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AN INVESTIGATION INTO SOME FACTORS AFFECTING ACADEMIC PERFORMANCE OF FIRST YEAR REGULAR SCIENCE DEGREE STUDENTS (1987/88)

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By

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A C K N O W L E D G E M E N T

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A B S T R A C T

The purpose of the study was to assess the influence of ESLCE GPA and some Selected factors on first year Science Students' academic performance. The data analyzed came from a random sample of one hundred and fifty students enrolled in the Faculty of Science (AAU) as freshmen in 1987/88. Regression methods were used to analyze the data. The influence of 15 variables on Freshman University performance of Science students was examined. A transform of the first-semester Freshman GPA appeared to have a strong linear relationship with identical transform of ESLCE GPA. This finding contradicts the findings of other researchers in this area to-date. The performance of students from Addis Ababa and those from Other Regions appeared to show a difference. It also seemed that dormitory facilities had a positive effect on student performance. On account of the strong resationship between the transformed variables of ESLCE GPA and first semester GPA, the effect of theremaining 13 other explanatory variables appeared to be very small.

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CHAPTER I

INTRODUCTION

1.1 STATEMENT OF THE PROBLEM

The results of the Ethiopian School Leaving Certificate Examinations (ESLCE) have been the main criteria for placing students into one of the higher education institutions in Ethiopia. This is because they are presumed to be the best predictors of academic success. Eventhough there is no detailed recent study on the predictive ability of ESLCE, some preliminary studies (Asmerom et al., 1984; King, 1969; King and King, 1972; Lakew, 1972; Mekonnen, 1987; Melaku, 1975; Mittman, 1972; Tracy, 1965; Yusuf et al., 1984) made at Addis Ababa University (AAU) showed only a small correlation between the ESLCE Grade Point Average (GPA) and University performance. In these studies, University performance was measured by first semester GPA, first year Cumulative GPA or the four-year Cumulative GPA. This small correlation appears to suggest that the variation, in University performance, explained by the ESLCE results is very small and other factors may be responsible. In other words, the efficiency of the results of ESLCE in identifying students with the potential to succeed in University appeared questionable.

As in most developing countries the quality of education in Ethiopia varies among different schools and possibly also among different administrative regions. This variation is reflected in differences in the proportion of students from the various regional schools who pass the ESLCE which is required for entry into any one of the higher education institutions. More specifically, the proportion of high school students admitted to these institutions from the Addis Ababa region is large compared to that from each of the administrative regions. This might be due to a higher concentration of educational resources in Addis Ababa which presumably enables the students to have a better preparation for the ESLCE.

better in the University than the students from the other regions.

Contrary to this, Asmerom et al. (1984) found that the students from the other regions seem to succeed better than the students from the Addis Ababa region. Their findings were based on a sample of three groups of students taken from a population of first-year students for six consecutive years (1978-84). The groups were "failures" (students who left their faculties for academic reasons), "regulars" (students who successfully completed their studies with a final cumulative GPA ranging between 2.00 and 2.75), and "exceptionals" (students graduated with a final Cumulative GPA above 2.75). They compared the ESLCE GPA and the first semester GPA based on means, standard deviations and the linear correlation coefficient for the three groups, independently. However, the data were not examined by pooling the three groups together and/or taking the same academic year.

It is, moreover, possible that a number of factors, other than the results in ESLCE, may significantly affect the performance of University students. The type and location of the secondary school attended, the type of study at a secondary school, type of admission (regular, private or special), quality of teaching and quality of life in the Freshman year may also have an influence on students' performance in the Freshman year. However, little is known about the way in which these and other factors may affect the performance of University students.

1.2 PURPOSE OF THE STUDY

So far, no study has been carried out to assess the effect of ESLCE GPA and other factors on the performance of Freshman Science Students. For this reason, it was found informative to undertake a study in order to look into this problem. The purpose of this study is, therefore, to

1. get an answer to the following question: Does ESLCE identify Science students with the potential to succeed at our Faculty in the Freshman year?

2. examine factors that may possibly affect Freshman performance at the Faculty of Science and thereby to establish factors that appear to be important determinants of first-year performance.

It is expected that the final result of the study will serve as a first step for designing a much more detailed investigation of the factors affecting students' University performance. It could also help to stimulate further research on the subject. In addition, it may also suggest possible recommendations that may lead to the inclusion of some additional factors in the admission criteria in order to enable the selection of students with a better chance of success. It may, in addition, have administrative and budgetary implications, This may be, in turn, helpful in reducing wastage of manpower resources and in enabling a reduction in the attrition rate.

1.3 LIMITATIONS AND PROBLEMS

Since an objective of this study was to assess the effect of some selected factors on first-year Science students' performance, it was originally planned to collect information on more factors than those actually included in this study. For example, information was required on level of parental education, number of times the student sat for ESLCE, the number of secondary schools attended, the student's physical status and his or her socio-economic background. However, the Registrar's office of AAU at Sidist Kilo could not cooperate in supplying the required information. Instead we could have access only to the Records' Office of the Faculty of Science. For this reason, our scope was limited to examining those factors for which information was available in the students' files at the Faculty's Records' Office and our Freshman Programme.

This study was also hampered by the inavailability of suitable software that can be used for analyzing our data. Despite the crudeness of the available software, the Systems Design and Data Processing Center (SDDPC) at

Sidist Kilo could not provide even its humble Computer output quickly enough. For instance, on one occasion we had to wait for at least two weeks to get the results of a single two-variable regression through the origin which was found, at any rate, to be incorrect. Hence, after wasting considerable time and effort at SDDPC, alternative arrangements had to be made in May with an institution, in town, which had better and more efficient computing facilities, and, of course, the good will to help students.

CHAPTER II

RELATED RESEARCH IN AAU

Researchers have successively attempted to find out whether the ESLCE results, represented by the GPA, can be considered as the best predictor of academic success in AAU. In one of these studies, Korten and Bayorek (1964) concluded that the ESLCE has almost no validity in predicting success in the College of Business. They recommended, however, that their findings should be chcked against the experience of the other faculties.

Tracy (1965), initiated by the Registrar's Office, made a study which covered several faculties and colleges of the University. He claims to have found a statistically significant relation (r=.36) between the overall ESLCE GPA and first-year Cumulative GPA for 302 freshmen who entered Haile Sellassie I University (HSIU) in September, 1963.

Tracy's (1965) study also appeared to show that the correlations between the individual ESLCE and Freshman subject grades were lower than the overall correlation (For instance; English (r=.20), Mathematics (r=.31)). These seemed to indicate to him that the predictive value of the ESLCE subjects is very low, and he, therefore, suggested an improvement in the content of the subject-matter examinations.

Tracy (1965) concluded that the ESLCE GPA predicted University performance only moderately and variably in the faculties and colleges. He, therefore, opted for additional criteria, such as aptitude tests and class rankings, to be used in order to strengthen existing admission criteria.

Tracy's (1965) study was updated by King (1969) using the same procedure and method of analysis. King's (1969) study was based on Freshmen admitted into the University in 1967. He found a moderate relation (r=.47) between the ESLCE GPA and the first-year University Cumulative GPA for 528 freshmen. The correlation for 86

Science students was .60 . The ESLCE GPA was found to predict University Freshman performance "fairly well", both for the entire University and for the separate faculties. He suggested that the 1967 ESLC examinations were better than those in 1963 since his correlations were consistently and slightly higher than those reported by Tracy (1965).

Analyzing the three required subjects at that time, King (1969) found the correlation for the English grades (r=.39) to be about the same as the overall correlation and the ESLCE grade in English, they claimed, would serve well in predicting students' performance. The Mathematics grades correlated moderately (r=.35) while the ESLCE grade in Amharic lacked predictive relationship with University performance (r=.03). The above relations for the 86 Science students were: Amharic (r=.16), English (r=.43), Mathematics (r=.42).

In studying 417 freshmen admitted in 1968-70 with an ESLCE GPA of 2.00, Mittman (1971) inferred that a higher GPA is necessary for success in the University. According to him, the student with 2.00 ESLCE GPA is a "poor academic risk."

Another research report which bears on University admission is one by Langmuir (1971). He recommended that proficiency in Amharic should not be regarded as a prerequisite to general studies in the same sense as secondary school Mathematics is a prerequisite for entering the Science streams.

In another study, King and King (1972) have found Amharic to have the lowest relationship with University performance (r=.177) when compared with ESLCE GPA and the English grade. They examined language and educational backgrounds, and scores on a variety of achievement and aptitude tests for their relation to the first semester performance of HSIU freshmen. They based their study on 1,213 students who entered as freshmen in September, 1968. The ESLCE GPA showed the highest correlation with first semester GPA (r=.452). The second highest correlation to first semester GPA came from the ESLCE English grade (r=.420).

King and King (1972) also found the correlation between the ESLCE grade in Mathematics and the first semester GPA to be r=.297. American standard tests and tests developed for Ethiopian students showed similarly low-to-moderate relations. This appears to have suggested to them that these tests will not improve the existing admission criterion. Neverthless, they seem to have suggested that the simultaneous use of the American and experimental tests with ESLCE would improve prediction of University performance. This, of course, is not understandable.

In another study, Mittman (1972) considered 2,117 freshmen covering four years, 1961-64) E.C. He claims to have found that ESLCE examinations in Amharic, English and Mathematics do not influence first-year GPA significantly.

In his doctoral thesis, Lakew (1972) concluded that Amharic had a lower correlation (r=.23) with freshman University performance than English (r=.38).

Melaku (1975) studied the relationship between ESLCE results and University performance of only dismissed students. The available population for this study was 308 dismissed students from the Freshman Programme at the end of the first semester of the 1973-74 academic year. ESLCE GPA and the ESLCE grades in the three required subjects showed weak relations with University GPA. The correlations were: Amharic (r=.00), English (r=.06), Mathematics (r=.05), ESLCE GPA (r=.10), Accordingly, Melaku concluded that neither the ESLCE GPA nor the grades in Amharic, English or Mathematics affected University performance of dismissed students.

Another research report which discusses some problems relevant to the present research is that by Asmerom et al. (1984). This study was part of a study reported by Yusuf et al. (1984). Sponsored by the Commission for Higher Education (CHE), the latter was a study which dealt with problems of attrition and drop-outs in institutions of higher learning in Ethiopia.

One of the main tasks of Asmerom et al.'s (1984) study was to find out "whether the ESLCE is a good instrument for screening would-be successful candidates at higher institutions of learning in Ethiopia." A sample of 500 "failures" along with 250 "regular" and "exceptional" students was drawn from a population of first-year students over six consecutive years (1978-84). The "failures" were defined as those students who left their faculties for academic reasons. The "regulars" and "exceptionals" were students who successfully completed their studies with a final Cumulative GPA in the range, 2.00-2.75, and above 2.75, respectively. The study included six faculties. The method of analysis employed was comparison of the ESLCE results with first-year first semester results based on the sample mean, standard deviation and linear correlation coefficient. The "regulars" and "exceptionals" were used as "control groups" in the comparison.

They reported the relation between ESLCE and first-semester Freshman GPA in the "failures" group was significant, but negative. However, no reason was given for the significantly negative relation.

They also concluded that "students with high ESLCE GPA (i.e., on the average close to 3.00) would not have a problem in succeeding with the same or better grade." This suggested to them that "the ESLCE had identified individuals in the 'regular' and 'exceptional' groups who can successfully complete their studies."

Asmerom et al. (1984) also examined the relations between the ESLCE and first semester results in Mathematics and English in the faculties of Social Science, Natural Science and Technology. The ESLCE and first semester grades in Mathematics were reported to be significantly and positively related except for the "regular" and "exceptionals" in the Faculties of Natural Science and Technology. These results were taken to mean that ESLC Mathematics cannot serve to predict success in first semester Mathematics in areas where the teaching of Mathematics is apparently thorough. They concluded that, in order to succeed, students in the faculties of Natural Science and Technology required a minimum of "B" grade in ESLC Mathematics while those who enter the Faculty of Social Science need only a "C" grade. They further conjectured that the ESLC Mathematics requirement does not seem to fit with the theoretically-oriented Mathematics course offerred in the Faculty of Science. Accordingly, they suggest that, if the ESLC Mathematics is to be useful in selecting successful candidates for the Sciences, it has to be oriented towards these fields or separate examinations have to be set.

Asmerom et al. (1984) have also considered the regions where the students took the ESLCE. The regions considered were Addis Ababa against the other regions put together. These results appear to show that students from Addis Ababa had a high entrance GPA compared to the students from the other regions while this was the opposite for the first semester GPA. Hence, students from the other regions seemed to succeed better in higher education than those from the Addis Ababa region. They mentioned the following three factors that might be responsible for the poor performance of the Addis Ababa students:

(i) over-confidence due to having high ESLCE GPA
(ii) lack of boarding facilities, and
(iii) the higher potential for success of the students from the other regions.

Mekonnen (1987) studied the educational performance of the group of students who entered AAU in 1975 E.C., where students who dropped out before 1978 E.C. were excluded. He found correlations of .29 and .63 between the four-year Cumulative GPA and the ESLCE subject grades in English and Mathematics for Science students only. He also found the ESLCE grade in Mathematics to be the best predictor of success in Faculty of Science.

Mekonnen (1987) also examined the relations between the ESLCE subject grades and the first-year University subject grades. For instance, he found correlations of

.31 and .33 for English and Mathematics, respectively. Considering students who took ESLCE only in 1974 E.C., the above correlations were found to be .47 and .49 .

The findings in these studies have not always been in agreement and the use of the correlation coefficient as a measure of relationships does not appear to have been validated; indeed, it has been used (see Tracy, 1965) even when the relationship was presumed to be non-linear. The conclusions regarding ESLCE's usefulness have not been very positive and yet we see that it is still in use. Hence, we will investigate this relationship once again, more carefully; the scope of the investigation is rather limited on account of various insurmountable constraints, the most serious being that of the inavalability of any form of suitable computing facility in the Department of Statistics.

CHAPTER III

PROCEDURES AND METHODS

3.1 PROCEDURES

3.1.1 The Sample

The study was based on regular degree students admitted to the Faculty of Science (AAU) as freshmen for the 1987/88 academic year. A total of 825 freshmen were used as the study population. Foreign students wdre not included, and so were students who had dropped out before the end of the first semester. These 825 individuals represented approximately 96 percent of all the regular degree students registered in the freshman year. For purposes of this study, a simple random sample of 150 students was drawn from the available population. The sample size was arrived at using the general rule (Draper and Smith, 1981: P.417) of taking about ten complete sets of observations for each potential variable to be included in the model. In this study, there were sixteen such variables.

3.1.2 Variables included in the study

Our basic interest was to examine the influence of ESLCE results and other selected factors on Freshman Science students' performance. The results in the first semester examinations were used to measure Freshman performance, and, therefore, used as the response variable (Y). The factors that may affect students' performance constituted the explanatory variables (X's). A number of them were categorical variables; others were continuous.* All in all, 16 explanatory variables were considered in relation to Freshman performance. All variables are described below.

Background variables

X_1 = Sex (=1, if male, 0 otherwise)

X_2 = Age upon admission

X_3 = Marital status (=1, if single, 0 otherwise)
X_4 = School type (=1, if government, 0 otherwise)

Location of the secondary school attended

X_5 = 1, if in Addis Ababa, 0 otherwise
X_6 = 1, if in Asmara , 0 otherwise
X_7 = Academic background (=1, if academic science, 0 otherwise)
X_8 = The time in years between his/her first ESLCE and admission to the Faculty.

Type of admission

X_{12} = 1, if regular, 0 otherwise
X_{13} = 1, if private, 0 otherwise

ESLCE Results

The ESLC examinations are tests prepared and administered annually in a variety of subjects. They are based on the Ministry of Education secondary school curriculum, and are usually taken by students in their final year of secondary school. In addition to their use as a criterion for AAU admissions, ESLCE results are considered in admissions to other training programmes such as the Teachers' Training Institutions (TTI).

Students are required to take the ESLC examinations in English and Mathematics, and in order to apply to a programme in one of the higher education institutions they must sit for at least three other examinations and pass. They receive letter grades, A, B, C, D, F, in the subjects they entered. The numerical equivalents of the letter grades are: A=4.0, B=3.0, C=2.0, D=1.0 and F=0.0. The grades of five subjects - English, Mathematics and three other subjects in which the student obtained better grades - are averaged to give the ESLCE GPA.

In this study three ESLCE results were considered:
X_9 = ESLCE GPA
X_{10} = ESLCE English grade
X_{11} = ESLCE Mathematics grade

Campus Variables

X_{14} = Dormitory facility (=1, if dormitory is provided, 0 otherwise)

X_{15} = Freshman stream of study (=1, if Physical Science, 0 otherwise)

X_{16} = Teachers' level of education.

In X_{16}, the teachers' level of education refers to the average years of education of teachers after the Bachelor's degree. For each Freshman section, it is obtained by multiplying the number of credit hours of each course by the numerical equivalent of the instructor's level of education, and dividing the sum for all courses by the total number of credit hours. We have assigned weights of 0, 2, and 5 for Bachelor's, Master's and Ph.D degrees, respectively.

University Performance

Students at AAU receive a letter grade A, B, C, D or F, in each course taken and completed at the end of each semester. Course grades are averaged into a semester GPA which can vary from a value of 0.0, indicating failure in all courses, to a value of 4.0, representing an A in each course.

As freshmen, the students in our sample took required courses in English, Mathematics, Philosophy and Chemistry. Beyond this basic requirement they took either a Biology or Physics course, as required by the stream-life science or physical science - in which they were enrolled.

For purposes of this study three measures of Freshman University performance were considered:

Y = First Semester GPA

Y_1 = Freshman English (FlEn 101A) Grade

Y_2 = Preliminary Mathematics (Math 100) Grade.

3.1.3 Data Collection and Sources

The data used in this study mainly came from students' files kept in the office of the Coordinator for the Freshman Programme. Data on the explanatory variables were collected for all students in the sample at the beginning of the second semester of the academic year 1987/88. A schedule was prepared for extracting the required information from the students' files. A sample of this schedule and the sample data are given in the Appendix.

Sources of the data were the office of the Coordinator of Science Freshman Programme, the office of the Dean of Students and the departments in the Faculty.

3.2 METHODS OF DATA ANALYSIS

The influence of the selected factors on Freshman Science Students' performance was examined by means of regression methods. Dummy variables were used in assessing the effects of categorical variables such as regional background and dormitory facility. The relation between all potential variables and the first semester GPA was first investigated. This was followed by a consideration of ESLCE GPA alone. In general, the steps followed in our data analysis were the following:

i. Examining the scatter plot of the response variable against each of the explanatory variables.
ii. Formulating a general model that relates the response variable to the explanatory variables.
iii. Fitting the model.
iv. Examining the adequacy of the fitted model and checking the validity of the assumptions of the assumed model.
v. Making inference based on the fitted model.

A lack of fit in the linear model was examined using pure error whenever repeat observations were available. Scatter plots of the standardized residuals against the predicted values or against each of the explanatory variables were studied. They were used in detecting heterogeneity of error variance, nonlinearity of the model, outliers and other inadequacies of the hypothesized model.

The normal probability (P-P) plot helped in checking the assumption of the normality of the error terms.

Diagnostic statistics - studentized residuals, Mahalanobis distance, Cook's distance and outlier tests - were also used to provide information about influential cases, outliers and the validity of the model assumptions.

Based on the results of the diagnostic procedures used remedies suited to the symptoms were applied. Then the results obtained were assessed repeating the procedure stated above. After getting an acceptable model, the overall importance of the explanatory variables was determined.

The detailed theory that justifies these methods is found in Belsley, Kuh and Welsch (1980), Chatterjee and Price (1977), Cook and Weisberg (1982), Draper and Smith (1981), Seber (1977) and Weisberg (1980).

CHAPTER IV

RESULTS AND ANALYSES OF DATA

4.1 INFLUENCE OF THE SELECTED FACTORS

Table 4.1 presents the means and standard deviations of the 18 variables considered in the analysis (since only two private students were included in our sample, the dummy variable X_{13} was not examined). The mean of the ESLCE results was above a "B" average, except for Mathematics which was 2.33. However, the mean of the first semester GPA's was 1.91, or slightly below a "C" avergge. The mean of the Freshman English and Preliminary Mathematics grades were 2.13 and 1.99, respectively.

Table 4.1 : Means ans Standard Deviations of the Variables (n = 150)

Variable	Mean	Std Dev
X_1	.933	.250
X_2	18.873	2.332
X_3	.953	.212
X_4	.953	.212
X_5	.420	.495
X_6	.093	.292
X_7	.893	.310
X_8	.200	1.074
X_9	3.252	.256
X_{10}	3.080	.499
X_{11}	2.327	.755
X_{12}	.960	.197
X_{14}	.680	.468
X_{15}	.947	.225
X_{16}	1.584	.347
Y	1.906	.645
Y_1	2.133	.682
Y_2	1.987	.733

In Table 4.1 the mean corresponding to each dummy variable is the proportion of students in the category where the dummy variable has a value of unity. For instance, the mean of X_1, which is .93, was the proportion of male students in our sample.

Table 4.2 shows a further breakdown of the first semester performance of the students in our sample. 16 percent of the students received GPA's below 1.50, while 32 percent received GPA's ranging from 1.50 to 1.99. Only 52 percent of the students received above 2.00. Note that these results do not include the results obtained in the "Supplemental examinations."

Table 4.2: First Semester Performance of the Students

GPA's	No. of Students	Proportion	Mean GPA	SD
Below 1.50	24	.16	.85	.47
1.50 -1.99	48	.32	1.75	.12
Above 2.00	78	.52	2.33	.43

Table 4.3 is the sample correlation matrix for all variables and shows the interrelations of all 18 variables. One may note that there are relatively few large correlations. The ESLCE GPA appeared to have some correlation with the other ESLCE results and with Freshman Science performance. The ESLCE English seems to be mildly correlated with both first semester GPA and Freshman English, while ESLCE Mathematics shows some relation with Preliminary Mathematics. It is also particularly worthwhile to note the high correlation between X_5 and X_{14}, where X_{14} represents Dormitory facility and X_5 is the Region variable.

Table 4.3: The Sample Correlation Matrix

Variable	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	X_{11}	X_{12}	X_{14}	X_{15}	X_{16}	Y	Y_1	Y_2
X_1	1.000																	
X_2	.158	1.000																
X_3	.194	-.230	1.000															
X_4	-.059	.070	-.049	1.000														
X_5	-.097	-.215	-.004	-.196	1.000													
X_6	-.006	-.042	-.038	.071	-.273	1.000												
X_7	-.092	-.149	.026	-.076	-.100	.037	1.000											
X_8	.050	.648	-.283	.041	-.083	-.060	.024	1.000										
X_9	.159	-.002	-.004	.020	.038	.024	-.065	-.028	1.000									
X_{10}	.151	.165	.036	-.028	-.110	-.006	-.075	.083	.492	1.000								
X_{11}	.045	-.034	-.198	-.072	.259	.013	-.223	.043	.570	.108	1.000							
X_{12}	-.055	-.567	.277	-.045	.036	.065	.040	-.820	.042	-.036	-.047	1.000						
X_{14}	-.183	.122	-.016	.255	-.806	.220	.180	.061	-.129	.024	-.215	.006	1.000					
X_{15}	-.063	.064	-.053	.229	.082	.076	-.082	.044	.095	-.021	.142	-.048	-.036	1.000				
X_{16}	-.028	-.116	.008	.017	.063	-.210	.078	-.009	.031	-.008	.061	.050	.022	.161	1.000			
Y	.153	-.010	.052	.129	-.026	.106	-.087	-.024	.337	.202	.144	-.014	-.055	.242	.014	1.000		
Y_1	.170	-.036	.136	-.282	.052	.072	.195	.000	.167	.284	-.046	-.010	-.118	-.041	-.050	.528	1.000	
Y_2	.068	-.080	.083	.212	.016	.037	-.125	-.107	.325	.150	.190	.089	-.032	.239	.121	.835	.286	1.000

Table 4.4 shows the result of fitting a linear regression model with all 15 explanatory variables. The plot of the standardized residuals versus fitted values of Y (Fig. 1) and ESLCE results (Figures 2, 3, 4), as well as other plots of the standardized residuals versus the explanaroty variables (see Appendix C), look acceptable. But observation 92 has a large residual and may be suspected as an outlier. From an examination of the raw data, it appears that this particular individual seems to have performed very poorly in the University as compared to other individuals with similar characterstics (His ESLCE and first semester GPA's were 3.8 and 0.22 respectively). It was examined using an outlier test (Weisberg, 1980 : P.115). The test statistic gave a value of t_{92} = -3.970. Entering Table D in Weisberg (1980: PP. 264-267) with P=16 and n=150, we find the critical value for a test size of 0.05 to be 3.68. Since $/t_{92}/$ exceeded

Table 4.4: Estimated Regression Coefficients for the Full Model

Variable	$\hat{B}$	SE $\hat{B}$	Beta	T	Sig T
X_{16}	-.00158	.15303	-.852E-03	-.010	.9918
X_3	.09440	.26268	.03096	.359	.7199
X_{14}	-.10176	.21209	-.07381	-.480	.6321
X_{10}	.07265	.12205	.05613	.595	.5527
X_{15}	.60141	.23772	.21011	2.530	.0126
X_7	-.10812	.17768	-.05190	-.609	.5439
X_{12}	-.37775	.45047	-.11510	-.839	.4032
X_1	.24968	.23411	.09684	1.067	.2881
X_6	.17792	.18590	.08047	.957	.3402
X_4	.23711	.25633	.07776	.925	.3566
X_{11}	-.06575	.09405	-.07695	-.699	.4857
X_2	-.02351	.03082	-.08499	-.763	.4469
X_9	.77405	.29371	.30754	2.635	.0094
X_8	-.03559	.09022	-.05926	-.394	.6939
X_5	-.08572	.20176	-.06579	-.425	.6716
(Constant)	.79901	1.12742		-.709	.4797

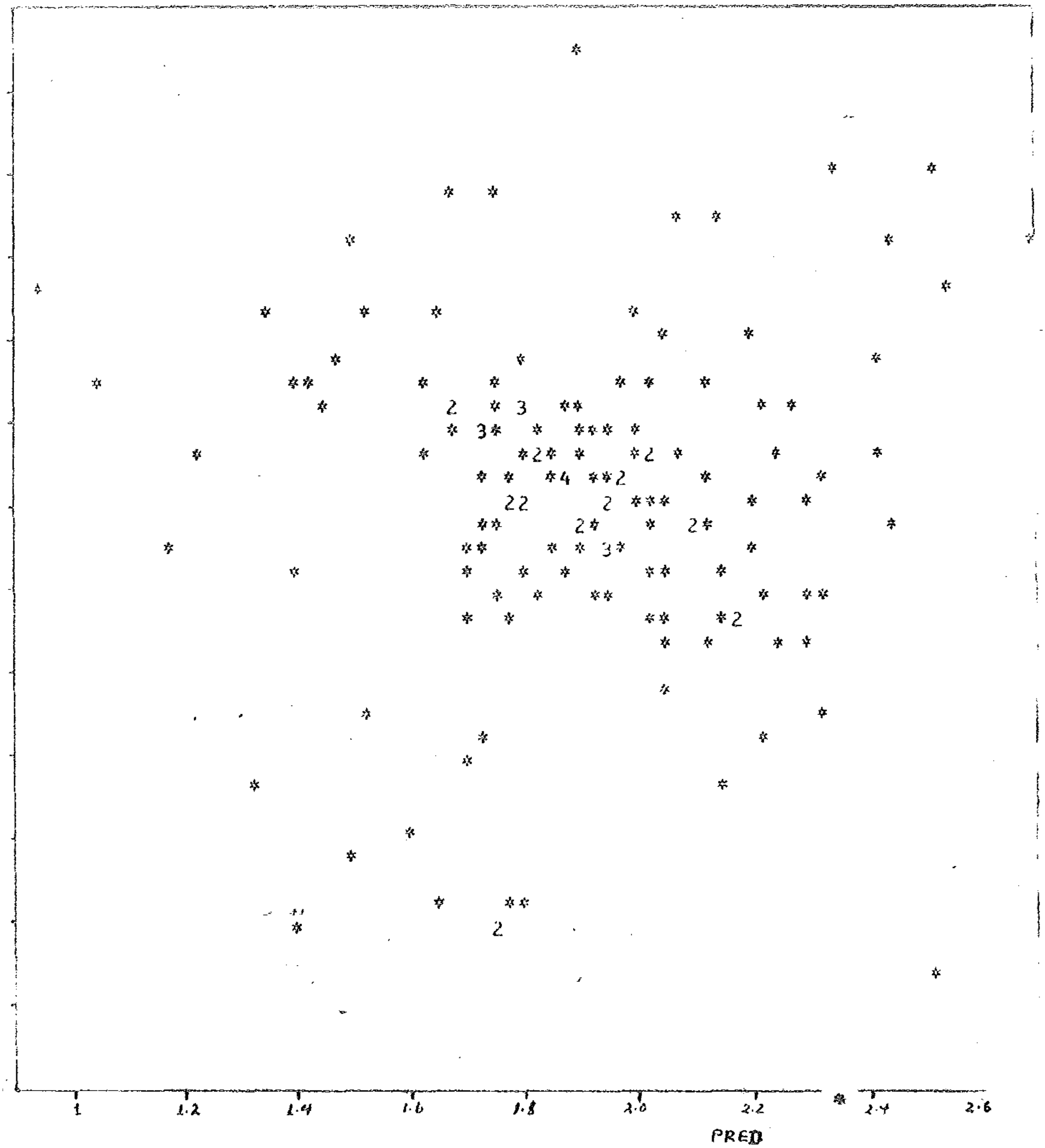

Fig. 1. Standardized residual versus fitted values: Full Model

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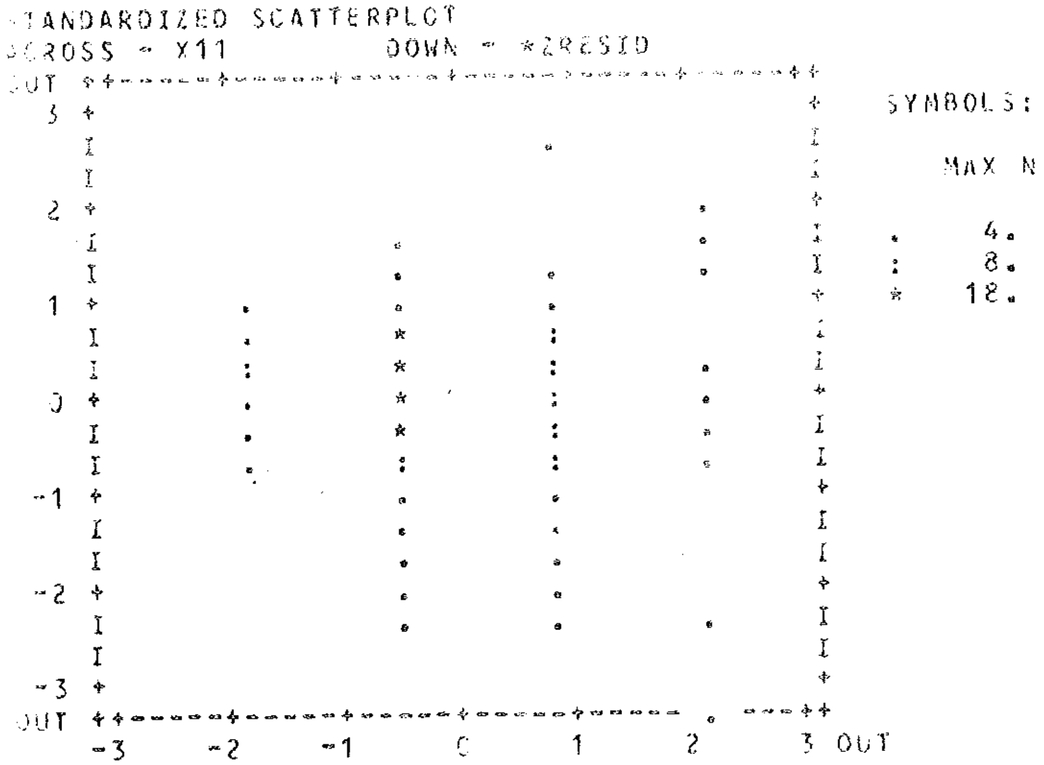
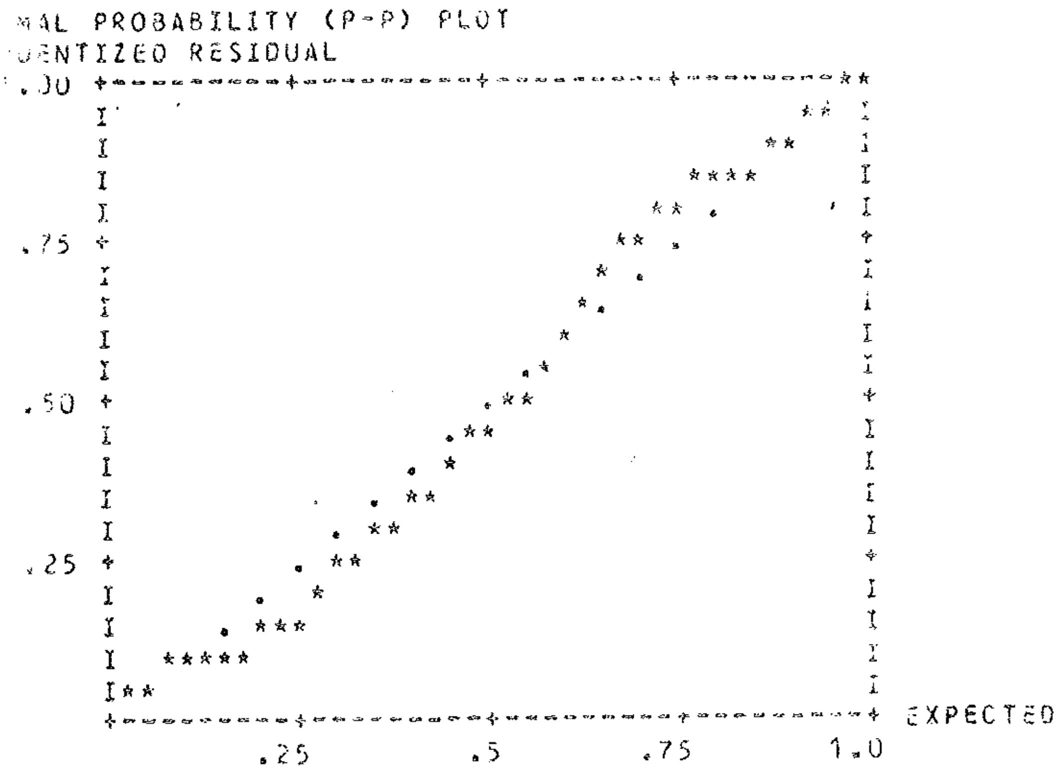
STANDARDIZED SCATTERPLOT
ACROSS - X9            DOWN - *ZRESID
OUT  ++------+------+------+-------+------+-------++
   3 +                                             +   SYMBOLS:
     I                     .                       I
     I                                             I      MAX N
   2 +                                     .     . +
     I               .         .                 . I   .     3.
     I    .          .                     .     . I   :     6.
   1 +               .     .   .           .       +   *    14.
     I               *     :   .     .             I
     I               *     *   :     .     .       I
   0 +               :     *   *     .     .       +
     I               :     *   :     .             I
     I               .     :   :     :             I
  -1 +                     .   .     .             +
     I               .               .             I
     I               .     .   .                   I
  -2 +               .         .                   +
     I               :     .               .       I
     I                                             I
  -3 +                                             +
OUT  ++------+------+------+-------+------+-------++
     -3     -2     -1       0      1      2      3 OUT
```

```
STANDARDIZED SCATTERPLOT
ACROSS - X10           DOWN - *ZRESID
OUT  ++------+------+------+-------+------+-------++
   3 +                                             +   SYMBOLS:
     I                     .                       I
     I                                             I      MAX N
   2 +                     .             .         +
     I      .              .             .         I   .     5.
     I      .              .             .         I   :    10.
   1 +                     :             .         +   *    23.
     I      .              *             .         I
     I      .              *             .         I
   0 +                     *             .         +
     I      .              *             .         I
     I      .              *             .         I
  -1 +      .                            .         +
     I                     .                       I
     I                     .                       I
  -2 +                     .                       +
     I      .              .             .         I
     I                                             I
  -3 +                                             +
OUT  ++------+------+------+-------+------+-------++
     -3     -2     -1       0      1      2      3 OUT
```



ig. 4. Standardized residuals versus X_{11} : Full Model.



ig. 5. Normal probability plot : Full Model.

this value, this ovservation was considered as an outlier. However, since $V_{92,92}$ = .130 and D_{92} = .1329 are not very large (that is, they are much smaller than 2P/n=.213 and $F_{.5(16,134)}$=.958, respectively), this observation has only a minor effect on estimates of the regression parameters. Hence, we will proceed with-out deleting it. (Here V_{ii} is the i^{th} diagonal element of the "hat matrix" (see Cook and Weisberg, 1982: P.11) and D_i is the Cook's distance (see Weisberg, 1980: P.108)).

Inspection of the other diagonstic statistics (see Appendix C) does not display any unusual features. The normal probability plot (Fig. 5) does not show a strong departure from normality of the error terms. All the diagonal elements of the inverse of the correlation matrix of the explanatory variables, known as Variance Inflationary Factors (VIF), were found to be between 1 and 10. This suggests that multicollinearity is not a serious problem in our estimation (see Draper and Smith, 1981: P.416). However, the fitted model cannot be considered as a satisfactory model for analysing the data, since a problem of heteroscedasticity appears to exist. Hence, the analysis leading to Table 4.4 is capable of refinement; the information in Table 4.3 and 4.4 will be useful in a step-by-step modelling procedure.

Table 4.3 reveals that X_9 appears to be the variable most highly correlated with Y. Further, we also see that X_5 and X_{14} are even more highly correlated, therby probably accounting for the rather meaningless signs, and small magnitudes, of the estimates of the coefficients of X_5 and X_{14} in Table 4.4, contrary to that expected on common sense grounds. Hence, we will start the model building process with X_9; X_5 and X_{14} will be considered latter.

4.2 The Relation between ESLCE GPA and First Semester GPA

From Table 4.3 it is seen that ESLCE GPA had the highest correlation with first semester GPA; this correlation was .337. The scatter plot of these two GPA's is given in Fig. 6. Table 4.5 presents the analysis of variance table for the regression of Y on X_9. It can be seen that there exists a significant lack of fit ($F=2.728$, $P < .025$). Inspection of the plot of the standardized residuals against the predicted values and X_9 indicated the possible existence of outliers and reconfirmed the violation of the assumption of homoscedasticity. Log transformation on the Y's gave the same results as the crude one. These indications suggest the use of Weighted Least Squares (WLS) after an examination of the status of the suspected outliers. This will be done in the following Section.

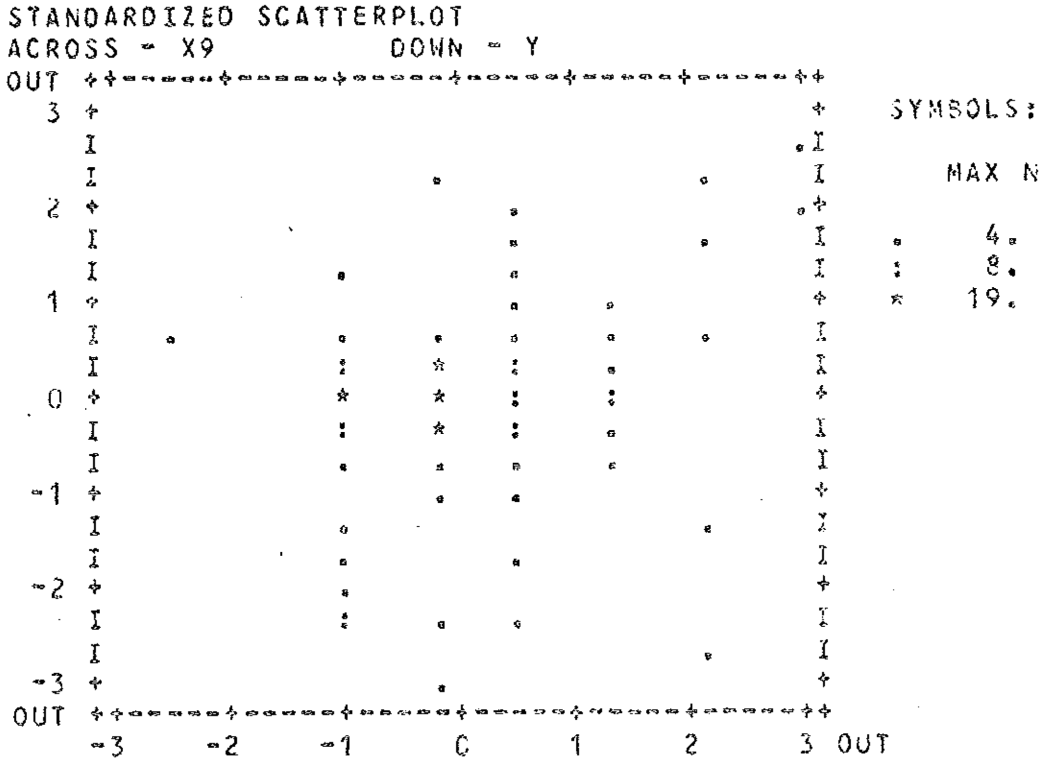


Fig. 6. First Semester GPA (Y) versus ESLCE GPA (X_9)

Table 4.5: ANOVA for the Regression of Y on X_9

Source	DF	SS	MS	F	Sig F
Regression	1	7.064	7.064	19.016	
Residual	148	54.981	.371		
Lack of fit	5	4.787	.957	2.728	$P < .025$
Pure error	143	50.194	.351		

4.3 REGIONAL BACKGROUND AND DORMITORY FACILITY

Here regional background refers to the region where a student has taken his ESLCE. An answer was sought for the following question: Does the relation between ESLCE GPA and first semester GPA depend on regional background? The two groups of interest were the students from the Addis Ababa region and those from all other regions put together. Table 4.6 shows the ESLCE GPA and University performance (Y) of the two regions.

Table 4.6: ESLCE and First Semester results of the two regions.

		ESLCE GPA		First Semester GPA		Correlation
Region	No.	Mean	SD	Mean	SD	$r_{X_9 Y}$
Addis Ababa	63	3.263	.268	1.887	.625	.356
Other regions	87	3.243	.249	1.920	.663	.327
Total	150	3.252	.256	1.906	.643	.337

The means of the two GPA's do not appear to be different for the two regions. Moreover, the correlations are also quite similar and it may well be that the relationship between Y and X_9 show the same behaviour. But this will be more thoroughly investigated in this section.

Tables 4.7 and 4.8 present the ANOVA tables of the regressions of Y on X_9, separately for the two regions. These are based on the following models:

$$Y_{AA} = B_{10} + B_{19}X_9 + U_1 \quad (1)$$
$$Y_{OR} = B_{00} + B_{09}X_9 + U_2 \quad (2)$$

where (1) represents Addis Ababa Region and (2) represents Other Regions. It can be seen from Tables 4.7 and 4.8 that there exists a significant lack of fit. Therefore, it is necessary to examine the residuals in order to find out the cause of the lack of fit.

When examining the residual plot from regression for Addis Ababa Region (Fig. 7) observation 40 was found to have the largest residual, -3.11. The value of the outlier test statistic (Weisberg, 1980: P. 115), $t_{40} = -3.400$, provides evidence that this case is an outlier. The plot of the standardized residuals versus X_9 also gave the same information. It was found that the individual represented by observation 40 was admitted with an ESLCE GPA of 3.2 but his first semester GPA was 0.0. This was considered abnormal and it was, therefore, deleted.

Table 4.7: ANOVA Table for Regression of Y on X_9
Addis Ababa Region

Source	DF	SS	MS	F	Sig F
Regression	1	3.075	3.075	8.857	
Residual	61	21.180	.347		
Lack of fit	4	3.696	.924	3.013	$P < .025$
Pure error	57	17.484	.307		

Table 4.8: ANOVA Table for Regression of Y on X_9
Other Regions

Source	DF	SS	MS	F	Sig F
Regression	1	4.046	4.046	10.203	
Residual	85	33.703	.397		
Lack of fit	5	6.897	1.379	4.117	$P < .005$
Pure error	80	26.806	.335		

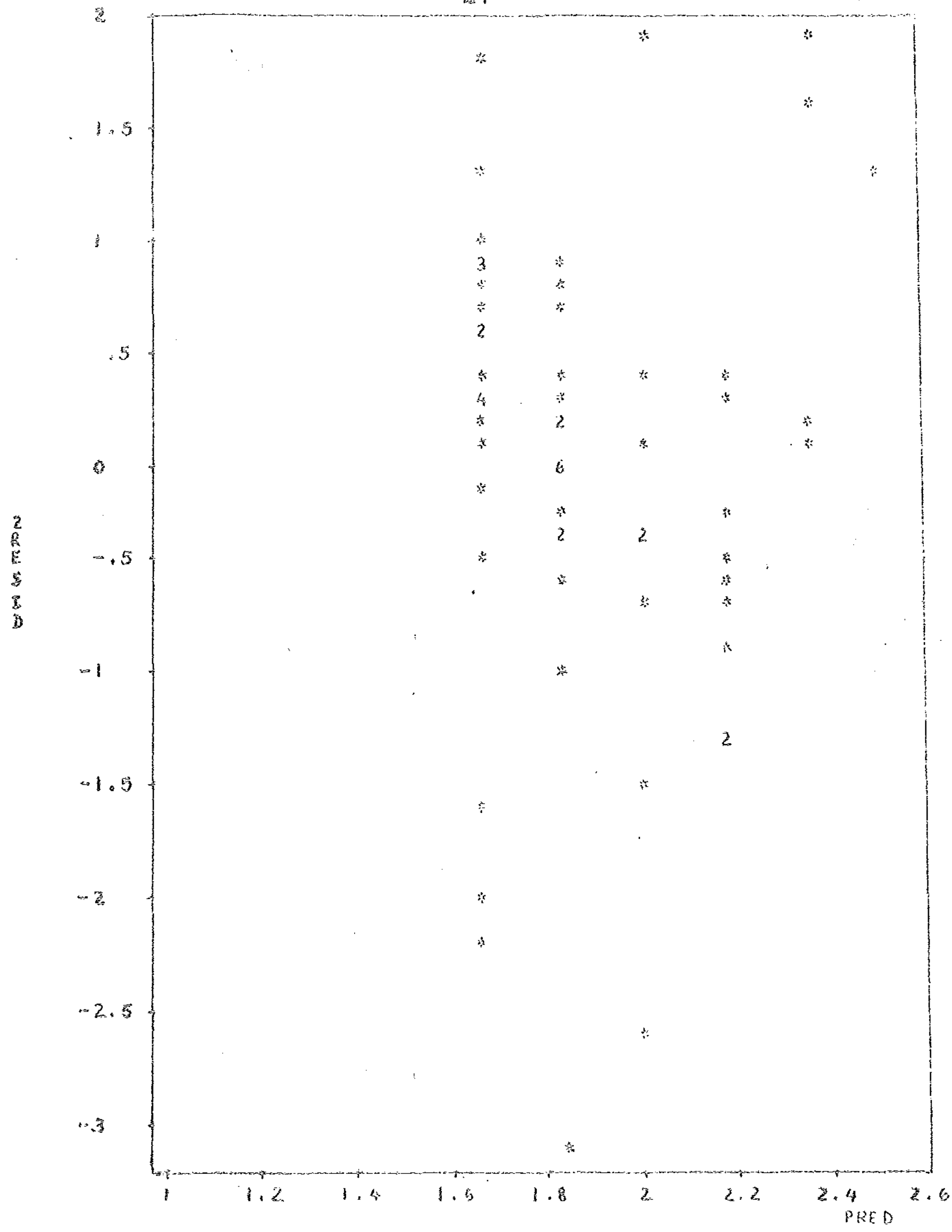


Fig. 7. Standardized residuals versus fitted values : Model in (1)

Similarly, the plot of the standardized residuals versus the fitted values from the regression of Y on X_9 for the Other Regions (Fig. 8) was examined. Observation 92 was found to have the largest residual and the outlier test statistic (Weisberg, 1980: P.115) gave a value, $t_{92} = -3.886$, which indicated that this case was also an outlier. The other diagnostic statistics ($V_{92,92} = .070$, $D_{92} = .485$) also suggested the observation to be influential. Observation 56 was also a suspect. The individual represented by this observation was the only one to have an ESLCE GPA of 2.6 in our sample.

Recently a "special" admission criterion for those who completed the National Military Service was adopted. They were admitted into a degree programme with an ESLCE GPA of 2.0 and above, and into a diploma programme with an ESLCE GPA of 1.5 and above. The entrance requirements for regular and private students in 1987/88 were ESLCE GPA's of at least 3.0 and 3.4, respectively. Some students from the army were also admitted with ESLCE GPA of 3.2 which is lower than the official requirement for the private students. Since our interest was in comparing the students' performance, under normal admitions, in the two regions, it was found reasonable to delete observation 56. The next step was to attend to the violation of the assumption of homoscedasticity.

As a remedy, weighted least squares (WLS), instead of the ordinary least squares (OLS) used before, was suggested by the data. The weights were estimated by the reciprocals of the variances of the Y-values at each value of X_9.

The computer program at SDDPC doesn't have provision for WLS. The problem considered here was handled by using OLS after rescaling the data. Hence, if S_1 represents the standard deviation of Y-values at a value of X_9 in Addis-Ababa, and S_0 that for Other Regions, then the following models were fitted:

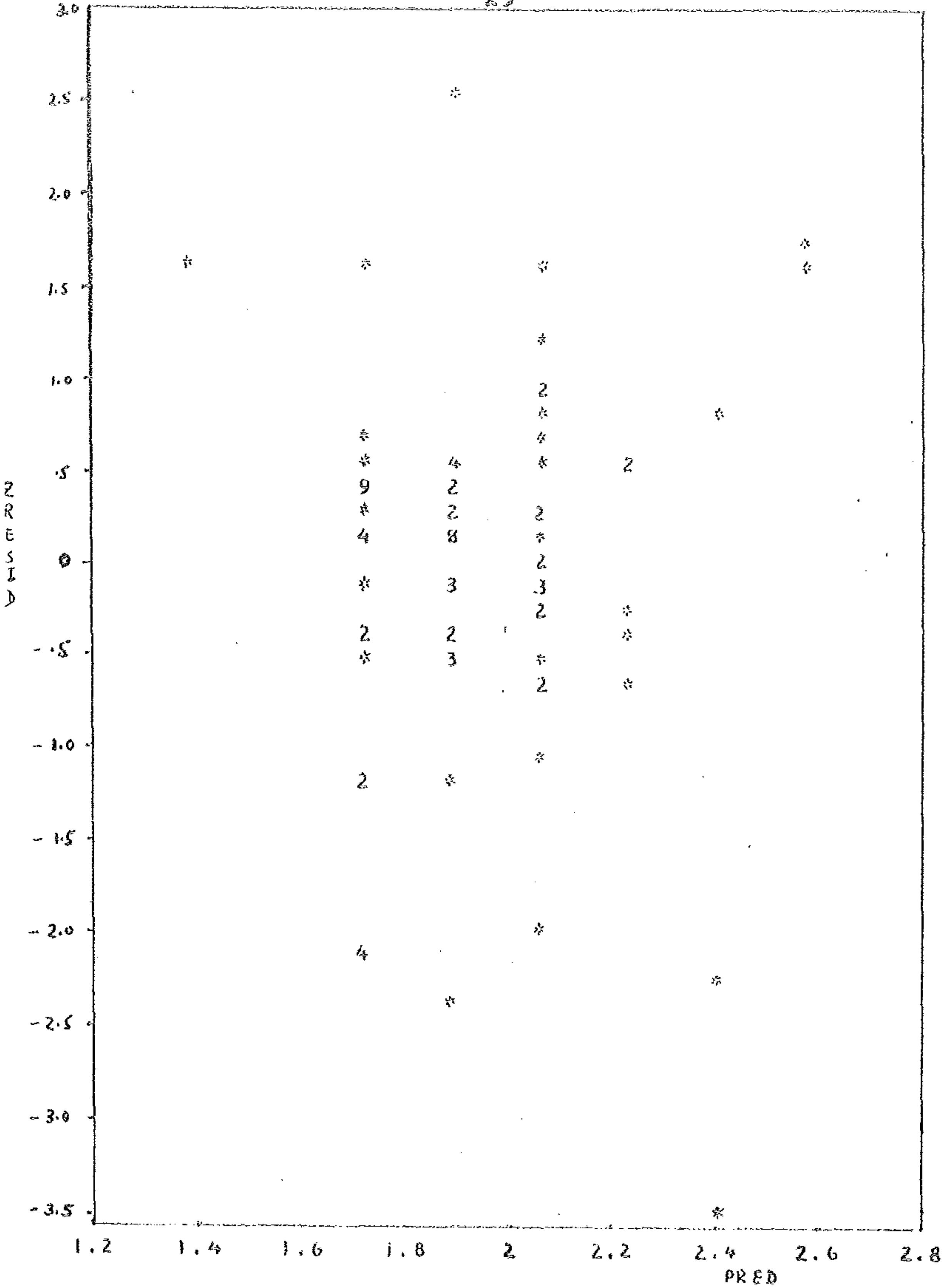


Fig. 8. Standardized residuals versus fitted values: Model in (2)

$$\left(\frac{Y}{S_1}\right)_{AA} = B_{10}\left(\frac{1}{S_1}\right) + B_{19}\left(\frac{X_9}{S_1}\right) + \left(\frac{U_1}{S_1}\right) \qquad (1a)$$

$$\left(\frac{Y}{S_0}\right)_{OR} = B_{00}\left(\frac{1}{S_0}\right) + B_{09}\left(\frac{X_9}{S_0}\right) + \left(\frac{U_2}{S_0}\right) \qquad (2a)$$

where (1a) represents Addis Ababa Region (AA) and (2a) represents Other Regions (OR). The estimated weight for the squared deviation of Y from its regression is given by $W_i = 1/S_i^2$, $i=0,1$.

In order to apply WLS to both groups, the few number of observations at $X_9 = 4.0$ (one for the Addis Ababa and two for the Other Regions) and at $X_9 = 3.8$ (two for the Other Regions) could not give reliable estimates of variance, if at all. The corresponding Y-values at $X_9 = 4.0$ in both cases and at $X_9 = 3.8$ in the Other Regions were, therefore, excluded from the study. Table 4.9 presents the weights used in applying WLS. Tables 4.10 and 4.11 give the WLS regression results.

Examination of the residual plots, diagnostic statistics, and normal probability plots (see Appendices D, E) showed no indication of serious violations in the model assumptions required for the application of OLS on (1a) and (2a).

Table 4.9: Weights for Weighted Least Squares

	AA Region			Other Regions			Pooled		
X_9	n	S_1	W_1	n	S_0	W_0	n	S_P	W_P
3.0	22	.57117	3.065	27	.63652	2.468	49	.60820	2.703
3.2	18	.27072	13.645	27	.50393	3.938	45	.42723	5.479
3.4	8	.77857	1.650	22	.49826	4.028	30	.58115	2.961
3.6	9	.33377	8.976	5	.36410	7.543	14	.34418	8.442
3.8	4	.58187	2.954				4	.58187	2.954

Table 4.10: Regression through the origin: AA Region

Variable	$\hat{B}$	SE $\hat{B}$	Beta	T
$(\frac{1}{S_1})$	.38776	.81718	.20289	.475
$(\frac{X_9}{S_1})$	.45228	.24953	.77502	1.813

$\sigma = 1.07203$ $R^2 = .95568$ DF = 59

Analysis of Variance

Source	DF	SS	MS	F
Regression	2	1461.96915	730.98457	636.052
Residual	59	67.80588	1.14925	

Table 4.11: Regression through the origin: Other Regions

Variable	$\hat{B}$	SE $\hat{B}$	Beta	T
$(\frac{1}{S_0})$	-1.53444	.97885	-.75773	-1.568
$(\frac{X_9}{S_0})$	1.06694	.29928	1.72326	3.565

$\sigma_2 = .99155$ $R^2 = .93672$ DF = 79

Analysis of Variance

Source	DF	SS	MS	F
Regression	2	1149.66732	574.83366	584.672
Residual	79	77.67062	.98317	

The models in (1a) and (2a) represent separate regression relationship for the two regions, each with distinct regression coefficients. If there were no differential effect attributable to the regional background of students, the data could be pooled and the single regression model

$$(\frac{Y}{S_P}) = B_0(\frac{1}{S_P}) + B_9(\frac{X_9}{S_P}) + (\frac{U}{S_P}) \qquad (3)$$

could be fitted. Here S_p represents the pooled standard deviation of Y-values at a value of X_9. This model would be appropriate to describe the entire data if in (1a) and (2a) :

(i) corresponding regression coefficients are the same,

(ii) the variances of the Y-values at corresponding values of X_9 are equal in both groups.

Comparison of the residual variances with the F-test is not valid, but the residual variances, 1.149 with 59 degrees of freedom and 0.983 with 79 degrees of freedom, appear to be similar. The variances at each value of X_9 in each group (see Table 4.9) were not very much different except at $X_9 = 3.2$. It was not, therefore, too unreasonable to assume the equality of the conditional variances of Y for the two regions. This assumption will then give rise to the model in (3) above when taken together with the equality of corresponding coefficients in the regression for the two rdgions. We will find out, in due course, whether this assumption is supported during a re-analysis of the data.

Out interest is to examine the hypothesis that there is only one regression relating ESLCE GPA to University performance for the two groups. That is, we want to test the null hypothesis:

$$H_{01} : B_{10} = B_{00} , B_{19} = B_{09}$$

against the alternative that there are differences in the regressions for the two regions. The dummy variables approach (Chatterjee and Pricé, 1977; Gujarati, 1970a and 1970b) was used in performing the analysis. The following model involving the dummy variable, X_5, was considered:

$$\left(\frac{Y}{S_p}\right) = B_0\left(\frac{1}{S_p}\right)+B_9\left(\frac{X_9}{S_p}\right)+B_5\left(\frac{X_5}{S_p}\right)+B_{59}\left(\frac{X_5 . X_9}{S_p}\right)+\left(\frac{U}{S_p}\right) \qquad (4)$$

The model given in (4) is equivalent to the models in (1a) and (2a) except for the pooled weight. The null hypothesis of interest can now be restated as:

$$H_{02}: B_5 = B_{59} = 0 .$$

Proceeding with the analysis of the data, the regression results for models in (3) and (4), respectively, are given in Tables 4.12 and 4.13 . The residual plots, diagnostic statistics, and normal probability plots (see Appendices F, G) did not indicate serious model violations in both cases. A formal test of H_{02} is not possible using standard regression theory. However, the values of estimates in the two models appear to suggest that a common regression may not be inappropriate.

Table 4.12: Regression through the origin: Model in (3)

Variables	$\hat{B}$	SE $\hat{B}$	Beta	T
$\frac{1}{S_P}$	-.24971	.63142	-.12630	-.395
$\frac{X_9}{S_P}$	.65865	.19230	1.09386	3.425

σ = 1.02713 R^2 = .93680 DF = 140

Analysis of Variance

Source	DF	SS	MS	F
Regress.	2	2189.30980	1094.65490	1037.594
Residual	140	147.69910	1.05499	

Table 4.13: Regression through the origin: Model in (4)

Variable	$\hat{B}$	SE $\hat{B}$	Beta	T
$(\frac{1}{S_P})$	-1.46519	.97676	-.74106	-1.500
$(\frac{X_9}{S_P})$	1.04560	.30035	1.73650	3.481
$(\frac{X_5}{S_P})$	1.89479	1.28807	.64352	1.471
$(\frac{X_5 \cdot X_9}{S_P})$	-.60703	.39257	-.68480	-1.546

σ = 1.02138 R^2 = .93840 DF = 138

Analysis of Variance

Source	DF	SS	MS	F
Regression	4	2193.04459	548.26115	525.54718
Residual	138	143.96431	1.04322	

Another question raised in this study was the effect of dormitory facilities (X_{14}) on the relation between University performance (Y) and ESLCE GPA (X_9). All students from the Other Regions were provided with dormitory facilities while only a few students (24 percent) got this priviledge from the Addis Ababa Region. Examination of the separate regressions of Y on X_9 for the Addis Ababa students with and without dormitory facilities may provide an answer to the above question under certain conditions.

The heterogeneity of variance was already removed from the regression of Y on X_9 for the Addis Ababa Region. Furthermore, the estimates of conditional variance of Y at each value of X_9 in each group (that is, students with and without dormitory facilities) were not found to be very much different. Therefore, the same S_1 as in Table 4.9 for the Addis Ababa Region was used in the WLS analysis using the separate regressions for the two groups:

$$\left(\frac{Y}{S_1}\right)_{DF} = B_{110}\left(\frac{1}{S_1}\right) + B_{119}\left(\frac{X_9}{S_1}\right) + \left(\frac{U_{11}}{S_1}\right) \qquad (5)$$

$$\left(\frac{Y}{S_1}\right)_{WD} = B_{D10}\left(\frac{1}{S_1}\right) + B_{D19}\left(\frac{X_9}{S_1}\right) + \left(\frac{U_{10}}{S_1}\right) \qquad (6)$$

where (5) represents with dormitory facilities (DF) and (6) represents without dormitory facilities (WD). The results of fitting the above models are given in Tables 4.14 and 4.15.

The dummy variable X_{14} was defined to take the value of 1 for each student provided with dormitory facilities and the value of 0 for each student who was not provided with dormitory facilities. Table 4.16 gives the results of fitting the model:

$$\left(\frac{Y}{S_1}\right)_{AA} = B_{10}\left(\frac{1}{S_1}\right) + B_{19}\left(\frac{X_9}{S_1}\right) + B_{14}\left(\frac{X_{14}}{S_1}\right) + B_{914}\left(\frac{X_9 \cdot X_{14}}{S_1}\right) + \left(\frac{U_1}{S_1}\right) \qquad (7)$$

Table 4.14: Regression through the origin: Model in (5)

Variable	$\hat{B}$	SE $\hat{B}$	Beta	T
$\frac{1}{S_1}$	1.46857	1.45576	.81630	1.009
$\frac{X_9}{S_1}$	.08721	.42471	.16615	.205

$\sigma_U = .91357 \qquad R^2 = .96459 \qquad DF = 12$

Analysis of Variance

Source	DF	SS	MS	F
Regression	2	272.80260	136.40130	163.432
Residual	12	10.01526	.83461	

Table 4.15: Regression through the origin: Model in (6)

Variable	$\hat{B}$	SE $\hat{B}$	Beta	T
$\frac{1}{S_1}$	-.56339	.88091	-.29178	-.640
$\frac{X_9}{S_1}$	.76877	.27568	1.27226	2.789

$Q_{u} = 1.09706$ $\quad R^2 = .96283$ $\quad$ DF = 45

Analysis of Variance

Source	DF	SS	MS	F
Regression	2	1402.78764	701.39382	582.771
Residual	45	54.15968	1.20355	

Table 4.16: Regression through the origin: Model in (7)

Variable	$\hat{B}$	SE $\hat{B}$	Beta	T
$\frac{1}{S_1}$	-.56339	.85201	-.29536	-.661
$\frac{X_9}{S_1}$	.76877	.26663	1.30548	2.883
$\frac{X_{14}}{S_1}$	2.03195	1.89335	.45538	1.073
$\frac{X_9 \cdot X_{14}}{S_1}$	-.68157	.56073	-.52357	-1.216

$0 = 1.06107$ $\quad R^2 = .96311$ $\quad$ DF = 57

Analysis of Variance

Source	DF	SS	MS	F
Regression	4	1675.59024	418.89756	372.06361
Residual	57	64.17494	1.12588	

Our objective is to find out if:

$$H_{03} : B_{14} = B_{914} = 0$$

is supported by the data.

Tables 4.14 and 4.15, and hence 4.16, give a rather strange result which does not accord with common sense. The results reflect the non-random nature of the dormitory facility allocation, giving rise to sub-samples for the Addis Ababa Region which are not random. An examination of the sub-samples clearly bears this out so that it is not possible to arrive at a useful conclusion regarding the effect of dormitory facilities from this particular analysis. However, we have seen that X_5 and X_{14} show a strong negative correlation. Hence, Tables 4.10, 4.11, 4.12 and 4.13 also partially reflect the influence of X_{14} on student performance and this appears to be positive.

CHAPTER V

DISCUSSION, CONCLUSION AND RECOMMENDATION

A fuller interpretation of our results is limited somewhat by the procedures we used in our analysis. After deleting some unusual observations and transforming the data, we arrived at a position where standard parametric theory could not be used. The weights for the WLS procedure were not known and we had to use estimates based on the data. In such a case, the statistical tests would not be exact (see Chatterjee and Price, 1977: PP.105-14). In speite of this, our analysis points to some interesting conclusions:

(i) A transform of First Semester GPA appears to have a strong linear relationship with an identical transform of ESLCE GPA. This result is borne out in Tables 4.10, 4.11, 4.12 and 4.13. Our findings contradict the findings of other researchers in this area to-date.

(ii) The First Semester performance of Science students from Addis Ababa and those from Other Regions appears to show a difference, as reflected in Tables 4.10, 4.11, 4.12 and 4.13.

(iii) There is indirect evidence in Tables 4.10, 4.11, 4.12 and 4.13 regarding the positive effect of dormitory facilities on student performance.

(iv) The 13 other explanatory variables appear to have a very small effect, given X_9, $X_5(X_{14})$ are already in the model.

These findings endorse the view that the ESLC examinations are useful, that dormitory facilities may, indeed, make a difference and that there appears to exist a distinct pattern in the performance of Science Freshmen from Addis Ababa when compared to those from all other regions. On account of the strong relationship between the transformed variables, as reflected in Tables 4.10, 4.11. 4.12 and 4.13, the effect of the remaining 13 other explanatory variables appears to be very small; resources at hand did not allow any further study involving these or the remaining two response variables.

These findings cannot be taken as conclusive evidence that gives a strong support to ESLCE to validate its traditional role, but the indications are that it is a useful instrument. Indeed, no statistical method can provide a certain verdict. Similarly, the positive effect of dormitory facilities is also indicated and it also accords with common sense.

The study involved only the Faculty of Science, on a limited scale, on account of administrative and other constraints. Hence, our study findings should be taken as a first step and they relate only to our Faculty's Freshmen of 1987/88. On the other hand, since ESLCE is of concern to the entire University, a University-wide study will be in order. This has not been possible in this research for reasons already given.

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APPENDIX A

DEPARTMENT OF STATISTICS

Schedule for Student File Sampling in the Faculty of Science

1. Sample Number ________
2. Student's I.D. No. ________
3. Sex: Male ______ Female ______
4. Age ________
5. Marital Status: Single ___ Married ___ Other ___
6. Last secondary school attended:
   - 6.1 Name of the School ____________________
   - 6.2 Location: Town ______ Administrative Region ______
   - 6.3 Attendance Year ________
   - 6.4 Type of the School: Government ________
     - Mission ________
     - Public ________
     - Other ________
   - 6.5 Type of study in the school:
     - Academic science ____________
     - Academic art ____________
     - Commercial ____________
     - Home Economics ____________
     - Agriculture ____________
     - Technic/Productive Technology ________
     - Other ____________
7. ESLCE results:
   - 7.1 ESLCE GPA ________
   - 7.2 ESLCE Grade in English ____________
     - Mathematics ____________
8. Status of Admission: Regular ________
   - Private ________
   - Quota ________
   - Special ________
9. Was the student provided with dormitory facility?
   - Yes ________ No ________

10. Student's choice of stream in Freshman Programme:

Stream: Physical Science ___________

Life Science _______________

Section: _______________

11. Average years of education of teachers after Bachelor's degree _____________

12. Student's University performance: in the Freshman year:

12.1 First Semester GPA ________

12.2 Subject Grades:

FlEn 101 __________

Math 100 ___________

Appendix B: Original Data.

SER	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	X_{11}	X_{12}	X_{13}	X_{14}	X_{15}	X_{16}	Y	Y_1	Y_2
1	1	18	1	0	1	0	1	0	3.4	3	3	1	0	0	1	1.3	.50	1	0
2	1	19	1	1	0	0	1	0	3.4	3	3	1	0	1	1	2.0	2.67	2	4
3	1	29	1	1	0	0	1	0	3.4	4	2	1	0	1	1	1.3	2.17	2	2
4	1	26	0	1	1	0	1	3	3.4	3	3	0	1	0	1	1.3	1.78	2	2
5	1	18	1	1	0	1	1	0	3.4	3	3	1	0	1	1	1.3	2.83	2	3
6	1	17	1	1	1	0	1	0	3.0	3	2	1	0	1	1	2.0	.78	2	2
7	1	18	1	1	0	0	1	0	3.2	3	1	1	0	1	0	1.7	1.17	2	1
8	1	20	1	1	0	0	1	0	3.2	3	2	1	0	1	1	1.7	2.00	2	2
9	1	20	1	1	0	1	1	0	3.0	3	2	1	0	1	1	1.3	1.83	2	2
10	1	19	1	1	1	00	1	0	3.0	3	2	1	0	0	1	1.3	2.00	2	2
11	1	18	1	0	1	0	1	0	3.0	3	2	1	0	0	0	1.3	1.72	4	2
12	1	18	1	1	0	0	1	0	3.0	3	2	1	0	1	1	1.3	2.00	2	2
13	1	18	11	1	0	0	1	0	3.2	3	2	1	0	1	0	1.3	.39	1	0
14	1	21	1	1	1	0	0	0	3.6	4	3	1	0	0	1	1.3	1.83	2	2
15	1	19	1	1	0	0	1	0	3.0	3	2	1	0	1	1	1.3	2.78	2	3
16	1	16	1	1	0	1	1	0	3.2	3	2	1	0	1	1	1.3	1.78	2	2
17	1	19	1	1	0	0	1	0	3.0	3	1	1	0	1	0	1.3	1.39	2	1
18	1	18	1	1	0	0	1	0	3.4	4	2	1	0	1	1	2.4	1.94	4	2
19	1	18	1	1	1	0	1	0	3.2	3	2	1	0	0	1	1.3	2.22	2	2
20	1	33	0	1	0	0	1	8	3.2	4	3	0	0	1	1	1.7	2.06	2	2
21	1	21	1	1	1	0	0	0	3.4	3	2	1	0	0	1	1.7	3.17	2	4
22	1	18	1	1	1	0	1	0	3.0	3	2	1	0	1	1	1.3	2.78	3	2
23	1	19	1	1	0	0	1	0	3.0	3	2	1	0	1	1	2.4	1.67	2	2
24	1	20	1	1	0	0	1	0	3.2	4	1	1	C	1	1	1.3	2.00	2	2
25	1	18	1	1	0	0	1	0	3.2	3	1	1	0	1	1	1.3	2.22	2	3
26	1	18	1	1	1	0	1	0	3.2	3	2	1	0	0	1	2.0	1.83	2	2
27	1	18	1	1	0	1	1	0	3.0	3	2	1	0	1	1	1.3	2.00	2	2
28	1	19	1	0	0	0	1	0	3.4	3	3	1	0	1	1	2.0	1.44	2	2
29	1	18	1	1	1	0	1	0	3.6	3	3	1	0	0	1	2.0	1.89	2	2
30	1	18	1	1	0	0	1	0	3.8	4	3	1	0	1	1	1.3	2.94	2	4
31	1	20	1	1	0	0	1	0	3.0	3	2	1	0	1	1	2.0	2.00	2	2
32	1	18	1	1	0	0	1	0	3.2	3	2	1	0	1	1	2.0	1.61	2	2
33	1	19	1	1	1	0	1	0	3.0	3	3	1	0	1	1	2.0	.56	2	1
34	1	20	1	1	0	0	1	0	3.4	4	2	1	0	1	0	1.3	.83	1	2
35	1	17	1	1	1	0	1	0	3.2	3	4	1	0	0	1	1.7	1.67	2	2
36	1	17	1	1	1	0	1	0	3.8	3	4	1	0	0	1	2.0	3.50	3	4
37	1	21	1	1	0	1	1	0	3.8	4	3	1	0	1	1	1.3	1.00	2	1
38	1	18	1	0	1	0	1	0	3.2	3	3	1	0	0	1	1.3	2.33	4	2
39	1	18	1	1	0	0	1	0	3.2	3	1	1	0	1	1	1.3	2.17	2	2
40	0	16	0	1	1	0	1	0	3.2	2	4	1	0	1	1	2.0	0.00	0	0
41	1	19	1	1	0	1	1	0	3.2	3	3	1	0	1	1	1.3	2.22	2	2
42	1	18	1	1	1	0	1	0	3.0	2	2	1	0	0	1	2.4	2.17	2	2
43	1	19	1	1	0	0	1	0	3.6	4	3	1	0	1	1	2.0	2.61	3	2
44	1	19	1	1	0	0	0	0	3.0	2	1	1	0	1	1	2.0	1.50	1	2
45	1	17	1	0	1	0	1	0	3.2	4	2	1	0	0	1	1.3	1.94	4	1
46	1	20	1	1	0	U	1	0	3.4	3	2	1	0	1	1	1.3	2.06	2	2
47	1	23	1	1	0	0	1	4	3.2	4	2	0	0	1	1	1.3	1.56	3	1
48	1	18	1	1	1	0	1	0	3.8	4	3	1	0	0	1	1.3	3.33	3	4
49	1	19	1	1	0	0	1	0	3.2	3	3	1	0	1	1	1.3	2.06	2	2
50	0	17	1	1	1	0	1	0	3.4	3	3	1	0	1	1	2.0	1.61	2	2
51	1	18	1	1	1	0	1	0	3.2	3	3	1	0	0	1	1.3	1.83	2	2
52	1	18	1	1	0	0	1	0	3.6	3	3	1	0	1	1	1.3	1.83	2	2
53	1	19	1	0	1	0	1	0	3.2	3	2	1	0	0	1	2.4	1.28	2	1
54	1	17	11	1	0	0	1	0	3.2	3	2	1	0	1	0	1.3	2.00	2	2

55	1	17	1	1	1	0	1	0	3.0	2	4	1	0	1	1	2.0	2.44	2	3
56	1	22	11	1	0	0	0	2	2.6	2	2	0	0	1	1	1.3	2.44	2	2
57	0	18	1	1	0	0	1	0	3.4	3	2	1	0	1	1	1.3	1.94	2	2
58	1	18	1	1	1	0	1	0	4.0	4	4	1	0	0	1	2.0	3.28	2	3
59	1	17	1	1	1	0	1	0	3.4	3	2	1	0	0	1	1.3	1.1772		1
60	0	18	1	1	0	0	1	0	3.0	3	2	1	0	1	1	1.3	.39	1	1
61	1	19	1	1	0	0	1	0	3.0	2	2	1	0	1	1	1.3	1.94	2	2
62	1	18	1	1	0	1	1	0	3.0	3	2	1	0	1	1	1.3	1.83	2	2
63	1	18	1	11	0	0	1	0	3.0	3	1	1	0	1	1	1.3	2.00	2	2
64	1	18	1	1	0	1	1	0	4.0	4	4	1	0	1	1	1.3	3.61	4	3
65	0	17	1	11	1	0	1	0	3.0	3	2	1	0	1	1	1.7	1.78	2	2
66	1	16	1	1	1	0	1	0	3.0	3	2	1	0	1	1	1.3	2.00	2	2
67	1	21	1	1	1	0	0	0	3.0	3	3	1	0	0	1	1.3	2.06	2	2
68	1	18	1	1	0	0	1	0	3.2	3	2	1	0	1	1	1.7	2.00	2	2
69	1	20	1	1	0	0	1	0	3.4	3	2	1	0	1	1	2.0	1.67	2	2
70	1	17	1	1	0	0	1	0	3.6	3	3	1	0	1	1	1.3	2.06	2	2
71	1	19	1	1	1	0	0	0	3.2	3	3	1	0	0	1	1.3	2.00	2	2
72	1	21	1	1	0	1	0	0	3.2	3	2	1	0	1	1	1.3	2.22	2	2
73	0	18	1	1	0	1	1	0	3.0	2	2	1	0	1	1	1.3	1.78	2	2
74	1	20	0	1	0	0	1	0	3.0	3	2	1	0	1	1	1.3	2.00	2	2
75	1	18	1	1	1	0	1	0	3.0	3	2	1	0	0	1	2.0	2.11	4	2
76	1	18	1	1	1	0	1	0	3.0	2	2	1	0	0	1	2.0	1.61	2	2
77	1	18	0	1	0	1	1	0	3.2	3	3	1	0	1	1	1.7	2.00	2	2
78	1	20	1	1	0	0	1	0	3.2	3	2	1	0	1	1	1.3	2.00	2	2
79	1	16	1	1	0	0	1	0	3.2	4	2	1	0	1	1	2.0	2.00	2	2
80	1	20	1	1	1	0	0	0	3.6	4	4	1	0	0	1	1.3	1.78	2	2
81	1	18	1	1	0	0	0	0	3.2	3	3	1	0	1	1	2.0	1.83	2	2
82	1	19	1	1	0	0	1	0	3.2	3	2	1	0	1	1	2.0	1.78	2	2
83	1	17	1	1	0	0	1	0	4.0	4	4	1	0	1	1	2.0	3.67	4	4
84	1	17	1	1	0	0	1	0	3.2	3	2	1	000	1	1	2.0	1.61	2	2
85	1	28	1	1	0	0	1	9	3.2	3	2	0	0	1	1	1.7	1.56	2	1
86	1	21	1	1	0	0	1	0	3.4	4	2	1	0	1	1	2.0	2.00	2	2
87	1	19	0	1	1	0	01	0	3.2	3	1	1	0	0	1	1.3	1.61	2	2
88	1	19	0	1	1	0	0	0	3.8	3	4	1	0	0	1	1.7	2.44	2	2
89	1	28	1	1	0	0	1	0	3.2	3	1	1	0	1	1	1.3	1.56	3	1
90	1	18	1	1	1	0	1	0	3.6	3	3	1	0	0	1	1.3	1.44	2	2
91	1	21	1	1	0	1	1	0	3.0	2	2	1	0	1	1	1.3	2.00	2	2
92	1	22	1	1	0	0	0	0	3.8	4	4	1	0	1	1	1.7	.22	0	1
93	1	18	1	1	1	0	1	0	3.8	4	3	1	0	0	1	1.3	2.39	3	2
94	1	18	1	1	0	0	1	0	3.4	3	3	1	0	1	1	1.3	1.78	2	2
95	1	20	1	1	0	0	1	0	3.4	3	2	1	0	1	1	2.0	2.67	2	3
96	1	21	1	1	0	0	1	0	3.2	3	2	1	0	1	1	1.3	2.00	2	2
97	1	17	1	1	0	0	1	0	3.0	3	2	1	0	1	1	2.0	1.78	2	2
98	1	18	1	1	0	0	1	0	3.4	3	2	1	0	1	1	2.0	2.00	2	2
99	0	17	0	1	0	0	1	0	3.0	33	2	1	0	1	1	1.3	2.00	2	2
100	1	18	1	1	1	0	1	0	3.0	3	3	1	0	0	1	1.7	1.83	2	2
101	1	20	1	1	0	0	1	0	3.0	2	2	1	0	1	1	1.3	.33	2	0
102	1	17	1	1	0	0	1	0	3.4	3	2	1	0	1	1	2.0	2.50	2	3
103	1	17	1	1	0	1	1	0	3.4	3	2	1	0	1	1	1.7	2.00	2	2
104	1	21	1	1	0	0	1	0	3.4	3	2	1	0	1	1	1.3	1.67	2	2
105	1	18	1	1	0	0	1	0	3.0	3	2	1	0	1	1	1.7	.39	1	0
106	1	18	1	1	0	0	0	0	3.6	4	3	1	0	1	1	1.3	2.00	2	?
107	1	18	1	1	0	0	1	1	3.0	3	2	1	0	1	1	1.3	2.00	2	2
108	1	17	1	1	0	0	1	0	3.4	2	3	1	0	1	1	1.3	2.11	2	3
109	1	18	1	1	1	0	1	0	3.2	3	2	1	0	0	01	1.3	1.78	2	2
110	1	17	1	1	0	1	1	0	3.4	4	1	1	0	1	1	1.3	2.56	4	2
111	1	19	1	1	0	0	1	0	3.2	3	2	1	0	1	1	2.0	2.22	2	2

112	0	19	1	1	1	0	1	0	3.0	3	2	1	0	1	1	2.0	1.83	2	3
113	0	17	1	1	1	0	1	0	3.0	3	1	1	0	1	1	1.3	2.22	2	2
114	1	18	1	1	1	0	1	0	3.2	3	2	1	0	0	1	1.3	1.94	3	2
115	1	18	1	1	1	0	0	0	3.4	4	3	1	0	0	1	2.0	2.22	2	3
116	1	18	1	1	0	0	1	0	3.0	3	2	1	0	1	1	1.3	.39	1	0
117	1	19	1	1	1	0	1	1	3.6	2	3	1	0	0	1	1.7	1.44	2	2
118	1	19	1	1	0	0	1	0	3.2	3	2	1	0	1	1	2.4	2.17	2	2
119	1	18	1	1	1	0	0	0	3.2	3	3	1	0	0	1	1.3	2.06	2	2
120	1	20	1	1	1	0	1	0	3.2	3	2	1	0	1	1	1.3	1.78	2	2
121	1	18	1	1	0	0	1	0	3.0	4	1	1	0	1	1	2.0	2.06	3	2
122	1	17	1	1	1	0	1	0	3.6	3	3	1	0	1	1	1.3	1.67	2	2
123	0	18	1	11	1	0	1	0	3.0	3	2	1	0	1	1	2.0	1.83	2	2
124	1	21	1	1	1	0	0	0	3.0	3	2	1	0	0	1	1.3	1.83	1	2
125	1	19	1	1	0	0	1	0	3.4	3	2	1	0	1	1	2.0	2.22	2	2
126	1	20	1	1	0	0	1	0	3.0	3	2	1	0	1	1	1.3	2.00	2	2
127	1	18	1	1	0	0	1	0	3.4	3	3	1	0	1	1	1.3	2.44	3	2
128	1	18	1	1	1	0	1	0	3.0	3	2	1	0	0	1	2.4	2.17	2	2
129	1	21	1	1	0	0	1	0	3.0	3	2	1	0	1	1	1.3	1.44	2	2
130	1	20	1	1	0	0	0	0	3.2	3	3	1	0	1	1	1.3	3.50	2	4
131	1	16	1	1	1	0	1	0	3.4	3	2	1	0	0	1	1.3	1.78	2	2
132	1	20	1	1	0	0	1	0	3.0	3	1	1	0	1	1	1.7	2.17	3	2
133	1	18	1	0	1	0	1	0	3.2	3	3	1	0	0	0	1.3	1.50	4	1
134	1	19	1	1	1	0	1	0	3.2	2	3	1	0	0	1	1.3	2.28	2	2
135	1	17	1	1	1	0	1	0	3.2	3	2	1	0	1	1	2.0	1.61	2	2
136	1	18	1	1	0	0	1	0	3.0	3	2	1	0	1	0	1.3	1.00	2	1
137	1	17	1	11	1	0	1	0	3.2	3	1	1	0	0	1	2.0	1.83	2	2
138	1	18	1	1	1	0	1	0	3.4	3	2	1	0	0	1	1.7	2.06	2	2
139	1	19	1	1	1	0	1	0	3.2	3	2	1	0	0	1	1.3	1.78	2	2
140	1	19	1	1	1	0	1	0	3.0	3	2	1	0	0	1	2.0	1.39	2	2
141	1	20	1	1	0	0	1	0	3.6	4	2	1	0	1	1	2.0	2.61	3	3
142	1	21	1	1	1	0	1	1	3.6	3	4	1	0	1	1	1.7	2.00	2	2
143	1	18	1	1	0	0	1	0	3.4	3	3	1	0	1	1	2.0	2.22	2	2
144	1	16	1	1	1	0	1	0	3.0	3	3	1	0	0	1	2.0	.44	0	1
145	1	17	1	1	1	0	1	0	3.6	3	3	1	0	0	1	1.3	2.39	3	2
146	1	19	1	1	1	0	1	0	3.0	3	2	1	0	0	1	1.3	1.89	2	2
147	1	19	1	1	0	0	1	0	3.4	3	2	1	0	1	1	1.7	3.06	3	2
148	1	20	1	1	1	0	1	1	3.6	3	3	0	1	0	1	1.7	2.30	2	2
149	1	18	1	1	1	0	1	0	3.0	3	1	1	0	0	1	1.3	2.17	3	2
150	1	20	1	1	0	0	1	0	3.0	3	2	1	0	1	1	1.3	.94	3	1

APPENDIX C DIAGNOSTIC STATISTICS AND PLOTS FULL MODEL

SEQNUM	Y	*PRED	*RESID	*SRESID	*SDRESID	*MAHAL	*COOK D
1	.5000	1.8020	-1.3020	-2.3495	-2.3904	23.8320	.0690
2	2.6700	1.9985	.6715	1.1273	1.1284	4.5268	.0031
3	2.1700	1.9026	.2672	.5172	.5157	40.1033	.0064
4	1.7800	2.0276	-.2476	-.5007	-.4993	49.1450	.0079
5	2.8300	2.2010	.6290	1.0811	1.0816	11.1502	.0065
6	.7800	1.7159	-.9359	-1.6283	-1.6385	14.4343	.0191
7	1.1700	1.3977	-.2277	-.4102	-.4089	23.3527	.0021
8	2.0000	1.8864	.1136	.1891	.1884	2.0337	.0000
9	1.8300	1.9101	-.0801	-.1383	-.1378	12.2861	.0001
10	2.0000	1.7717	.2283	.3852	.3840	6.0626	.0005
11	1.7200	.9567	.7633	1.4260	1.4315	32.1699	.0364
12	2.0000	1.7792	.2208	.3707	.3695	4.6134	.0003
13	.3900	1.3326	-.9426	-1.6725	-1.6839	19.5658	.0280
14	1.8300	2.3042	-.4742	-.8233	-.8223	13.8937	.0047
15	2.7300	1.7557	1.0243	1.7170	1.7297	4.1152	.0065
16	1.7800	2.1590	-.3790	-.6552	-.6538	12.7189	.0027
17	1.3900	1.2201	.1699	.3025	.3015	20.3799	.0010
18	1.9400	2.1597	-.2197	-.3763	-.3756	10.4779	.0007
19	2.2200	1.9501	.2699	.4528	.4514	4.2979	.0005
20	2.0600	1.5862	.4738	1.0775	1.0782	69.8356	.0656
21	3.1700	2.1418	1.0282	1.7979	1.8132	15.7814	.0256
22	2.7800	1.6935	1.0865	1.8956	1.9143	15.1742	.0273
23	1.6700	1.7540	-.0840	-.1430	-.1424	9.5198	.0001
24	2.0000	2.0254	-.0254	-.0433	-.0432	9.0273	.0000
25	2.2200	1.9998	.2202	.3729	.3717	6.9800	.0005
26	1.8300	1.9490	-.1190	-.2001	-.1993	5.0274	.0001
27	2.0000	1.9571	.0429	.0738	.0735	11.6420	.0000
28	1.4400	1.7614	-.3214	-.5938	-.5924	29.5823	.0057
29	1.8900	2.1928	-.3028	-.5117	-.5103	6.3960	.0009
30	2.9400	2.4054	.5346	.9114	.9108	8.8775	.0037
31	2.0000	1.7311	.2689	.4520	.4507	4.9115	.0005
32	1.6100	1.9329	-.3229	-.5390	-.5376	2.9015	.0005
33	.5600	1.6031	-1.0431	-1.8280	-1.8443	16.3514	.0275
34	.8300	1.5131	-.6831	-1.2290	-1.2313	23.1069	.0182
35	1.6700	1.8415	-.1715	-.2985	-.2975	14.5784	.0006
36	3.5000	2.3054	1.1946	2.0514	2.0766	10.8972	.0226
37	1.0000	2.5127	-1.5127	-2.6609	-2.7239	17.3317	.0621
38	2.3300	1.6472	.6828	1.2316	1.2340	23.7325	.0189
SEQNUM	Y	*PRED	*RESID	*SRESID	*SDRESID	*MAHAL	*COOK D

SEQNUM	Y	*PRED	*RESID	*SRESID	*SDRESID	*MAHAL	*COOK D
39	2.1700	1.9998	.1702	.2882	.2872	6.9800	.0003
40	.0000	1.3460	-1.3460	-2.5951	-2.6529	39.2362	.1557
41	2.2200	2.0227	.1973	.3410	.3399	12.6573	.0007
42	2.1700	1.7209	.4491	.7802	.7790	14.0115	.0043
43	2.6100	2.2259	.3841	.6502	.6488	6.9316	.0015
44	1.5000	1.8558	-.3558	-.6505	-.6491	27.0250	.0061
45	1.9400	1.8091	.1309	.2420	.2411	29.7488	.0010
46	2.0600	2.0418	.0182	.0305	.0304	4.1413	.0000
47	1.5600	2.1245	-.5645	-1.0615	-1.0620	33.6707	.0214
48	3.3300	2.4214	.9086	1.5517	1.5600	9.3848	.0113
49	2.0600	1.8448	.2152	.3633	.3622	6.1387	.0004
50	1.6100	1.7101	-.1001	-.1778	-.1772	19.8843	.0003
51	1.8300	1.8843	-.0543	-.0918	-.0915	6.3974	.0000
52	1.8300	2.1779	-.3479	-.5876	-.5862	6.2822	.0011
53	1.2800	1.6877	-.4077	-.7543	-.7531	29.8964	.0093
54	2.0000	1.3561	.6439	1.1453	1.1466	20.2236	.0136
55	2.4400	1.5118	.9282	1.6751	1.6366	23.8516	.0351
56	2.4400	1.7176	.7224	1.5330	1.5408	58.2158	.0969
57	1.9400	1.8392	.1008	.1815	.1809	23.2307	.0004
58	3.2800	2.5094	.7706	1.3359	1.3398	13.4467	.0120
59	1.1700	2.1284	-.9584	-1.6173	-1.6278	6.1180	.0082
60	.3900	1.5295	-1.1395	-2.0507	-2.0758	23.1514	.0508
61	1.9400	1.6831	.2569	.4366	.4352	7.9585	.0008
62	1.8300	1.9571	-.1271	-.2189	-.2182	11.6420	.0003
63	2.0000	1.8450	.1550	.2613	.2604	5.7092	.0002
64	3.6100	2.6723	.9377	1.6664	1.6776	19.9943	.0285
65	1.7800	1.4667	.3133	.5519	.5505	17.7341	.0027
66	2.0000	1.7405	.2595	.4567	.4553	17.4956	.0018
67	2.0600	1.7671	.2929	.5102	.5088	14.7448	.0019
68	2.0000	1.9334	.0666	.1108	.1104	1.8599	.0000
69	1.6700	2.0407	-.3707	-.6226	-.6212	4.6714	.0010
70	2.0600	2.2014	-.1414	-.2396	-.2389	7.3551	.0002
71	2.0000	1.9689	.0311	.0533	.0531	10.7066	.0000
72	2.2200	2.1495	.0705	.1261	.1256	21.7590	.0002
73	1.7800	1.6348	.1452	.2716	.2707	32.5246	.0013
74	2.0000	1.6378	.3622	.6704	.6690	29.9735	.0074
75	2.1100	1.7942	.3158	.5342	.5328	6.6705	.0010
76	1.6100	1.7215	-.1115	-.1904	-.1897	9.3570	.0002
77	2.0000	1.9512	.0488	.0923	.0919	34.7900	.0002
78	2.0000	1.8870	.1130	.1886	.1879	2.8682	.0001
79	2.0000	2.0526	-.0526	-.0905	-.0902	11.4075	.0000
80	1.7800	2.2619	-.4819	-.8429	-.8419	15.8136	.0056
SEQNUM	Y	*PRED	*RESID	*SRESID	*SDRESID	*MAHAL	*COOK D

SEQNUM	Y	*PRED	*RESID	*SRESID	*SDRESID	*MAHAL	*COOK D
81	1.8300	1.9753	-.1453	-.2527	-.2518	14.3519	.0005
82	1.7800	1.9094	-.1294	-.2159	-.2151	2.7647	.0001
83	3.6700	2.5168	1.1532	2.0040	2.0271	14.1251	.0283
84	1.6100	1.9564	-.3464	-.5801	-.5787	3.8065	.0007
85	1.5600	1.7557	-.1957	-.5074	-.5060	87.8662	.0238
86	2.0000	2.0898	-.0898	-.1524	-.1518	7.4808	.0001
87	1.6100	2.0393	-.4293	-.7355	-.7343	10.2455	.0028
88	2.4400	2.2726	.1674	.3216	.3205	38.4139	.0023
89	1.5600	1.7646	-.2046	-.3856	-.3843	34.1132	.0029
90	1.4400	2.1939	-.7539	-1.2720	-1.2749	5.9543	.0049
91	2.0000	1.8140	.1860	.3280	.3269	17.9364	.0010
92	.2200	2.3530	-2.1330	-3.7677	-3.9698	18.4165	.1329
93	2.3900	2.4214	-.0314	-.0536	-.0534	9.3848	.0000
94	1.7800	2.0231	-.2431	-.4087	-.4074	4.9545	.0004
95	2.6700	2.0407	.6293	1.0569	1.0574	4.6714	.0028
96	2.0000	1.8635	.1365	.2287	.2278	3.8936	.0001
97	1.7800	1.8016	-.0216	-.0364	-.0363	5.2824	.0000
98	2.0000	2.0877	-.0877	-.1471	-.1466	4.2027	.0000
99	2.0000	1.4587	.5413	1.0443	1.0447	39.3635	.0253
100	1.8300	1.7289	.1011	.1730	.1724	9.9170	.0001
101	.3300	1.6595	-1.3295	-2.2636	-2.2996	8.5233	.0219
102	2.5000	2.1112	.3888	.6539	.6525	5.1208	.0011
103	2.0000	2.2396	-.2896	-.5018	-.5004	13.2306	.0017
104	1.6700	2.0183	-.3483	-.5860	-.5845	5.1536	.0009
105	.3900	1.7786	-1.3886	-2.3215	-2.3608	3.3497	.0101
106	2.0000	2.3587	-.3587	-.6286	-.6272	16.3824	.0033
107	2.0000	1.7436	.2564	.4362	.4349	3.3560	.0008
108	2.1100	1.9740	.1360	.2356	.2348	13.2239	.0004
109	1.7800	1.9501	-.1701	-.2853	-.2843	4.2979	.0002
110	2.5600	2.4287	.1313	.2346	.2338	21.3188	.0006
111	2.2200	1.9094	.3106	.5182	.5168	2.7647	.0004
112	1.8300	1.4192	.4108	.7309	.7297	20.2949	.0056
113	2.2200	1.5331	.6869	1.2348	1.2372	22.8827	.0182
114	1.9400	1.9501	-.0101	-.0169	-.0168	4.2979	.0000
115	2.2200	2.2188	.1203E-02	.0021	.0021	15.9484	.0000
116	.3900	1.7792	-1.3892	-2.3328	-2.3727	4.6134	.0133
117	1.4400	2.0616	-.6216	-1.0994	-1.1003	18.7821	.0116
118	2.1700	1.9088	.2612	.4424	.4410	7.0188	.0007
119	2.0600	1.9924	.0676	.1162	.1158	11.3198	.0001
120	1.7800	1.8013	-.0213	-.0373	-.0371	16.1683	.0000
121	2.0600	1.9165	.1435	.2474	.2466	12.0401	.0004
122	1.6700	2.1157	-.4457	-.7880	-.7869	18.6587	.0059
SEQNUM	Y	*PRED	*RESID	*SRESID	*SDRESID	*MAHAL	*COOK D

SEQNUM	Y	*PRED	*RESID	*SRESID	*SDRESID	*MAHAL	*COOK D
123	1.8300	1.4427	.3873	.6859	.6846	19.1064	.0046
124	1.8300	1.8328	-.2843E-02	-.0049	-.0049	12.9647	.0000
125	2.2200	2.0642	.1558	.2611	.2602	4.0529	.0001
126	2.0000	1.7322	.2678	.4493	.4480	4.3854	.0005
127	2.4400	2.0231	.4169	.7009	.6996	4.9545	.0013
128	2.1700	1.7935	.3765	.6473	.6459	11.2525	.0023
129	1.4400	1.7087	-.2687	-.4524	-.4511	5.4239	.0006
130	3.5000	1.9294	1.5706	2.7110	2.7781	12.2985	.0450
131	1.7800	2.1519	-.3719	-.6310	-.6296	7.5613	.0015
132	2.1700	1.7973	.3727	.6252	.6238	4.3466	.0009
133	1.5000	1.0456	.4542	.8518	.8509	33.0406	.0134
134	2.2800	1.7882	.4918	.8434	.8425	10.5147	.0037
135	1.6100	1.8707	-.2607	-.4541	-.4527	14.7181	.0015
136	1.0000	1.1778	-.1778	-.3168	-.3157	20.6170	.0011
137	1.8300	2.0382	-.2082	-.3576	-.3564	10.8922	.0007
138	2.0600	2.1042	-.0442	-.0743	-.0741	4.7248	.0000
139	1.7800	1.9266	-.1466	-.2459	-.2451	4.4044	.0001
140	1.3900	1.7706	-.3806	-.6449	-.6435	7.1646	.0015
141	2.6100	2.2682	.3418	.5797	.5783	7.4220	.0013
142	2.0000	1.9197	.0803	.1432	.1427	20.8014	.0002
143	2.2200	2.0220	.1980	.3323	.3312	4.4438	.0003
144	.4400	1.7754	-1.3354	-2.3033	-2.3415	12.0911	.0319
145	2.3900	2.2175	.172[illegible]	.2916	.2906	6.4095	.0003
146	1.8900	1.7717	.1183	.1996	.1989	6.0626	.0001
147	3.0600	2.0647	.9953	1.6611	1.6722	2.8499	.0046
148	2.3000	2.4834	-.1834	-.4121	-.4108	63.4605	.0081
149	2.1700	1.8610	.3090	.5255	.5241	8.2341	.0011
150	.9400	1.7322	-.7922	-1.3292	-1.3330	4.3854	.0041
SEQNUM	Y	*PRED	*RESID	*SRESID	*SDRESID	*MAHAL	*COOK D

<u>Notations</u>. (see Weisberg, 1980; Cook and Weisberg, 1982)

PRED . PREDICTED (FITTED) VALUES

RESID : RESIDUALS

ZRESID STANDARDIZED RESIDUALS

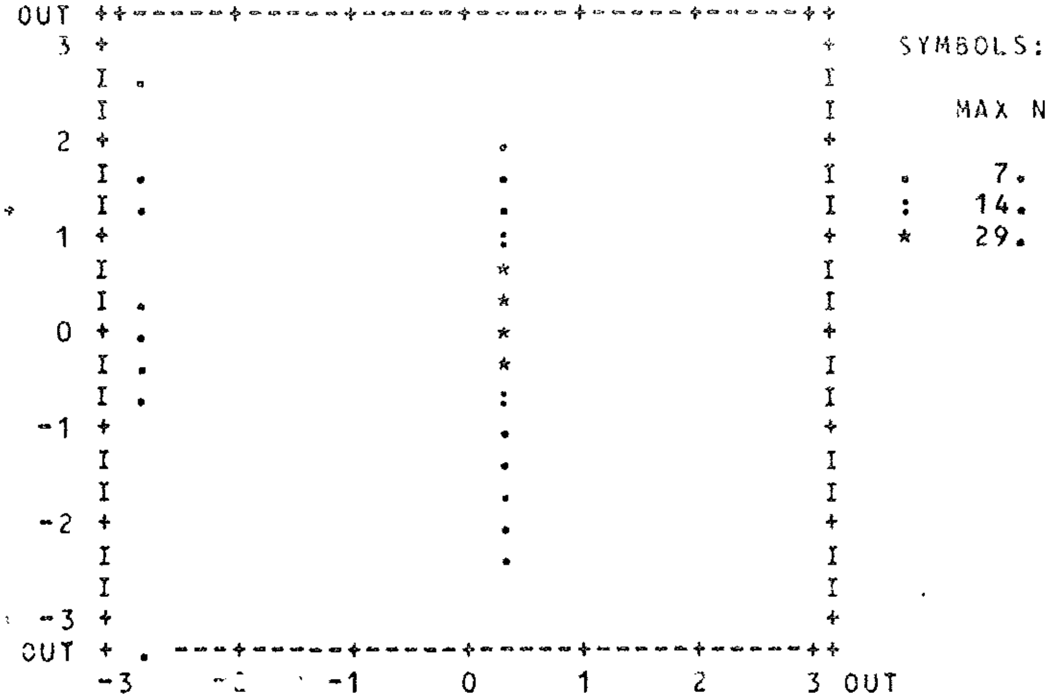
SRESID STUDENTIZED RESIDUALS

SDRESID : STUDENTIZED DELETED RESIDUAL (OUTLIER TEST STATISTIC, t_i)

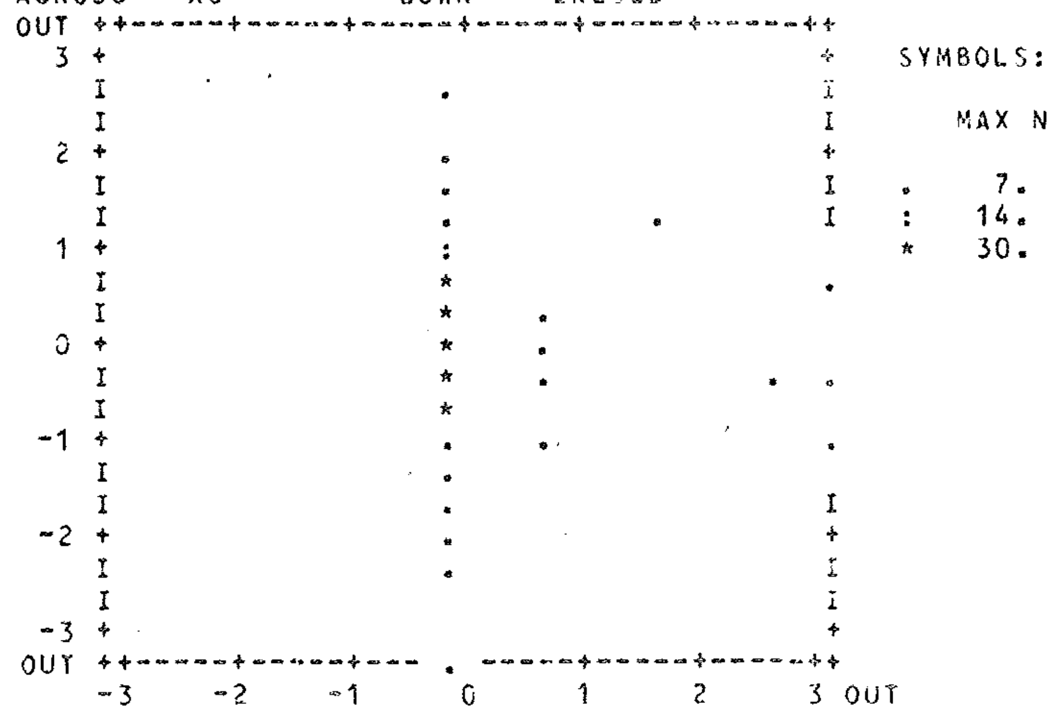
MAHAL : MAHALANOBIS DISTANCE (M_i)

COOK D [illegible] STANCE (D_i)

STANDARDIZED SCATTERPLOT
ACROSS - X7   DOWN - *ZRESID



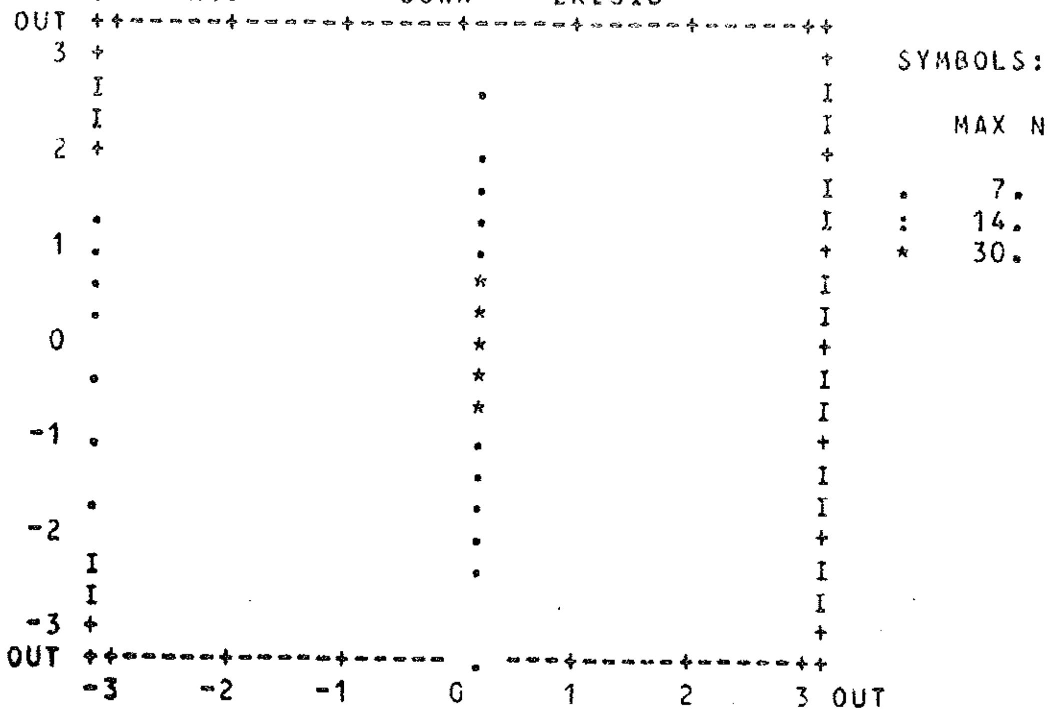
STANDARDIZED SCATTERPLOT
ACROSS - X8   DOWN - *ZRESID



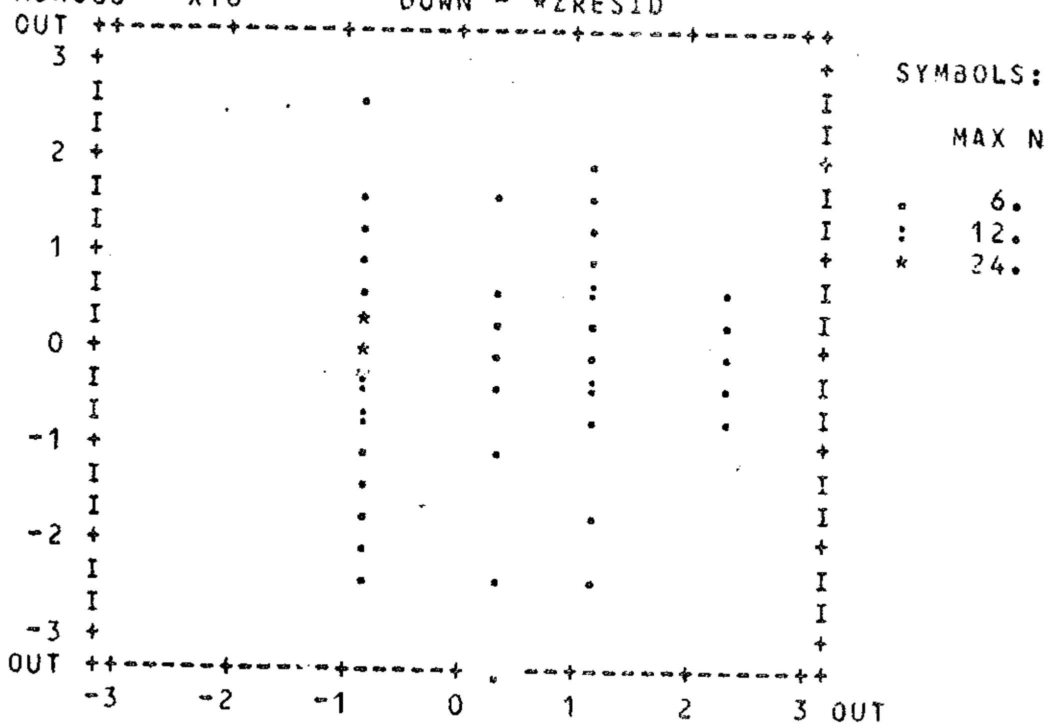
```
STANDARDIZED SCATTERPLOT
ACROSS - X14          DOWN - *ZRESID
OUT ++-----+-----+-----+-----+-----+-----++
  3 +                                     +   SYMBOLS:
    I                     .               I
    I                                     I      MAX N
  2 +         .           .               +
    I         .           .               I   .    6.
    I         .           .               I   :   12.
  1 +         .           :               +   *   24.
    I         .           :               I
    I         :           *               I
  0 +         :           *               +
    I         :           *               I
    I         .           :               I
 -1 +         .           .               +
    I         .           .               I
    I         .           .               I
 -2 +         .           .               +
    I         .           .               I
    I                                     I
 -3 +                                     +
OUT ++-----+-----+-----+--  . +-----+-----++
    -3    -2    -1     0     1     2     3 OUT
```

```
STANDARDIZED SCATTERPLOT
ACROSS - X12          DOWN - *ZRESID
OUT ++-----+-----+-----+-----+-----+-----++
  3 +                                     +   SYMBOLS:
    I                    .                I
    I                                     I      MAX N
  2 +                    .                +
                         .                I   .    7.
    .                    .                I   :   14.
  1                      :                +   *   31.
    .                    *                I
                         *                I
  0                      *                +
    .                    *                I
                         *                I
 -1 .                    .                +
                         .                I
    I                    .                I
 -2 +                    .                +
    I                    .                I
    I                                     I
 -3 +                                     +
OUT ++-----+-----+------ . ---+-----+-----++
    -3    -2    -1     0     1     2     3 OUT
```

STANDARDIZED SCATTERPLOT
ACROSS - X15 DOWN - *ZRESID



STANDARDIZED SCATTERPLOT
ACROSS - X16 DOWN - *ZRESID



APPENDIX D : DIAGNOSTIC STATISTICS AND PLOTS : Model in (1a)

SUBJECT	Y	*PRED	*RESID	*ZRESID	*SRESID	*MAHAL	*COOK D
1	[illegible]	2.4731	-1.8309	-1.7079	-1.8410	.3350	.0081
2	[illegible]	2.4731	-.1869	-.1743	-.1679	.3350	.0001
3	[illegible]	[illegible]	-1.6886	-1.5753	-1.7220	1.1750	.0245
4	[illegible]	[illegible]	.4472	.4171	.4559	1.1750	.0017
5	[illegible]	[illegible]	[illegible]	-1.1634	-1.2975	1.1750	.0140
6	[illegible]	[illegible]	[illegible]	-.5197	-.6025	4.5737	.0116
7	[illegible]	[illegible]	[illegible]	1.3264	1.4751	2.1960	.0341
8	[illegible]	2.4731	[illegible]	1.4910	1.6073	.3350	.0062
9	[illegible]	[illegible]	1.8120	1.6913	1.8454	1.1750	.0226
10	[illegible]	[illegible]	[illegible]	-.0174	-.0193	2.1966	.0000
11	[illegible]	[illegible]	[illegible]	-.3520	-.4090	4.5737	.0054
12	[illegible]	[illegible]	[illegible]	-1.9246	-2.1147	1.1750	.0375
13	[illegible]	[illegible]	-.6097	-.5687	-.6324	2.1966	.0063
14	[illegible]	[illegible]	[illegible]	2.7341	2.5272	3.1909	.1454
15	[illegible]	[illegible]	[illegible]	1.7084	1.8966	2.1964	.0564
16	[illegible]	[illegible]	[illegible]	.6548	.7594	1.1750	.0042
17	[illegible]	[illegible]	[illegible]	.7616	.4326	2.1966	.0025
18	[illegible]	[illegible]	[illegible]	1.2516	2.2189	3.1909	.1121
19	[illegible]	2.4731	-.4055	-.3780	-.4075	.3350	.0004
20	[illegible]	[illegible]	[illegible]	-.0174	-.0195	2.1966	.0000
21	[illegible]	[illegible]	[illegible]	-1.9125	-2.1269	2.1966	.0704
22	[illegible]	[illegible]	1.2179	1.1357	1.2414	1.1750	.0129
23	[illegible]	[illegible]	[illegible]	-.9051	-.9757	.3350	.0023
24	[illegible]	[illegible]	[illegible]	[illegible]	.0682	1.1750	.0000
25	[illegible]	[illegible]	.4472	.4171	.4559	1.1750	.0017
26	[illegible]	[illegible]	[illegible]	.5151	.5601	1.1750	.0027
27	[illegible]	[illegible]	[illegible]	.5634	.6321	2.1966	.0063
28	[illegible]	[illegible]	[illegible]	[illegible]	.6523	1.1750	.0035
29	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.1750	.0005
30	[illegible]	[illegible]	[illegible]	[illegible]	-.7642	4.5737	.0191
31	[illegible]	[illegible]	[illegible]	-.7754	-.3625	2.1966	.0117
32	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	3.1909	[illegible]
33	[illegible]	[illegible]	[illegible]	-1.5097	[illegible]	4.5737	.1135
34	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	3.1909	[illegible]
35	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.1750	[illegible]
36	[illegible]	[illegible]	[illegible]	-.1097	[illegible]	[illegible]	.0007
37	[illegible]	[illegible]	[illegible]	[illegible]	.1330	1.1750	.0002
38	[illegible]	[illegible]	[illegible]	.7764	[illegible]	1.1750	.0060
SUBJECT	Y	*PRED	*RESID	*ZRESID	*SRESID	*MAHAL	*COOK D

SEQNUM	Y0	*PRED	*RESID	*SDRESID	*DRESID	*MAHAL	*COOK D
[illegible]	[illegible]	[illegible]	.3877	[illegible]	.4022	2.1965	.0025
[illegible]	[illegible]	[illegible]	.3752	[illegible]	.3303	.7350	.0003
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-1.3655	4.5737	.1175
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.5670	2.1965	.0115
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-.2109	2.1965	.0007
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-1.1605	4.5737	.0410
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.1525	1.1750	.0002
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.1575	1.1750	.0002
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.7594	1.1750	.0045
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-.1575	.3350	.0001
[illegible]	[illegible]	[illegible]	-1.2076	[illegible]	-1.2659	2.1965	.0255
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.7050	2.1965	.0455
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-.5033	2.1965	.0117
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-.0193	2.1965	.0000
[illegible]	[illegible]	[illegible]	.1727	[illegible]	.1737	.3350	.0001
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-.2109	2.1965	.0007
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-.6330	1.1750	.0074
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-.0317	4.5737	.0001
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-2.3285	1.1750	.0455
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.2110	4.5737	.0479
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.3595	1.1750	.0096
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-.4200	4.5737	.0076
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.7594	1.1750	.0048
SEQNUM	Y0	*PRED	*RESID	*SDRESID	*DRESID	*MAHAL	*COOK D

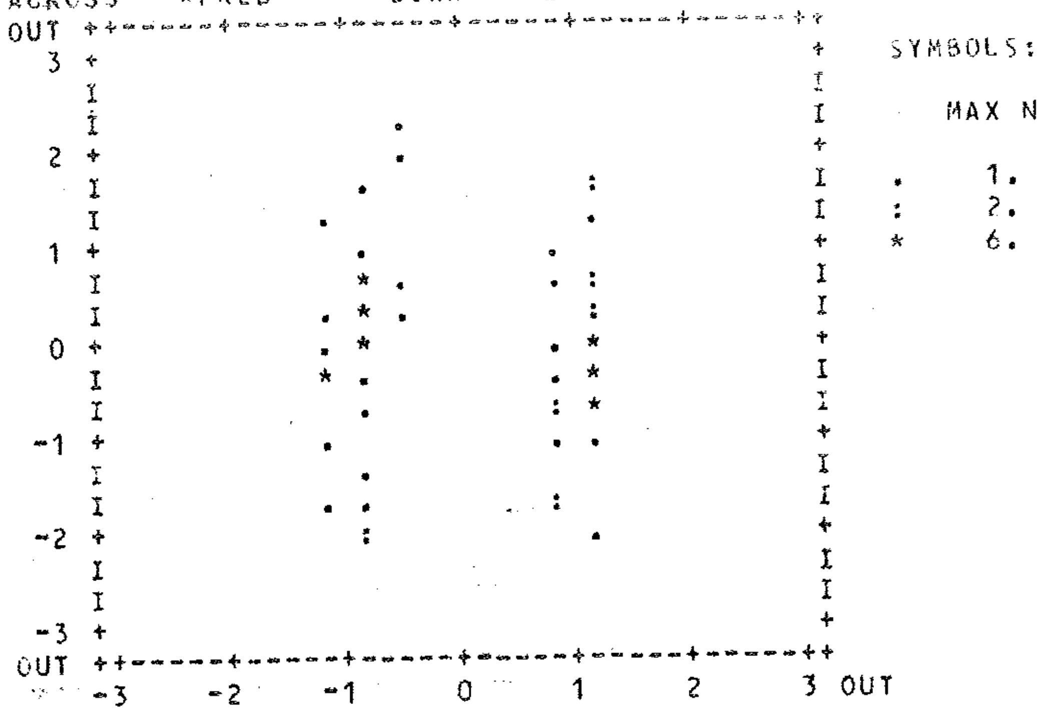
Notations :

DRESID : DELETED RESIDUAL (PREDICTED RESIDUAL, See COOK and WEISBERG, 1982 P.33)

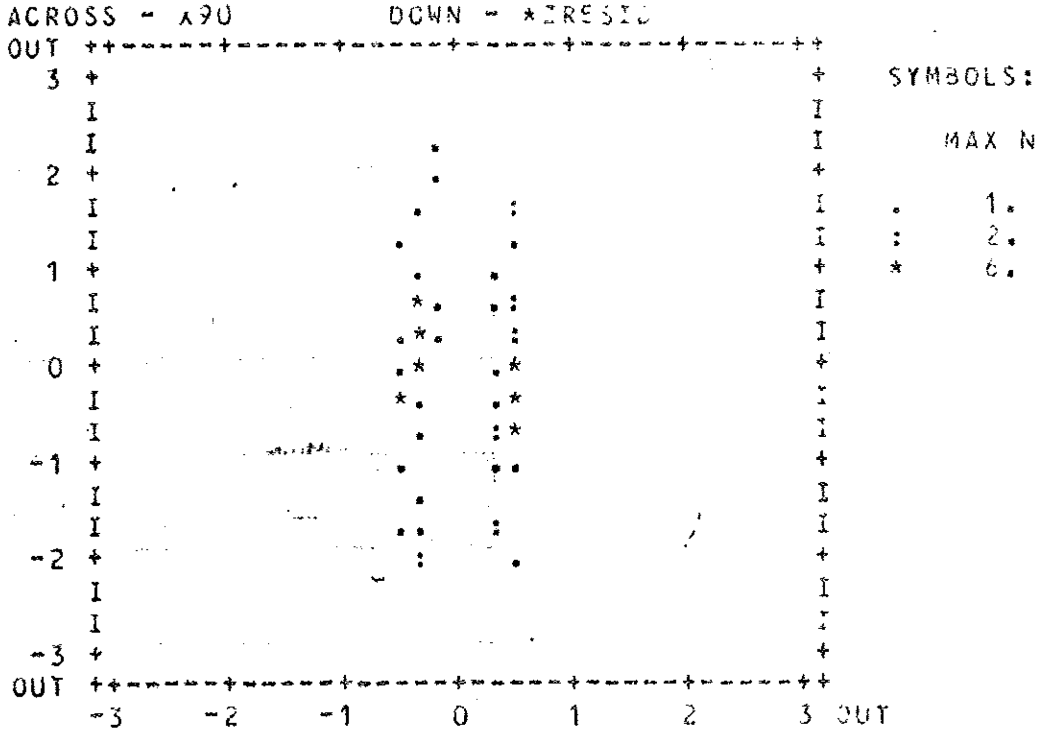
$Y_0 = Y / S_1$

$X_{90} = X_9 / S_1$

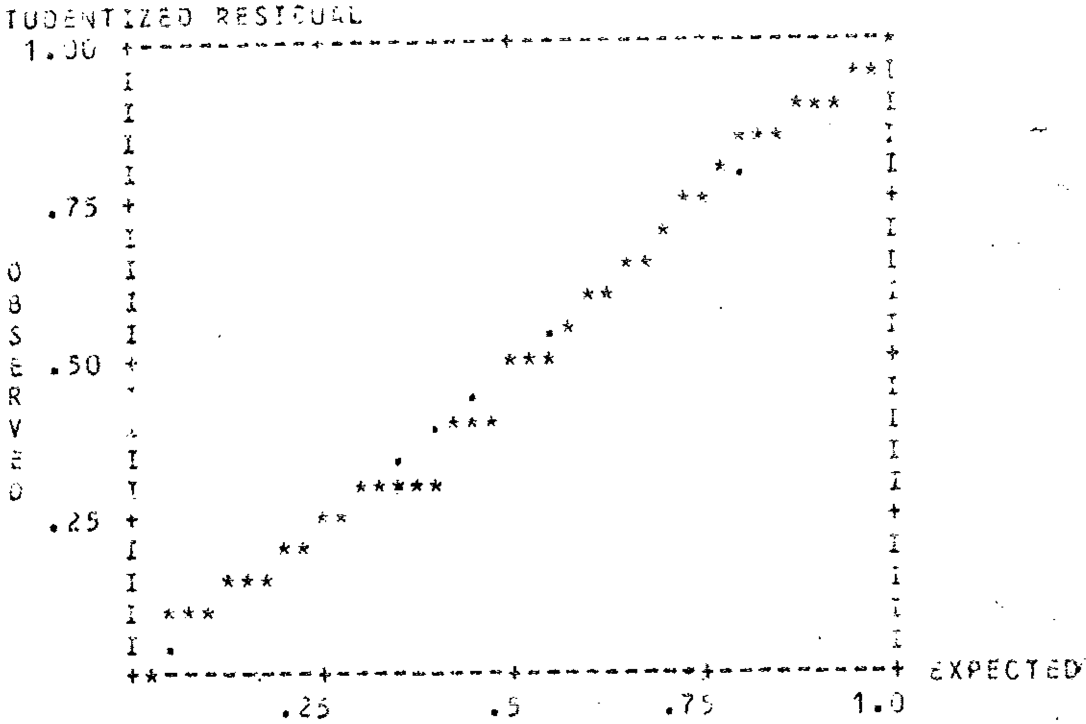
STANDARDIZED SCATTERPLOT
ACROSS - *PRED DOWN - *ZRESID



STANDARDIZED SCATTERPLOT
ACROSS - A90 DOWN - *ZRESID



NORMAL PROBABILITY (P-P) PLOT
STUDENTIZED RESIDUAL



APPENDIX E DIAGNOSTIC STATISTICS AND PLOTS : Model in (2a)

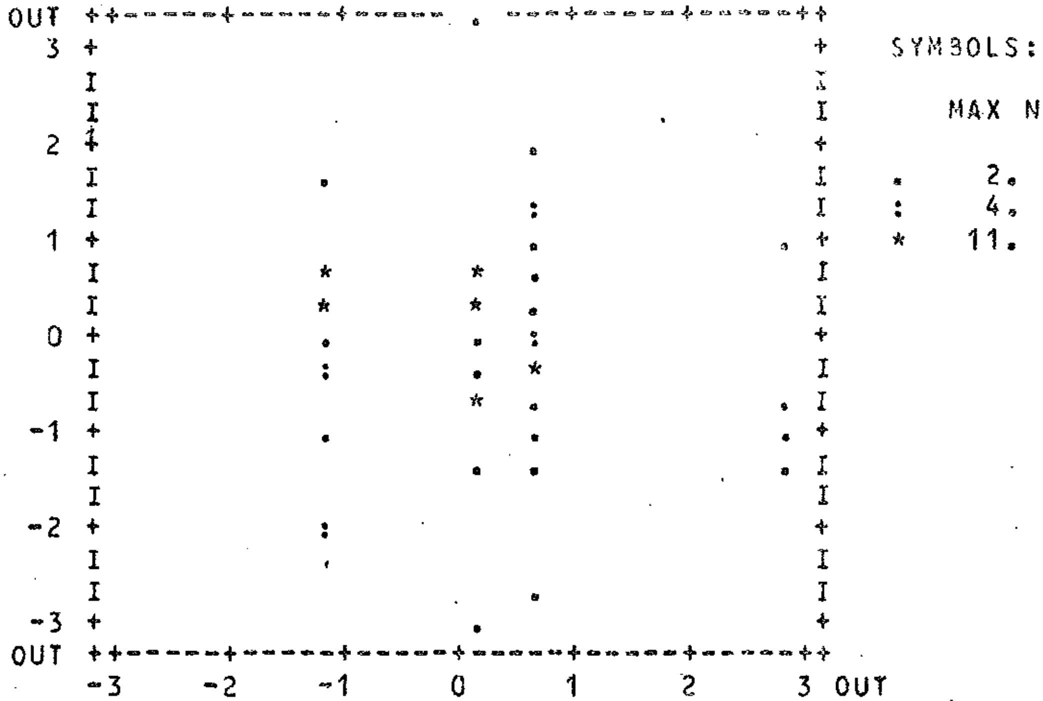
SEQNUM	YO	*PRED	*RESID	*ZRESID	*DRESID	*MAHAL	*COOK D
1	5.3586	4.2010	1.1577	1.1676	1.1815	1.6311	.0143
2	4.3552	4.2010	.1542	.1555	.1574	1.6311	.0003
3	5.6798	4.2010	1.4788	1.4914	1.5092	1.6311	.0233
4	2.3218	3.7302	-1.4085	-1.4205	-1.4295	1.1888	.0153
5	3.9688	3.7302	.2386	.2406	.2421	1.1888	.0004
6	2.8750	2.6180	.2570	.2592	.2634	1.9479	.0008
7	3.1421	2.6180	.5241	.5286	.5370	1.9479	.0035
8	.7739	3.7302	-2.9563	-2.9815	-3.0004	1.1888	.0672
9	4.3675	2.6180	1.7495	1.7644	1.7926	1.9479	.0395
10	3.5322	3.7302	-.1980	-.1997	-.2010	1.1888	.0003
11	2.1837	2.6180	-.4342	-.4379	-.4449	1.9479	.0024
12	3.8935	4.2010	-.3074	-.3100	-.3137	1.6311	.0010
13	4.0879	3.7302	.3576	.3607	.3630	1.1888	.0010
14	2.6079	2.6180	-.0100	-.0101	-.0103	1.9479	.0000
15	3.9688	3.7302	.2386	.2406	.2421	1.1888	.0004
16	4.4054	3.7302	.6751	.6809	.6852	1.1888	.0035
17	3.1421	2.6180	.5241	.5286	.5370	1.9479	.0035
18	2.5901	4.2010	-1.3109	-1.3221	-1.3376	1.6311	.0183
19	3.1421	2.6180	.5241	.5286	.5370	1.9479	.0035
20	3.1949	3.7302	-.5354	-.5399	-.5433	1.1888	.0022
21	1.6658	4.2010	-2.5352	-2.5566	-2.5873	1.6311	.0686
22	4.3062	3.7302	.5759	.5808	.5845	1.1888	.0025
23	4.4054	3.7302	.6751	.6809	.6852	1.1888	.0035
24	7.1684	6.3350	.8334	.8405	.9284	8.2849	.0448
25	2.3566	2.6180	-.2614	-.2636	-.2679	1.9479	.0009
26	4.1344	4.2010	-.0666	-.0671	-.0679	1.6311	.0000
27	3.0957	3.7302	-.6346	-.6400	-.6440	1.1888	.0031
28	4.0879	3.7302	.3576	.3607	.3630	1.1888	.0010
29	5.0261	6.3350	-1.3089	-1.3200	-1.4580	8.2849	.1106
30	3.9688	3.7302	.2386	.2406	.2421	1.1888	.0004
31	3.8935	4.2010	-.3074	-.3100	-.3137	1.6311	.0010
32	.6127	2.6180	-2.0053	-2.0224	-2.0547	1.9479	.0516
33	3.0475	2.6180	.4296	.4335	.4404	1.9479	.0024
34	2.8750	2.6180	.2570	.2592	.2634	1.9479	.0008
35	3.1421	2.6180	.5241	.5286	.5370	1.9479	.0035
36	3.9688	3.7302	.2386	.2406	.2421	1.1888	.0004
37	3.3517	4.2010	-.8493	-.8565	-.8665	1.6311	.0077
38	5.6578	6.3350	-.6772	-.6829	-.7543	8.2849	.0296
SEQNUM	YO	*PRED	*RESID	*ZRESID	*DRESID	*MAHAL	*COOK D

<u>Notation</u> : $Y_0 = Y/S_0$, $X_{90} = X_9/S_0$

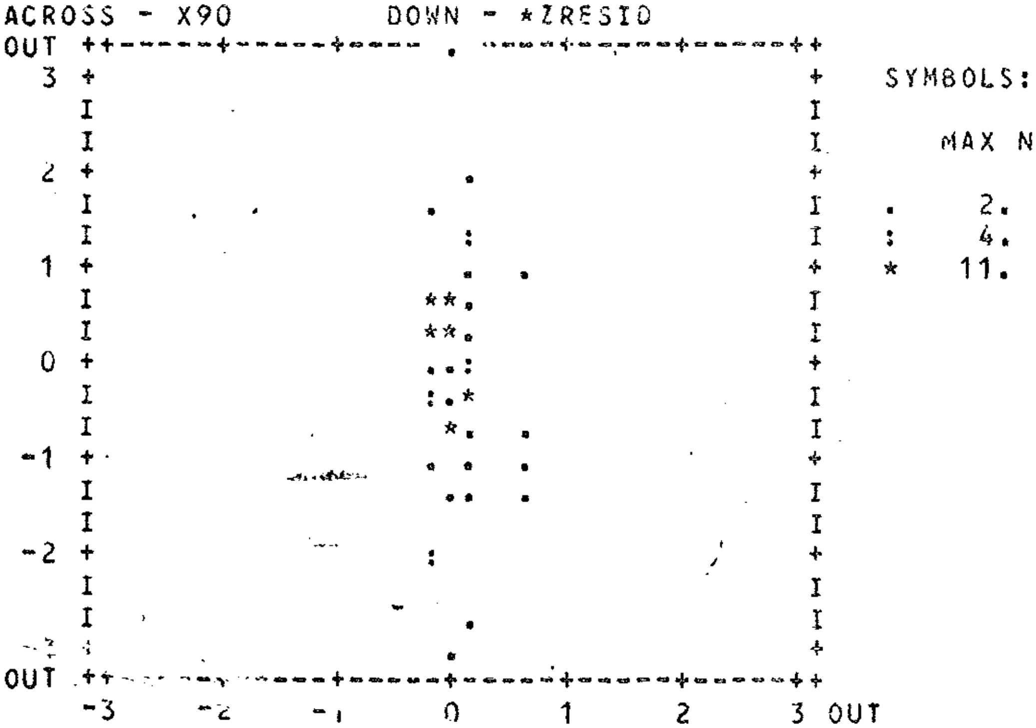
SEQNUM	YO	*PRED	*RESID	*IRESID	*DRESID	*MAHAL	*COOK D
39	4.4054	3.7302	.6751	.6809	.6852	1.1888	.0035
40	2.7965	2.6180	.1785	.1800	.1829	1.9479	.0004
41	3.1421	2.6180	.5241	.5286	.5370	1.9479	.0035
42	3.9688	3.7302	.2386	.2406	.2421	1.1888	.0004
43	3.9688	3.7302	.2386	.2406	.2421	1.1888	.0004
44	3.9688	3.7302	.2386	.2406	.2421	1.1888	.0004
45	3.6315	3.7302	-.0986	-.0995	-.1003	1.1888	.0001
46	3.5322	3.7302	-.1980	-.1997	-.2016	1.1888	.0003
47	3.1949	3.7302	-.5354	-.5399	-.5433	1.1888	.0022
48	3.0957	3.7302	-.6346	-.6400	-.6440	1.1888	.0031
49	4.0140	4.2010	-.1870	-.1886	-.1908	1.6311	.0004
50	3.0957	3.7302	-.6346	-.6400	-.6440	1.1888	.0031
51	3.1421	2.6180	.5241	.5286	.5370	1.9479	.0035
52	3.5724	4.2010	-.6286	-.6339	-.6414	1.6311	.0042
53	5.3587	4.2010	1.1577	1.1676	1.1815	1.6311	.0143
54	3.9688	3.7302	.2386	.2406	.2421	1.1888	.0004
55	2.7965	2.6180	.1785	.1800	.1829	1.9479	.0004
56	4.0140	4.2010	-.1870	-.1886	-.1908	1.6311	.0004
57	3.1421	2.6180	.5241	.5286	.5370	1.9479	.0035
58	.5185	2.6180	-2.0995	-2.1174	-2.1513	1.9479	.0566
59	5.0175	4.2010	.8165	.8235	.8333	1.6311	.0071
60	4.0140	4.2010	-.1870	-.1886	-.1908	1.6311	.0004
61	3.3517	4.2010	-.8493	-.8565	-.8666	1.6311	.0077
62	.6127	2.6180	-2.0053	-2.0224	-2.0547	1.9479	.0516
63	5.4930	6.3350	-.8420	-.8491	-.9379	8.2649	.0458
64	3.1421	2.6180	.5241	.5286	.5370	1.9479	.0035
65	4.2347	4.2010	.0336	.0341	.0345	1.6311	.0000
66	5.1379	4.2010	.9369	.9449	.9562	1.6311	.0094
67	4.4054	3.7302	.6751	.6809	.6852	1.1888	.0035
68	.6127	2.6180	-2.0053	-2.0224	-2.0547	1.9479	.0516
69	4.3062	3.7302	.5759	.5808	.5845	1.1888	.0025
70	3.2363	2.6180	.6184	.6236	.6336	1.9479	.0049
71	4.4555	4.2010	.2545	.2567	.2598	1.6311	.0007
72	3.1421	2.6180	.5241	.5286	.5370	1.9479	.0035
73	4.8970	4.2010	.6961	.7020	.7104	1.6311	.0052
74	2.2623	2.6180	-.3557	-.3587	-.3644	1.9479	.0016
75	6.9454	3.7302	3.2152	3.2426	3.2631	1.1888	.0795
76	3.4092	2.6180	.7912	.7979	.8107	1.9479	.0080
77	1.5710	2.6180	-1.0469	-1.0559	-1.0727	1.9479	.0141
78	7.1684	6.3350	.8334	.8405	.9284	8.2649	.0446
79	4.4555	4.2010	.2545	.2567	.2598	1.6311	.0007
80	6.1414	4.2010	1.9404	1.9569	1.9803	1.6311	.0402
81	[illegible]	2.6180	-1.1412	-1.1509	-1.1693	1.9479	.0167

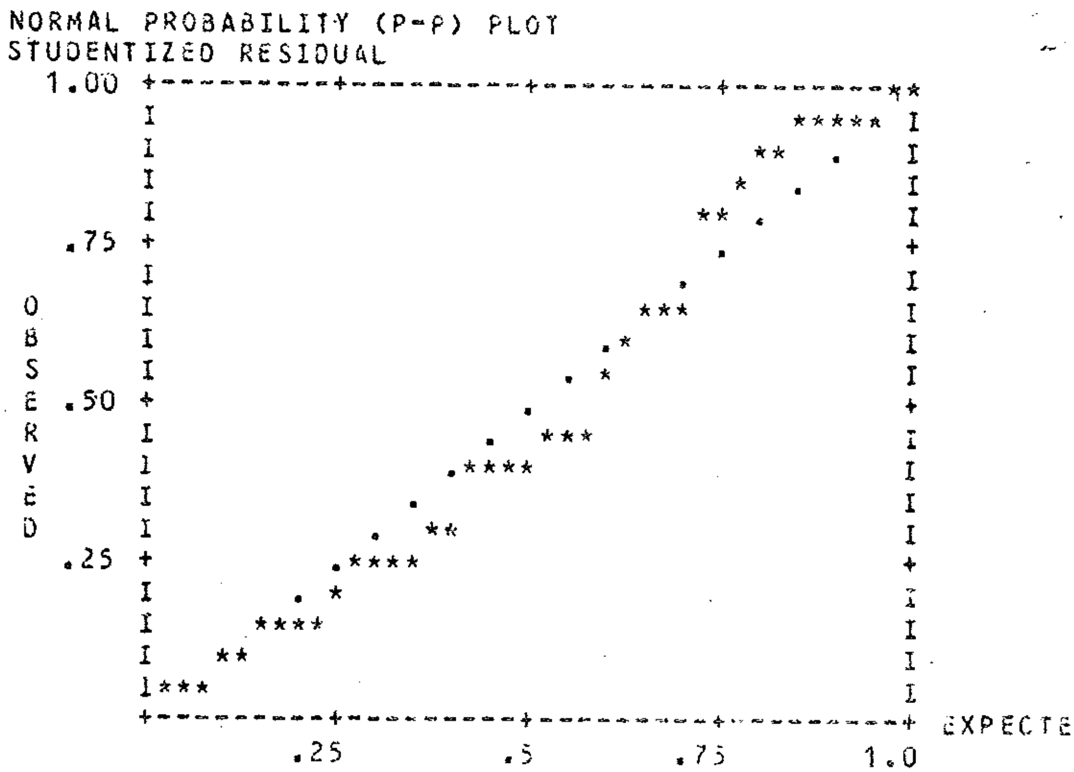
*IRESID *DRESID *MAHAL *COOK D

STANDARDIZED SCATTERPLOT
ACROSS - *PRED DOWN - *ZRESID



STANDARDIZED SCATTERPLOT
ACROSS - X90 DOWN - *ZRESID




NORMAL PROBABILITY (P-P) PLOT
STUDENTIZED RESIDUAL
1.00
.75
.50
.25
OBSERVED
.25
.5
.75
1.0
EXPECTE

APPENDIX F : DIAGNOSTIC STATISTICS AND PLOTS : Model in (3)

SEQNUM	YOD	*PRED	*RESID	*ZRESID	*DRESID	*MAHAL	*COOK D
1	.8596	3.4237	-2.5641	-2.4957	-2.5802	.9287	.0206
2	4.5943	3.4237	1.1706	1.1397	1.1783	.9287	.0043
3	3.7340	3.4237	.3103	.3021	.3123	.9287	.0003
4	3.0629	3.4237	-.3608	-.3513	-.3632	.9287	.0004
5	4.8697	3.4237	1.4459	1.4077	1.4555	.9287	.0066
6	1.2825	2.8383	-1.5558	-1.5147	-1.5743	1.6695	.0133
7	2.7386	4.3489	-1.6103	-1.5678	-1.6270	1.4602	.0129
8	4.6813	4.3489	.3325	.3237	.3359	1.4602	.0005
9	3.0089	2.8383	.1706	.1661	.1726	1.6695	.0002
10	3.2884	2.8383	.4501	.4382	.4555	1.6695	.0012
11	2.8280	2.8383	-.0103	-.0100	-.0104	1.6695	.0000
12	3.2884	2.8383	.4501	.4382	.4555	1.6695	.0012
13	.9129	4.3489	-3.4360	-3.3453	-3.4717	1.4602	.0587
14	5.5170	6.1037	-.5867	-.5244	-.8867	6.4066	.0166
15	4.5709	2.8383	1.7326	1.6866	1.7532	1.6695	.0171
16	4.1864	4.3489	-.1625	-.1582	-.1644	1.4602	.0002
17	2.2854	2.8383	-.5529	-.5382	-.5594	1.6695	.0017
18	3.3582	3.4237	-.0655	-.0637	-.0661	.9287	.0000
19	5.1963	4.3489	.8474	.8250	.8562	1.4602	.0036
20	4.8218	4.3489	.4729	.4604	.4778	1.4602	.0011
21	5.4547	3.4237	2.0310	1.9773	2.0444	.9287	.0130
22	4.5709	2.8383	1.7326	1.6866	1.7532	1.6695	.0171
23	2.7458	2.8383	-.0925	-.0900	-.0936	1.6695	.0000
24	4.6813	4.3489	.3325	.3237	.3359	1.4602	.0005
25	5.1963	4.3489	.8474	.8250	.8562	1.4602	.0036
26	4.2834	4.3489	-.0655	-.0637	-.0661	1.4602	.0000
27	3.2884	2.8383	.4501	.4382	.4555	1.6695	.0012
28	2.4778	3.4237	-.9459	-.9209	-.9521	.9287	.0028
29	5.4313	6.1037	-.6724	-.6546	-.7042	6.4066	.0106
30	3.2884	2.8383	.4501	.4382	.4555	1.6695	.0012
31	3.7885	4.3489	-.5604	-.5456	-.5664	1.4602	.0017
32	.9207	2.8383	-1.9175	-1.8669	-1.9403	1.6695	.0210
33	1.4282	3.4237	-1.9955	-1.9428	-2.0087	.9287	.0125
34	3.9089	4.3489	-.4400	-.4283	-.4445	1.4602	.0010
35	5.2151	3.0723	2.1428	2.0862	2.2167	4.7327	.0776
36	5.4538	4.3489	1.1049	1.0757	1.1164	1.4602	.0061
37	5.0792	4.3489	.7304	.7111	.7380	1.4602	.0027
38	5.1963	4.3489	.8474	.8250	.8562	1.4602	.0036
SEQNUM	YOD	*PRED	*RESID	*ZRESID	*DRESID	*MAHAL	*COOK D

SEQNUM	YOO	*PRED	*RESID	*ZRESID	*DRESID	*MAHAL	*COOK D
39	3.5074	2.8383	.7296	.7104	.7365	1.6695	.0030
40	7.5832	6.1637	1.4195	1.3820	1.4866	6.4066	.0473
41	2.4663	2.8383	-.3720	-.3621	-.3764	1.6695	.0008
42	4.5439	4.3489	.1920	.1869	.1940	1.4602	.0002
43	3.5447	3.4237	.1210	.1176	.1216	.9287	.0000
44	3.6514	4.3489	-.6974	-.6790	-.7047	1.4602	.0024
45	5.7229	3.9722	1.8507	1.8018	1.9145	4.7327	.0579
46	4.8215	4.3489	.4729	.4604	.4776	1.4602	.0011
47	2.7704	3.4237	-.6533	-.6361	-.6577	.9287	.0013
48	4.2834	4.3489	-.0655	-.0637	-.0661	1.4602	.0000
49	5.3170	6.1637	-.8467	-.8244	-.8867	6.4066	.0168
50	2.9960	4.3489	-1.3528	-1.3171	-1.3669	1.4602	.0091
51	4.6813	4.3489	.3325	.3237	.3359	1.4602	.0005
52	4.0118	2.8383	1.1736	1.1426	1.1875	1.6695	.0079
53	3.3382	3.4237	-.0855	-.0833	-.0861	.9287	.0000
54	2.0132	3.4237	-1.4105	-1.3732	-1.4196	.9287	.0062
55	.6412	2.8383	-2.1970	-2.1390	-2.2232	1.6695	.0275
56	3.1897	2.8383	.3515	.3422	.3557	1.6695	.0007
57	3.0089	2.8383	.1706	.1661	.1726	1.6695	.0002
58	3.2884	2.8383	.4501	.4382	.4555	1.6695	.0012
59	2.9267	2.8383	.0884	.0861	.0895	1.6695	.0000
60	3.2884	2.8383	.4501	.4382	.4555	1.6695	.0012
61	3.3870	2.8383	.5488	.5343	.5553	1.6695	.0017
62	4.6813	4.3489	.3325	.3237	.3359	1.4602	.0005
63	2.8736	3.4237	-.5501	-.5356	-.5537	.9287	.0010
64	5.9852	6.1637	-.1785	-.1737	-.1869	6.4066	.0007
65	4.6813	4.3489	.3325	.3237	.3359	1.4602	.0005
66	5.1963	4.3489	.8474	.8250	.8562	1.4602	.0036
67	2.9267	2.8383	.0884	.0861	.0895	1.6695	.0000
68	3.2884	2.8383	.4501	.4382	.4555	1.6695	.0012
69	3.4693	2.8383	.6310	.6143	.6385	1.6695	.0023
70	2.6472	2.8383	-.1911	-.1861	-.1934	1.6695	.0002
71	4.6813	4.3489	.3325	.3237	.3359	1.4602	.0005
72	4.6813	4.3489	.3325	.3237	.3359	1.4602	.0005
73	4.6813	4.3489	.3325	.3237	.3359	1.4602	.0005
74	5.1717	6.1637	-.9920	-.9656	-1.0389	6.4066	.0231
75	4.2834	4.3489	-.0655	-.0637	-.0661	1.4602	.0000
76	4.1664	4.3489	-.1825	-.1777	-.1844	1.4602	.0002
77	3.7685	4.3489	-.5804	-.5651	-.5864	1.4602	.0017
78	3.6514	4.3489	-.6974	-.6790	-.7047	1.4602	.0024
79	3.4415	3.4237	.0177	.0173	.0179	.9287	.0000
80	3.7685	4.3489	-.5804	-.5651	-.5864	1.4602	.0017
SEQNUM	YOO	*PRED	*RESID	*ZRESID	*DRESID	*MAHAL	*COOK D

SEQNUM	YCO	*PRED	*RESID	*ZRESID	*DRESID	*MAHAL	*COOK D
81	4.1934	3.8723	.3211	.3126	.3322	4.7327	.001
82	3.6514	4.3489	-.6974	-.6790	-.7047	1.4602	.0024
83	4.1839	6.1637	-1.9798	-1.9276	-2.0734	6.4066	.0919
84	3.2884	2.8383	.4501	.4382	.4555	1.6695	.0012
85	4.1074	3.8723	.2352	.2290	.2433	4.7327	.0009
86	3.0629	3.4237	-.3608	-.3513	-.3632	.9287	.0004
87	4.5943	3.4237	1.1706	1.1397	1.1783	.9287	.0043
88	4.6813	4.3489	.3325	.3237	.3359	1.4602	.0005
89	2.9267	2.8383	.0884	.0861	.0895	1.6695	.0000
90	3.4415	3.4237	.0177	.0173	.0179	.9287	.0000
91	3.2884	2.8383	.4501	.4382	.4555	1.6695	.0042
92	3.0089	2.8383	.1706	.1661	.1726	1.6695	.0002
93	.5426	2.8383	-2.2957	-2.2350	-2.3230	1.6695	.0301
94	4.3018	3.4237	.8781	.8549	.8839	.9287	.0024
95	3.4415	3.4237	.0177	.0173	.0179	.9287	.0000
96	2.8736	3.4237	-.5501	-.5356	-.5537	.9287	.0010
97	.6412	2.8383	-2.1970	-2.1390	-2.2232	1.6695	.0275
98	5.8109	6.1637	-.3528	-.3435	-.3695	6.4066	.0029
99	3.2884	2.8383	.4501	.4382	.4555	1.6695	.0012
100	3.6307	3.4237	.2070	.2015	.2084	.9287	.0001
101	4.1664	4.3489	-.1825	-.1777	-.1844	1.4602	.0002
102	4.4051	3.4237	.9813	.9554	.9878	.9287	.0030
103	5.1963	4.3489	.8474	.8250	.8562	1.4602	.0036
104	3.0089	2.8383	.1706	.1661	.1726	1.6695	.0002
105	3.6501	2.8383	.8118	.7904	.8215	1.6695	.0036
106	4.5409	4.3489	.1920	.1869	.1940	1.4602	.0002
107	3.8200	3.4237	.3963	.3858	.3989	.9287	.0005
108	.6412	2.8383	-2.1970	-2.1390	-2.2232	1.6695	.0275
109	4.1839	6.1637	-1.9798	-1.9276	-2.0734	6.4066	.0919
110	5.0792	4.3489	.7304	.7111	.7380	1.4602	.0027
111	4.8218	4.3489	.4729	.4604	.4778	1.4602	.0011
112	4.1664	4.3489	-.1825	-.1777	-.1844	1.4602	.0002
113	3.3870	2.8383	.5486	.5343	.5553	1.6695	.0017
114	4.8521	6.1637	-1.3116	-1.2769	-1.3736	6.4066	.0403
115	3.0089	2.8383	.1706	.1661	.1726	1.6695	.0002
116	3.0089	2.8383	.1706	.1661	.1726	1.6695	.0002
117	3.8200	3.4237	.3963	.3858	.3989	.9287	.0005
118	3.2884	2.8383	.4501	.4382	.4555	1.6695	.0012
119	4.1986	3.4237	.7749	.7544	.7800	.9287	.0019
120	3.5679	2.8383	.7296	.7104	.7383	1.6695	.0030
121	2.3676	2.8383	-.4706	-.4582	-.4762	1.6695	.0013
122	8.1923	4.3489	3.8434	3.7419	3.8834	1.4602	.0735
SEQNUM	YCO	*PRED	*RESID	*ZRESID	*DRESID	*MAHAL	*COOK D

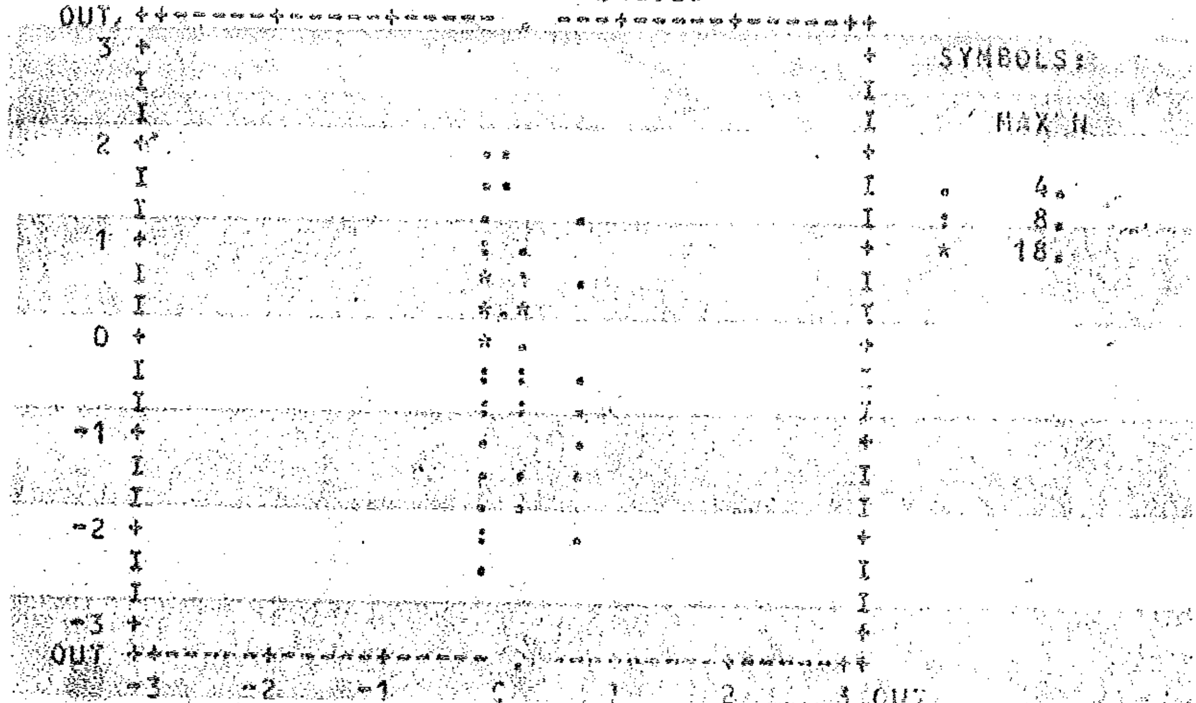
SEQNUM	Y00	*PRED	*RESID	*ZRESID	*DRESID	*MAHAL	*COOK D
123	3.0629	3.4237	-.3608	-.3513	-.3632	.9287	.0004
124	3.5679	2.8383	.7296	.7104	.7383	1.6695	.0030
125	3.5110	4.3489	-.8379	-.8157	-.8406	1.4602	.0035
126	5.3337	4.3459	.9878	.9618	.9951	1.4602	.0049
127	3.7655	4.3459	-.5804	-.5651	-.5804	1.4602	.0017
128	1.6442	2.8383	-1.1941	-1.1625	-1.2083	1.6695	.0081
129	4.2804	4.3459	-.0655	-.0637	-.0661	1.4602	.0000
130	3.5447	3.4237	.1210	.1178	.1218	.9287	.0000
131	4.1634	4.3459	-.1825	-.1777	-.1844	1.4602	.0002
132	2.2857	2.8383	-.5526	-.5382	-.5594	1.6695	.0017
133	7.5232	6.1037	1.4195	1.3820	1.4666	6.4066	.0473
134	5.7509	6.1037	-.3528	-.3435	-.3695	6.4066	.0029
135	3.8200	3.4237	.3963	.3858	.3969	.9287	.0005
136	.7237	2.8383	-2.1146	-2.0590	-2.1400	1.6695	.0255
137	6.8840	6.1037	.7803	.7597	.8172	6.4066	.0143
138	3.1076	2.8383	.2693	.2622	.2725	1.6695	.0004
139	5.2654	3.4237	1.8417	1.7931	1.8538	.9287	.0107
140	6.6220	6.1037	.5183	.5051	.5434	6.4066	.0063
141	3.5679	2.8383	.7296	.7104	.7383	1.6695	.0030
142	1.5456	2.8383	-1.2927	-1.2586	-1.3081	1.6695	.0095
SEQNUM	Y00	*PRED	*RESID	*ZRESID	*DRESID	*MAHAL	*COOK D

Notations:

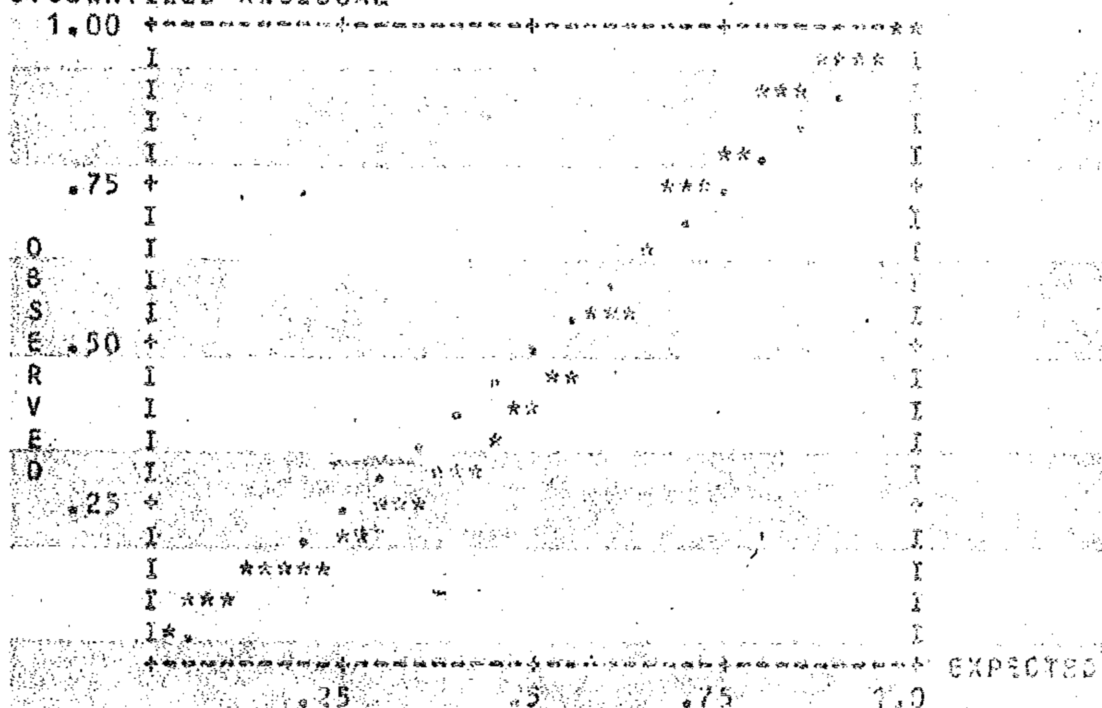
$Y00 = Y / S_p$

$X900 = X9 / S_p$

STANDARDIZED SCATTERPLOT
ACROSS - X900 DOWN - *ZRESID



NORMAL PROBABILITY (P-P) PLOT
STUDENTIZED RESIDUAL



APPENDIX G DIAGNOSTIC STATISTICS AND PLOTS Model in (4)

SEQNUM	Y[illegible]	*PRED	*RESID	*ZRESID	*DRESID	*MAHAL	*COOK D
1	.8604	3.3051	-2.4447	-2.3935	-2.4753	1.7570	.0182
2	4.5944	3.5961	.9983	.9774	1.0135	2.1355	.0037
3	3.7340	3.5961	.1379	.1350	.1400	2.1355	.0001
4	3.0629	3.3051	-.2422	-.2371	-.2452	1.7570	.0002
5	4.8697	3.5961	1.2736	1.2469	1.2931	2.1355	.0060
6	1.2826	2.8696	-1.5870	-1.5539	-1.6299	3.7201	.0167
7	2.7385	4.4021	-1.6636	-1.6287	-1.6936	2.5164	.0122
8	4.6813	4.4021	.2792	.2733	.2842	2.5164	.0003
9	3.0088	2.7484	.2604	.2550	.2684	3.1889	.0004
10	3.2884	2.8696	.4188	.4100	.4300	3.7201	.0012
11	2.8280	2.8696	-.0416	-.0407	-.0427	3.7201	.0000
12	3.2833	2.7484	.5349	.5236	.5523	3.1889	.0016
13	.9156	4.4021	-3.4865	-3.4152	-3.5522	2.5164	.0536
14	5.3170	5.8355	-.5185	-.5076	-.5599	10.5169	.0056
15	4.5708	2.7484	1.8224	1.7843	1.8643	3.1889	.0187
16	4.1665	4.4021	-.2356	-.2306	-.2400	2.5164	.0002
17	2.2854	2.7484	-.4630	-.4533	-.4737	3.1889	.0012
18	3.3383	3.5961	-.2578	-.2524	-.2616	2.1355	.0002
19	5.1963	4.2905	.9058	.8868	.9286	3.4889	.0051
20	4.8217	4.4021	.4196	.4108	.4272	2.5164	.0006
21	5.4547	3.3051	2.1496	2.1046	2.1766	1.7570	.0140
22	4.5708	2.8696	1.7012	1.6656	1.7470	3.7201	.0192
23	2.7458	2.7484	-.2640E-02	-.2585E-02	-.0027	3.1889	.0000
24	4.6813	4.4021	.2792	.2733	.2842	2.5164	.0003
25	5.1963	4.4021	.7941	.7775	.8085	2.5164	.0028
26	4.2834	4.2905	-.7071E-02	-.6923E-02	-.0072	3.4889	.0000
27	3.2833	2.7484	.5349	.5236	.5523	3.1889	.0016
28	2.4779	3.5961	-1.1182	-1.0948	-1.1355	2.1355	.0046
29	5.4913	5.8355	-.3441	-.3369	-.3717	10.5169	.0025
30	3.2833	2.7484	.5349	.5236	.5523	3.1889	.0016
31	3.7685	4.4021	-.6337	-.6204	-.6451	2.5164	.0018
32	.9207	2.8696	-1.9489	-1.9081	-2.0013	3.7201	.0251
33	1.4285	3.5961	-2.1676	-2.1225	-2.2010	2.1355	.0175
34	3.9089	4.2905	-.3816	-.3736	-.3916	3.4889	.0009
35	6.0151	3.6025	2.4126	2.3621	2.5502	7.6620	.0841
36	5.4538	4.2905	1.1633	1.1389	1.1926	3.4889	.0084
37	5.0792	4.4021	.6771	.6629	.6893	2.5164	.0020
38	5.1963	4.4021	.7941	.7775	.8085	2.5164	.0028
SEQNUM	Y[illegible]	*PRED	*RESID	*ZRESID	*DRESID	*MAHAL	*COOK D

SEQNUM	Y00	*PRED	*RESID	*ZRESID	*DRESID	*MAHAL	*COOK D
39	3.5679	2.8696	.6983	.6837	.7171	3.7201	.0032
40	7.5832	6.6795	.9037	.8848	1.0233	16.5940	.0293
41	2.4663	2.7484	-.2822	-.2762	-.2886	3.1889	.0004
42	4.5409	4.2905	.2504	.2452	.2567	3.4889	.0004
43	3.5447	3.5961	-.0514	-.0503	-.0521	2.1358	.0000
44	3.6514	4.4021	-.7507	-.7350	-.7643	2.5164	.0025
45	5.7229	3.6025	2.1205	2.0741	2.2414	7.6620	.0650
46	4.8217	4.4021	.4196	.4108	.4272	2.5164	.0006
47	2.7704	3.3051	-.5347	-.5235	-.5414	1.7570	.0009
48	4.2834	4.2905	-.7071E-02	-.6923E-02	-.0072	3.4889	.0000
49	5.3170	6.6795	-1.3626	-1.3340	-1.5429	16.5940	.0667
50	2.9960	4.2905	-1.2944	-1.2673	-1.3270	3.4889	.0104
51	4.6813	4.4021	.2792	.2733	.2842	2.5164	.0003
52	4.0118	2.8696	1.1422	1.1183	1.1729	3.7201	.0086
53	3.3386	3.5961	-.2575	-.2524	-.2618	2.1358	.0002
54	2.0135	3.3051	-1.2916	-1.2646	-1.3080	1.7570	.0051
55	.6412	2.7484	-2.1072	-2.0631	-2.1556	3.1889	.0250
56	3.1897	2.7484	.4413	.4321	.4514	3.1889	.0011
57	3.0088	2.7484	.2604	.2550	.2664	3.1889	.0004
58	3.2884	2.7484	.5399	.5286	.5523	3.1889	.0016
59	2.9267	2.8696	.0570	.0558	.0586	3.7201	.0000
60	3.2884	2.8696	.4188	.4100	.4300	3.7201	.0012
61	3.3870	2.8696	.5174	.5066	.5313	3.7201	.0018
62	4.6813	4.4021	.2792	.2733	.2842	2.5164	.0003
63	2.8738	3.5961	-.7224	-.7073	-.7335	2.1358	.0019
64	5.9852	6.6795	-.6943	-.6798	-.7662	16.5940	.0173
65	4.6813	4.2905	.3908	.3827	.4007	3.4889	.0009
66	5.1962	4.4021	.7941	.7775	.8085	2.5164	.0026
67	2.9267	2.7484	.1782	.1745	.1823	3.1889	.0002
68	3.2884	2.7484	.5399	.5286	.5523	3.1889	.0016
69	3.4693	2.8696	.5996	.5871	.6156	3.7201	.0024
70	2.6472	2.8696	-.2225	-.2178	-.2285	3.7201	.0003
71	4.6813	4.4021	.2792	.2733	.2842	2.5164	.0003
72	4.6813	4.4021	.2792	.2733	.2842	2.5164	.0003
73	4.6813	4.4021	.2792	.2733	.2842	2.5164	.0003
74	5.1717	5.8355	-.6637	-.6499	-.7166	10.5169	.0091
75	4.2864	4.4021	-.1157	-.1132	-.1209	2.5164	.0001
76	4.1664	4.4021	-.2358	-.2306	-.2400	2.5164	.0002
77	3.7684	4.4021	-.6337	-.6204	-.6451	2.5164	.0018
78	3.6514	4.4021	-.7507	-.7350	-.7643	2.5164	.0025
79	3.4415	3.5961	-.1546	-.1514	-.1570	2.1358	.0001
80	3.7685	4.2905	-.5220	-.5111	-.5352	3.4889	.0017
SEQNUM	Y00	*PRED	*RESID	*ZRESID	*DRESID	*MAHAL	*COOK D

SEQNUM	YCC	*PRED	*RESID	*ZRESID	*DRESID	*MAHAL	*COOK D
81	4.1934	3.6035	.5909	.5785	.6246	7.6020	.0050
82	3.6914	4.4021	-.7507	-.7350	-.7643	2.5164	.0025
83	4.1[illegible]	5.[illegible]	-1.6516	-1.6170	-1.7337	10.5169	.0565
84	3.2[illegible]	2.7484	.5399	.5286	.5523	3.1689	.0016
85	4.1074	3.6035	.5050	.4944	.5336	7.6020	.0037
86	3.[illegible]	3.5961	-.5532	-.5320	-.5413	2.1355	.0011
87	4.[illegible]	3.5961	.9983	.9774	1.0135	2.1355	.0037
88	4.[illegible]	4.4021	.2792	.2733	.2842	2.5164	.0003
89	2.9[illegible]7	2.7484	.1782	.1745	.1823	3.1689	.0002
90	3.44[illegible]	3.5961	-.1546	-.1514	-.1570	2.1355	.0009
91	3.2[illegible]	2.7484	.5399	.5286	.5523	3.1689	.0016
92	3.[illegible]	2.6896	.1393	.1363	.1430	3.7201	.0001
93	.5[illegible]	2.7484	-2.2059	-2.1597	-2.2565	3.1689	.0274
94	4.3[illegible]	3.5961	.7058	.6910	.7165	2.1355	.0019
95	3.44[illegible]	3.5961	-.1546	-.1514	-.1570	2.1355	.0001
96	[illegible]	3.5961	-.7224	-.7073	-.7335	2.1355	.0019
97	.[illegible]	2.7484	-2.1072	-2.0631	-2.1556	3.1689	.0250
98	[illegible]	6.[illegible]	-.9838	-.9634	-.9830	10.5940	.0271
99	3.2[illegible]	2.7484	.5399	.5286	.5525	3.1689	.0016
100	3.[illegible]	3.5961	.0347	.0340	.0352	2.1355	.0000
101	4.1664	4.2905	-.1241	-.1215	-.1272	3.4689	.0001
102	4.4[illegible]1	3.5961	.8090	.7921	.8214	2.1353	.0024
103	5.1963	4.4021	.7941	.7775	.8085	2.5164	.0028
104	3.[illegible]	2.6896	.1393	.1363	.1430	3.7201	.0001
105	3.[illegible]1	2.8696	.7805	.7641	.8015	3.7201	.0040
106	4.54[illegible]	4.2905	.2504	.2452	.2567	3.4689	.0004
107	3.[illegible]	3.3051	.5150	.5042	.5214	1.7570	.0008
108	.[illegible]41[illegible]	2.7484	-2.1072	-2.0631	-2.1556	3.1689	.0250
109	4.1[illegible]	5.[illegible]	-1.6516	-1.6170	-1.7037	10.5169	.0565
110	5.0792	4.4021	.6771	.6629	.6893	2.5164	.0020
111	4.8213	4.2905	.5313	.5202	.5447	3.4689	.0017
112	4.1664	4.2905	-.1241	-.1215	-.1272	3.4689	.0001
113	3.3870	2.7484	.6386	.6252	.6535	3.1689	.0023
114	4.[illegible]521	5.[illegible]	-.9833	-.9625	-1.0620	10.5169	.0200
115	3.00[illegible]	2.8696	.1393	.1363	.1430	3.7201	.0001
116	3.0[illegible]	2.8696	.1393	.1363	.1430	3.7201	.0001
117	3.[illegible]	3.5961	.2240	.2193	.2274	2.1355	.0002
118	3.2[illegible]4	2.7484	.5399	.5286	.5523	3.1689	.0016
119	4.19[illegible]	3.5961	.6025	.5594	.6117	2.1355	.0013
120	3.[illegible]79	2.8696	.6983	.6837	.7171	3.7201	.0032
121	2.3[illegible]7	2.7484	-.3806	-.3726	-.3896	3.1689	.0008
122	[illegible].1[illegible]	4.4021	3.7902	3.7108	3.8555	2.5164	.0032
SEQNUM	YCC	*PRED	*RESID	*ZRESID	*DRESID	*MAHAL	*COOK D

SEQNUM	Y00	*PRED	*RESID	*ZRESID	*DRESID	*MAHAL	*COOK D
123	3.0629	3.3051	-.2422	-.2371	-.2452	1.7570	.0002
124	3.5679	2.7484	.8195	.8023	.8333	3.1689	.0038
125	3.5110	4.2905	-.7795	-.7632	-.7991	3.4689	.0038
126	5.3367	4.2905	1.0462	1.0243	1.0726	3.4689	.0068
127	3.7685	4.2905	-.5220	-.5111	-.5352	3.4689	.0017
128	1.6442	2.7484	-1.1042	-1.0811	-1.1290	3.1689	.0069
129	4.2834	4.2905	-.70718E-02	-.69235E-02	-.0072	3.4689	.0000
130	3.5447	3.3051	.2396	.2346	.2426	1.7570	.0002
131	4.1664	4.2905	-.1241	-.1215	-.1272	3.4689	.0001
132	2.3054	2.8696	-.5642	-.5720	-.5999	3.7201	.0023
133	7.5832	6.6795	.9037	.8848	1.0233	16.5940	.0293
134	5.8109	5.8355	-.0245	-.0240	-.0265	10.5169	.0000
135	3.8200	3.5961	.2240	.2193	.2274	2.1358	.0002
136	.7234	2.8696	-2.1462	-2.1013	-2.2039	3.7201	.0305
137	6.9440	5.8355	1.1085	1.0854	1.1973	10.5169	.0254
138	3.1075	2.8696	.2379	.2329	.2443	3.7201	.0004
139	5.2654	3.5961	1.6694	1.6344	1.6949	2.1358	.0104
140	6.6826	5.8355	.8471	.8294	.9148	10.5169	.0149
141	3.5659	2.8696	.6963	.6837	.7171	3.7201	.0032
142	1.5455	2.7484	-1.2029	-1.1777	-1.2305	3.1689	.0081
SEQNUM	Y00	*PRED	*RESID	*ZRESID	*DRESID	*MAHAL	*COOK D

```
STANDARDIZED SCATTERPLOT
ACROSS - X?00            DOWN - *ZRESID
OUT ++--------+---------+--------- . ---+---------+--------++
  3 +                                                              +    SYMBOLS:
    I                                                              I
    I                              .                               I       MAX N
  2 +                             ..                               +
    I                             .                                I    .     5.
    I                             .                                I    :    10.
  1 +                             .  .    .                        +    *    21.
    I                             *. :    .                        I
    I                             *. *                             I
  0 +                             *  :    .                        +
    I                             :  .    .                        I
    I                             .  :    .                        I
 -1 +                             .       .                        +
    I                             .  .    .                        I
    I                             .  .    .                        I
 -2 +                             :                                +
    I                             .                                I
    I                                                              I
 -3 +                                                              +
OUT ++--------+---------+--------- . ---+---------+--------++
      -3        -2        -1         0         1         2         3 OUT
```

NORMAL PROBABILITY (P-P) PLOT - STUDENTIZED RESIDUAL