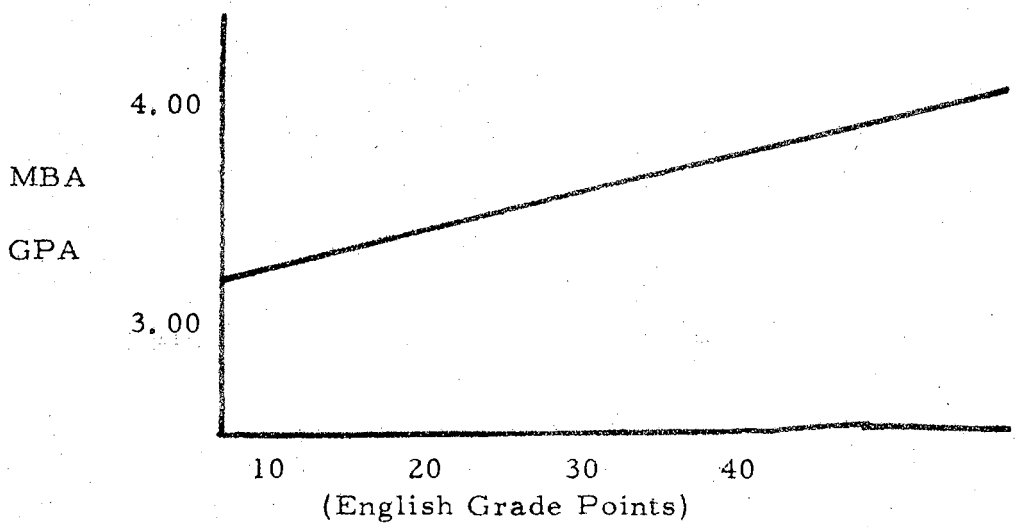

Figure 5. Effect of English Grade Points on MBA GPA

from actual data inserted into the regression equations. However, these figures give no indication of the significance of the relationships. To show the significance of the correlation coefficients and to aid in the interpretation of Figures 1 through 5, Table II has been prepared.

Column 3, Level of Significance, of Table II was prepared by referring to a Cumulative F-Distribution table. Since all of the variables are positively related to MBA GPA, the level of significance found for each of the variables gives a better indication of the relationship than do Figures 1 through 5. For example, from Table II the correlation between rank in class and MBA grade average was found to be not significant at the .10 level. Three of the variables, Overall GPA, ATGSB score, and English grade points, were found to be significant at relatively high levels (.025 and .05). The simple

TABLE II

REGRESSION EQUATIONS AND SIGNIFICANCE LEVELS
FOR INDIVIDUAL VARIABLES

Variable	Correlation V x 16	Level of Significance	Regression Equation
1. Rank in Class	.19050	Less than .10	$Y = 3.07751 + .00408X_1$
2. Overall GPA	.25692	.025	$Y = 2.61931 + .25676X_2$
7. ATGSB Total	.30636	.025	$Y = 2.79495 + .00120X_7$
13. Math/Stat Grade Points	.42808	.001	$Y = 3.11589 + .00628X_{13}$
14. English Grade Points	.26631	.05	$Y = 3.16448 + .01158X_{14}$

correlation between math/stat grade points and MBA GPA was .42808 and was significant at the .001 level. Both the correlation coefficient and the level of significance indicate a strong relationship between these variables.

Although these simple relationships, especially the math/stat grade points, are significant and of some value, it is apparent that higher correlations would be desirable. Under the assumption that a combination of two or more good predictors might yield a better predictor or indicator of success, the analysis will now turn to combinations of independent variables. In the next section of this chapter, it will be shown how the predictive capabilities of a simple regression equation may be increased by the combination of certain factors.

Analysis of Combinations of Variables

As previously stated, the purpose of this section is to identify which variables may be combined with already significant variables to yield a better prediction of grade average in the MBA program. With this purpose in mind, it would be of little value to examine those combinations which add to the correlation of a single variable but still are not significant. An example of this would be comginations involving variable 1, rank in class. Rank in class itself was not significant at the .10 level and it was found that combinations involving rank in class and other variables were no more significant than the added variables. Disregarding insignificant combinations involving rank in class, the

analysis will begin with variable 2, undergraduate overall grade point average.

From Table III, it is observed that by adding variable 8, undergraduate university attended (classified by degrees conferred), a contribution of .06619 is made to the multiple correlation and the significance level is increased from .025 to .01.

Examining the multiple correlation coefficients shows that the variables of College (Business, Arts and Sciences, Engineering), age, marital status, and years of permanent employment make relatively minor contributions when added to the regression equation. In fact, in some cases the addition of another variable increased the correlation coefficient but lowered the level of significance. Variable 7, ATGSB score, makes a significant contribution to the multiple correlation coefficient and also improves the level of significance to .005.

A major increase in the correlation coefficient is made by the addition of the mathematics/statistic grade points variable and the English points variable. The combination of independent variables 7 through 14 with variable 2 (see Table III) yields a multiple correlation coefficient of .58297 which is significant at the .001 level. As a point of comparison, this correlation compares very favorably with those found and used by the Harvard researchers (Whitla, 1968).

The simple correlation and the level of significance were slightly higher for ATGSB score than for overall GPA. However, for the most part, the variables added to the ATGSB score in the multiple regression

TABLE III

REGRESSION COMBINATIONS INVOLVING UNDERGRADUATE GPA

Regression Factors Included	Multiple Correlation Coefficient	Contribution of Added Variables	Significance Level
2. Overall GPA	.25692	.25692	.025
2, 8. Undergraduate University	.32311	.06619	.01
2, 8, 9. College	.34532	.02221	.025
2, 8, 9, 7. ATGSB Score	.42160	.07628	.005
2, 7, 8, 9, 10. Age	.42939	.00779	.005
2, 7, 8, 9, 10, 11. Marital Status	.43991	.01052	.01
2, 7, 8, 9, 10, 11, 12. Years of Employment	.44029	.00038	.025
2, 7, 8, 9, 10, 11, 12, 13. Math Points. 14. English Points	.58297	.14268	.001
2, 4. Last 2 GPA. 7. ATGSB Score	.40083	.14391	.01

equation added very little to the multiple correlation. As was the case with all the independent variables, the combination or addition of math/stat grade points contributed significantly to the correlation. The summarization of factors added to variable 7, presented in Table IV, shows that although the combinations are significant, they are not appreciably more or less valuable as a predictor of MBA grade average than are several other available combinations.

TABLE IV

REGRESSION COMBINATIONS INVOLVING ATGSB SCORE

Regression Factor Included	Multiple Correlation Coefficient	Contribution of Added Variable(s)	Significance Level
#7 ATGSB	.30600	.30600	.01
#7 8 Und. Univ.	.32870	.02270	.005
#7 8 9 College	.33451	.00581	.01
#7 5 Verbal 6 Quant.	.38618	.08018	.025
#7 13 Math Pts.	.45960	.15360	.0005
#7 14 Eng. Pts.	.34419	.03819	.005

It has been pointed out that there are several independent variables that, either alone or in conjunction with others, can be used to give a relatively good indication of grade average in the MBA program. The one variable that has the highest and most significant simple correlation coefficient is variable 13, mathematics and statistics grade points. This variable is also the largest contributor to the multiple correlation combinations.

Tables III and IV indicate that those combinations involving math grade points have the highest multiple correlations and are also the most significant. In all cases, the addition of variable 13 makes a significantly large contribution to the predictive ability of the multiple regression equations. As might be expected, since variable 13 is quite significant, the contribution of other variables is rather small in most cases. Table V summarizes the contribution of some of the other independent variables to a regression equation using mathematics grade points. It is seen that the multiple correlation contribution is rather small and that the level of significance is high enough that no major change can be made in it.

The only major contribution made by a single variable to the math points correlation is made by the English points variable. The correlation obtained using the two variables is .51515, significant at the .0005 level, and of value in estimating values of the dependent variable. Although this correlation is relatively high for only two variables, by referring to Table III it is seen that these two, plus several

others, yield an even higher correlation, .58297. It is this combination of variables that will be the last item of analysis.

TABLE V

REGRESSION COMBINATIONS INVOLVING MATH/STAT GRADE POINTS

Regression Factors Included	Multiple Correlation Coefficient	Contribution of Added Variable(s)	Significance Level
#13 Math Pts.	.42780	.42780	.0005
#13 14 Eng. Pts.	.51515	.08735	.0005
#13 1 Rank	.44079	.01299	.005
#13 7 ATGSB-Total	.47544	.04764	.0005
#13 6 ATGSB-Quant.	.43165	.00385	.0005
#13 8 Univ. 9 College	.44019	.01239	.0005

The regression equation which combined variables 2 and 7 through 14 was found to be

$$Y = 3.08557 + .06151X_2 + .00025X_7 + .08110X_8 + .06699X_9 - .03361X_{10} + .11523X_{11} + .03822X_{12} + .00478X_{13} + .01436X_{14}$$

and resulted in the multiple correlation coefficient of .58297, significant at the .001 level.

As was pointed out, the combination of variables 2 and 7 through 14 yields a significantly high correlation coefficient that compares favorably with those found in other studies. However, although of statistical importance, the correlation coefficients and levels of significance used in the data analysis do not give a real indication of the predictive abilities of the regression equation. So that the predictive power of the combination of variables could be examined, an additional step was taken in the regression analysis and a Table of Residuals was obtained.

As shown in Table VI, the Table of Residuals consists of a Y value (dependent variable) and a Y estimate determined by the regression equation. The residual is the difference between the actual Y value and the Y estimate. The Y estimates were calculated by fitting into the equation the individual's actual values for the independent variables (2, 7 - 14).

The significance of Table VI lies in the fact that it shows that for almost all the cases the predicted grade average was quite close (less than 10% off) to the actual grade average the individual achieved in the MBA program. This then gives tangible rather than just statistical evidence that the predictor (regression equation) does have value.

This chapter has presented an analysis of the data used in this study. It has been shown that certain characteristics of an individual's

TABLE VI

TABLE OF RESIDUALS
Variables 2, 7, 8, 9, 10, 11, 12, 13, 14

Case No.	Y Value	Y Estimate	Residual
1	3.25000	3.59549	-0.34549
2	1.55000	2.73083	-1.18083
3	3.50000	3.33837	0.16163
4	3.62000	3.37291	0.24709
5	3.38000	3.68378	-0.30378
6	3.00000	3.30655	-0.30655
7	3.50000	3.40878	0.09122
8	3.16000	3.02924	0.13076
9	3.02000	3.09334	-0.07334
10	3.71000	3.65432	0.05568
11	3.60000	3.47923	0.12077
12	3.40000	3.28425	0.11575
13	3.13000	3.04452	0.08458
14	3.63000	3.42557	0.20443
15	2.40000	3.06204	-0.66204
16	3.13000	3.30286	-0.17286
17	3.70000	3.37324	0.32676
18	3.05000	3.14293	-0.09294
19	3.29000	3.46037	-0.17037
20	3.00000	2.81875	0.18125
21	3.20000	3.25988	-0.05988
22	3.00000	3.25797	-0.25797
23	3.39000	3.26731	0.12269
24	2.75000	3.43317	-0.68317
25	3.30000	3.30211	-0.00211
26	3.13000	3.53903	-0.40903
27	3.81000	3.44675	0.36325
28	2.70000	2.97801	-0.27801
29	3.60000	3.15950	0.44050
30	3.50000	3.31075	0.18925
31	3.47000	2.91360	0.55640
32	3.50000	3.19022	0.30978
33	3.80000	3.50628	0.29372
34	3.36000	3.49145	-0.13145
35	3.66000	3.63808	0.02192
36	3.40000	3.35220	0.04780
37	2.30000	2.95215	-0.65215
38	3.21000	3.20784	0.00216
39	3.70000	3.30455	0.39545
40	3.00000	2.92713	0.07287

TABLE VI (Continued)

Case No.	Y Value	Y Estimate	Residual
41	3.78000	3.49470	0.28530
42	3.16000	3.47366	-0.31366
43	3.03000	3.44363	-0.41363
44	3.69000	3.31707	0.37293
45	3.40000	3.08421	0.31579
46	3.44000	3.59893	-0.15893
47	3.70000	3.82197	-0.12197
48	3.20000	2.99841	0.29159
49	3.34000	3.12354	0.21646
50	3.20000	3.24482	-0.04482
51	3.08000	3.17787	-0.09787
52	3.20000	2.96530	0.23470
53	3.10000	3.21079	-0.11079
54	2.96000	3.30188	-0.34188
55	3.35000	3.23217	0.11783
56	3.59000	3.62812	-0.03812
57	3.34000	3.60198	-0.26198
58	3.53000	3.36674	0.16326
59	3.45000	3.14776	0.30224
60	2.73000	3.25339	-0.52339
61	3.30000	3.36248	-0.06248
62	4.00000	4.00546	-0.00546
63	3.90000	3.41792	0.48208
64	3.33000	3.33342	-0.00342
65	3.79000	3.40401	0.38599
66	3.31000	3.64804	-0.33804
67	3.69000	3.90796	-0.21796
68	3.38000	3.30133	0.07867
69	2.86000	3.17528	-0.31528
70	3.43000	3.33520	0.09480
71	3.28000	3.34876	-0.06876
72	3.40000	3.19055	0.20945
73	3.13000	3.17585	-0.04585
74	3.20000	3.03577	0.16423
75	3.40000	3.06863	0.33137
76	3.47000	3.58089	-0.11089
77	4.00000	3.57093	0.42907
78	2.20000	3.43399	-1.23399
79	2.96000	3.48158	-0.52158
80	3.75000	3.63122	0.11878
81	3.50000	3.45481	0.04519
82	4.00000	3.72489	0.27511
83	3.26000	3.22423	0.03576

TABLE VI (Continued)

Case No.	Y Value	Y Estimate	Residual
84	3.92000	3.66737	0.25263
85	3.60000	3.48160	0.11840
86	3.68000	3.56892	0.11108
87	3.76000	3.48114	0.27886
88	3.20000	3.39626	-0.19626
89	3.78000	3.62483	0.15517
90	3.95000	3.42157	0.52843
91	3.60000	3.43639	0.16361
92	3.43000	3.69001	-0.26001
93	4.00000	3.41415	0.58585

undergraduate record are useful in predicting the individual's success in the Oklahoma State University MBA program. Found to be an especially significant predictor of success was variable 13, mathematics and statistics grade points. Also found to be significantly correlated with MBA grade average were various combinations of independent variables. The combination of variables resulting in the best regression equation was used to derive a table of residuals, showing the differences between the actual values of the dependent variable and those predicted by the regression technique. By using the Table of Residuals, as well as the correlation coefficients and levels of significance presented in this chapter, an indication of the predictive power of the regression equation can be obtained.

Although the findings presented in this chapter are in many cases self-explanatory, there are certain relationships that could use some interpretation. The last section of this chapter will contain interpre-

tive comments that should add to the value of the findings.

Interpretation of Results

From Table II, it can be noted that variable 2, overall grade point average, has a correlation with MBA grade average of .25692 and is significant at the .025 level. Also significant at the .025 level, but with a higher multiple correlation (.30636), is variable 7, ATGSB score. Although it might be difficult to determine an exact reason, there would seem to be a logical explanation for the similar predictive values of these variables and for the slightly closer correlation of ATGSB score.

Undergraduate grade average, being a measure of academic achievement on the undergraduate level, would be expected to be related to the same type of measure on the graduate level. However, there are certain reasons why this correlation might not be a close one.

First, undergraduate grade average must be considered a better measure of actual achievement than of ability. If this is the case, an unmotivated or unconcerned student with great potential ability might not have an undergraduate record indicative of his capabilities.

Secondly, grade averages of the individuals in the study were determined at a number of different universities and several colleges within those universities. The grading standards could not be assumed to be the same or even closely similar at a large number of

institutions. Thus, depending upon the evaluation criteria used by each instructor, college, and university, the grade average of an individual might or might not be an accurate estimation of his abilities. This weakness of grade average as an indicator is closely tied to the strength of the ATGSB score as an indication of ability to perform successfully.

The higher correlation of the ATGSB score with MBA grade average can be attributed in part to the standardized nature of the test. Being a standardized and well constructed test, the Admission Test for Graduate Study in Business evaluates every individual on the same basis and thus the scores for two students can be readily compared. Since the test is the same for everyone, there is no bias involved as there well may be in grade distribution. Also, since the test is taken during one testing period, it would appear that the factors of motivation and enthusiasm would not be as significant as they would be during an undergraduate career. Thus, the test actually measures the student's capabilities for graduate work, assuming he becomes properly motivated.

From the preceding discussion, it can be seen that there are certain reasons for the higher correlation of ATGSB score with MBA GPA than the correlation for undergraduate grade point average. The testing process is not only more systematic and unbiased in determining a predictive measure, but also a better measure of potential ability rather than past achievement.

As has been pointed out, the two variables not normally used in evaluating applicants to graduate school, mathematics/statistics grade points and English grade points, both correlated significantly with success in graduate school (as indicated by graduate grades). Some interpretive reasons for these high correlations will now be presented.

The significant (.26631) correlation between English grade points and MBA GPA would logically seem to be explained by the amount of writing required in the Oklahoma State University MBA program. The underlying assumption in the collection of the English grade points figure and its use in the prediction technique was that it would be an indicator of proficiency in writing ability. Total English grade points accumulated was used rather than an English grade average because it was felt that the former was a weighted measurement that included not only grade received but also hours of work in the area.

An examination of the required course work in the OSU MBA program readily shows that in most of the courses a number of papers are required by the instructors. As would be expected, these papers vary in both length and scope, thus requiring a variety of writing abilities. If an ability to write and thus successfully express one's thought is as important as it would appear to be, such an ability is obviously quite valuable to the prospective student. If it can also be assumed that the English grade points figure is an acceptable indicator of writing proficiency, then the reason for the high correlation is apparent.

Although the high correlation associated with the English measure is readily explainable, the interpretation of the highest correlation found in this study, between math/stat grade points and MBA GPA is not so easily accomplished. There appear to be two explanations of the highly significant correlation (.42808 at the .001 level).

The first explanation of this correlation involves the increasing emphasis upon quantitative and analytic approaches to decision making. The increased importance attached to mathematical training and abilities is evidenced by the recent addition of both a mathematics and a computer science course to the list of prerequisites for the OSU MBA program.

Under the assumption that the number of mathematics and statistics grade points is an indicator of some degree of proficiency, the high correlation between math/stat grade points and grade average in the MBA program is at least partly explained. Just as in the case of writing ability, if mathematical ability is required for success in the program then the correlation would be expected.

The other explanation of the correlation is of a more general nature and deals with the overall capabilities of many of the more technically trained students in the MBA program. Although no definite evidence can be presented, it would appear that those individuals in many of the technical, analytical fields (engineering, mathematics) have trained themselves to systematically approach and solve problems of either a quantitative or qualitative nature. Although they

are obviously adept at solving problems in their own field, it would appear that many of the engineers coming into the MBA program readily adapt to less familiar study areas. The implied assumption in this case would be that those individuals who have trained themselves to solve problems such as those presented in engineering courses can easily apply their principles of reasoning and logic to more business oriented problems.

The two reasons discussed, the trend toward a more quantitative, analytical MBA program and the adaptiveness of analytically trained individuals, seem to explain the significance of the relationship between math/stat grade points and grade average in the MBA program.

While the explanations and interpretations presented may not be the sole factors contributing to the various correlation discussed, it is apparent that they are of importance. Although the applicability of a certain indicator or predictor will vary for individual situations, it would seem that some of the correlations obtained are significant enough to merit a close examination of their worth to both the students and the administrators of the OSU MBA program. Especially in the case of the previously unused variables, it would appear that there are potential benefits not only for purposes of evaluating applicants but also for counseling and advising students as to their preparation for the MBA program.

SUMMARY AND CONCLUSIONS

The number of applicants to graduate business programs is rapidly increasing. As the number of applicants rises, the number of individuals rejected or turned down must also rise. Because of this, it is apparent that a systematic and reliable method of evaluating individuals must be available to the administrators of graduate business programs. Such a method, expressed in the form of more specific admission criteria, would be able to differentiate between potentially successful applicants and those who would be unable to complete the program.

The establishment of admission standards and the evaluation of students is based upon an ability to predict success, as defined by grade point average in a particular program. This prediction of success involves the determination of which factors or characteristics of an individual are most highly correlated with his grade average, the indicator of success. If useful and significant relationships can be determined then the problem is one of implementing the findings. However, it has been found that many graduate schools of business cannot predict success and cannot devise meaningful admission criteria because they do not know which characteristics of an individual are related to success in their particular Master of Business Administration program.

This lack of knowledge on the part of graduate schools and the associated inability to establish standards or evaluate applicants, points to a need for research and study in this area. Before the desired systematic evaluation processes can be established, a thorough knowledge of the relationships of various factors with success (GPA) in a program must be obtained.

To determine which characteristics of an individual's record correlate most highly with success in the Oklahoma State University Master of Business Administration program, this study examined and analyzed the records of individuals who have completed the program or are currently in the program. The data collected for the analysis included information concerning the individuals' grade records, Admission Test for Graduate Study in Business scores, and other personal data available from admission applications and personal files. In addition, the students' transcripts were used to obtain the number of mathematics/statistics grade points accumulated and the number of English grade points.

The relationships of the different variables, as well as combinations of variables, to the dependent variable (MBA grade point average) were obtained by employing multiple regression analysis techniques. As part of the regression analysis, multiple correlation coefficients and levels of significance for the variables were obtained. These were then used to determine the relative importance and worth of the combinations as predictors or indicators of success in the MBA program.

The results of the study show that certain variables do relate significantly to MBA grade average. Two variables that have a significant correlation are undergraduate grade average and score on the Admission Test for Graduate Study in Business. Both of these factors, presently in use by the OSU MBA committee as indicators of promise of success, are measures of academic achievement or ability and would thus be expected to have a significant positive relationship with success in graduate work. Although certainly of some value in predicting success, these factors do not appear adequate, either singly or in combination with personal data, to give an accurate prediction of grade point average (success) in the OSU MBA program.

The two variables obtained from the individuals' transcripts, math/stat grade points and English grade points, were found to be significantly related to success. The English grade points variable appears to be of nearly the same value as a predictor as undergraduate grade average or ATGSB score. The significant correlation seems to be explainable, at least in part, by the amount of writing required in the MBA program. Although the English grade points variable gives an indication of possible value, the factor with the most potential value appears to be the math/stat grade points variable.

The mathematics/statistics grade points variable was shown to have a very high and significant correlation with success in the MBA program. This correlation, not readily explainable but nevertheless of obvious potential value in prediction, can possibly be indicative of

the movement of the OSU MBA program to a more quantitative analytical curriculum. Whether the relationship is explained by a more technical program, the adaptiveness of analytically trained individuals, or some other reason, its strength points to a definite correlation of mathematics background and success in the program.

The findings of this study concerning the math/stat indicator point to at least two important implications. First, a full explanation of the relationship could be of value to students, instructors, and administrators of the MBA program. Secondly, since this variable is not presently being used in the evaluation of the individuals' potential, an examination of its applicability and usefulness would seem in order.

Also pointed out by this study is the fact that several personal characteristics of an individual, although of relatively minor predictive value by themselves, can add somewhat to the predictive power of the more significant variable. By using several such variables as well as those of major significance, a statistically significant regression equation with good predictive capabilities was obtained. Such an equation, when used with actual data, was able to predict quite accurately the grade averages of individuals in the MBA program.

As has been pointed out, it appears that a systematic approach can be successfully employed in the prediction of grade averages in the Oklahoma State University Master of Business Administration program. Such a possibility points to several other related topics for research and study.

A valuable study would be one that could explain in full detail the reasons for some of the significant relationships. Also, work could be done to determine if certain factors not included in this study would add appreciably to the correlations obtained.

A SELECTED BIBLIOGRAPHY

Bixler, Roy W. "The Admission of Graduate Students." Admission and Retention of University Students. Ed. Floyd Reeves and John Dale Russel. Chicago: The University of Chicago Press, 1933, 133-180.

Bruning, James and B. L. Kintz. Computational Handbook of Statistics. Glenview: Scott-Foresman, 1968.

Bushwell, G. T. "A Study of Selective Admission and Retention of Graduate Students in the Department of Education." Admission and Retention of University Students. Ed. Floyd Reeves and John Dale Russel. Chicago: The University of Chicago Press, 1933, 183-244.

Cooley, William W. and Paul R. Lohnes. Multivariate Procedures for the Behavioral Sciences. New York: John Wiley, 1962.

Crawford, Albert Beecher. Measuring Promise for Graduate Work. New Haven: Yale University Press, 1942.

Donovan, George. "Admissions and the Graduate Schools." Philosophy and Problems of College Admissions. Ed. Catherine Rich and Thomas Garnet. Washington, D. C.: The Catholic University of American Press, 1963, 111-127.

Ehrenfeld, Sylvain and Sebastion Littauer. Introduction to Statistical Method. New York: McGraw-Hill, 1964.

Ezekiel, Mordecai and Karl Fox. Methods of Correlation and Regression Analysis. New York: John Wiley, 1959.

Ghiselli, Edwin. Theory of Psychological Measurement. New York: McGraw-Hill, 1964.

Havighurst, Robert J. "The Coming Crisis in Selection for College Entrance." The Coming Crisis in the Selection of Students for College Entrance. Ed. Kenneth Anderson. Washington, D. C.: American Educational Research Association, 1960, 1-2.

Hills, John R. "Assessing Academic Potential." Research Related to College Admissions. Ed. Kenneth M. Wilson. Atlanta: Southern Regional Education Board, 1963, 75-87.

MacNeel, Joseph Raymond. Admission of Students As Candidates for Master's Degrees. New York: Little and Ives, 1932.

Miller, Delbert C. Handbook of Research Design and Social Measurement. New York: David McKay, 1964.

Ostle, Bernard. Statistics in Research. Ames: The Iowa University Press, 1963.

Rozeboom, William. Foundations of the Theory of Prediction. Homewood: Dorsey Press, 1966.

Rulon, Phillip, David Tiedeman, Maurice Tatsuoka, and Charles Langmuir. Multivariate Statistics for Personnel Classification. New York: John Wiley, 1967.

Salzman, Lawrence. Computerized Economic Analysis. New York: McGraw-Hill, 1968.

Smith, George B. "Who Would Be Eliminated? A Study of Selective Admission to College." Kansas Studies in Education, Vol. 7 (December, 1956), 1-28.

Vernon, Phillip. The Measurement of Abilities. New York: Philosophical Library, 1961.

Ward, Joe H. "Multiple Linear Regression Models." Computer Applications in the Behavioral Sciences. Ed. Harold Borko. Englewood Cliffs: Prentice-Hall, 1962, 204-237.

Webb, Sam C. "Increased Selectivity and Institutional Standards." Research Related to College Admissions. Ed. Kenneth M. Wilson. Atlanta: Southern Regional Education Board, 1963, 53-61.

Whitla, Dean K. "Evaluation of Decision Making: A Study of College Admissions." Handbook of Measurement and Assessment in Behavioral Sciences. Ed. Dean K. Whitla. London: Addison-Wesley Publishing, 1968, 456-490.

Whitla, Dean K. "Some Concomitants of Increasing Selectivity in College Admissions." Research Related to College Admissions. Ed. Kenneth M. Wilson. Atlanta: Southern Regional Education Board, 1963, 63-73.

Williams, E. J. Regression Analysis. New York: John Wiley, 1959.

Woods, Paul J. "Correlates of Attrition and Academic Success." Research Related to College Admissions. Ed. Kenneth M. Wilson. Atlanta: Southern Regional Education Board, 1963, 89-105.

APPENDIX A

DATA COLLECTION INSTRUMENT

Variable Number			
	Identification Code		_____
1	Rank in Class		_____ of _____
2	GPA:	Overall	_____
3		Major	_____
4		Last 2 years	_____
5	ATGSB:	Verbal	_____
6		Quantitative	_____
7		Total	_____
8	Last Undergraduate University Attended		_____
9	Undergraduate College (A & S, Business, etc.)		_____
	Undergraduate Major		_____
10	Age (at application)		_____
11	Marital Status		_____
	High School Last Attended		_____
12	Permanent Employment		_____ Years
13	MATH/STAT Courses:		
		Hours A	_____
		Hours B	_____
		Hours C	_____
		Hours D	_____
			___points
14	English Courses:		
		Hours A	_____
		Hours B	_____
		Hours C	_____
		Hours D	_____
			___points

APPENDIX A (Continued)

Variable Number		
	Identification Code	_____
15	Received Assistantship:	___Yes ___No
	MBA Hours Completed	_____
16	MBA GPA	_____
	Paper Completed:	___Yes ___No
	Still Enrolled	___Yes ___No
	Degree Received	___Yes ___No

VITA

Danny Ray Riley

Candidate for the Degree of

Master of Business Administration

Thesis: A MULTIPLE REGRESSION ANALYSIS OF FACTORS RELATED TO SUCCESS IN THE OKLAHOMA STATE UNIVERSITY MASTER OF BUSINESS ADMINISTRATION PROGRAM

Major Field: Business Administration

Biographical:

Personal Data: Born in Ponca City, Oklahoma, January 8, 1946, the son of Mr. and Mrs. Glen Riley.

Education: Graduated from Ponca City Senior High School, Ponca City, Oklahoma, in May 1964; received the Bachelor of Science degree from Oklahoma State University in 1968, with a major in Personnel Management; completed requirements for the Master of Business Administration degree in May, 1970.

Professional Experience: Graduate Assistant in the College of Business Administration, Oklahoma State University, 1968-1969.

Name: Danny E. Riley Date of Degree: May 24, 1970

Institution: Oklahoma State University Location: Stillwater, Oklahoma

Title of Study: A MULTIPLE REGRESSION ANALYSIS OF FACTORS RELATED TO SUCCESS IN THE OKLAHOMA STATE UNIVERSITY MASTER OF BUSINESS ADMINISTRATION PROGRAM

Pages in Study: 63 Candidate for Degree of Master of Business Administration

Major Field: Business Administration

Scope and Method of Study: Information concerning academic and personal background was obtained from the records of ninety-seven individuals who have completed or are presently enrolled in the Oklahoma State University Master of Business Administration program. Using grade point average in the MBA program as the dependent variable, a regression analysis was performed with undergraduate grades, admission test scores, and certain other factors as the independent variables. The multiple regression technique was employed to determine the correlation of the various factors with success in the program. The purpose of the study was to determine which characteristics of an individual are most highly correlated with success in the MBA program at Oklahoma State University. By obtaining such relationships, a more accurate prediction of an applicant's performance can be made. This in turn could lead to more definite standards for evaluating applicants.

Findings and Conclusions: The data analyzed in this study indicate that the factor most highly correlated with success in the OSU MBA program is the number of mathematics and statistics grade points accumulated by an individual. Also significantly correlated were undergraduate grade average, Admission Test for Graduate Study in Business score, and English grade points. It was also found that by combining several factors a very accurate prediction of grade average in the MBA program could be obtained. One conclusion from the study is that the technique of multiple regression analysis is applicable and useful in determining the relationships of various factors with success, as defined by grade point average. A second conclusion is that a systematic approach, involving a multiple regression equation, to the prediction of grades can be successfully employed.

ADVISER'S APPROVAL Kent Mings