1970

Performance models for equity common trust funds

Michael Lynn Grimes

The University of Montana

PERFORMANCE MODELS FOR
EQUITY COMMON TRUST FUNDS

By

Michael L. Grimes

B.S., Montana State University, 1968

Presented in partial fulfillment of
the requirements for the degree of

Master of Business Administration

University of Montana

1970

Approved by:

Chairman, Board of Examiners

Dean, Graduate School

Date July 2, 1970

7-7-76

TABLE OF CONTENTS

LIST OF TABLES

LIST OF ILLUSTRATIONS

CHAPTER I

INTRODUCTION

The primary objectives of this study are: (1) to examine methods of measuring historical performance and risk of Equity Common Trust Funds, (2) to develop an analytical model for performance prediction, and, (3) to develop a simulation technique to test the predictive model.

Equity Common Trust Funds were chosen for this analysis for several reasons: (1) Due to the fiduciary relationship which exists between the investor and the managers of these funds, it is essential that the prospective investor have some method to compare the alternative funds available to him. This, of course, implies a measure of the management performance that has been exercised, and that can be expected in the future. (2) Just as the investor must compare the performance of these funds, the managers of the funds must objectively and critically analyze the performance of their fund in an attempt to improve performance. (3) Although Equity Common Trust Funds have been experiencing sizeable growth in the past few years, very little analysis has been done of these funds. Therefore, it becomes increasingly important that a study such as this be undertaken.[1]

DEFINITIONS

At this point, it becomes necessary to define certain terminology that will be used throughout this paper; most technical terms, however, will be defined as they occur.

1. Analyst

   This term will be used to refer to both a prospective investor and a manager of a specific fund.

2. Common Trust Fund

   A common trust fund is a fund maintained by a bank or a trust company exclusively for the collective investment and reinvestment of money contributed to the fund by the bank or trust company in its capacity as trustee, executor, administrator, or guardian . . .[2]

3. Equity Common Trust Fund

   These are pooled investment funds, the assets of which are composed almost entirely of common stocks. Also referred to as Common Stock Common Trust Funds.

---

[1]It should, however, be noted at this point that the analytical models used and developed in this paper should also apply elsewhere.

[2]Trust Division, American Bankers Association, Common Trust Funds (New York: Trust Division, American Bankers Association, 1956), p. 12.

4. Performance

   In this paper, performance refers to investment performance, i.e., unit value appreciation, income yield, and a combination of the two.

5. Risk

   In this paper, the term risk refers to the deviations or fluctuations associated with the measures of performance.

6. Unit Value

   . . . units, at the time of the establishment of the [particular] fund, will have an initial valuation placed on them, but thereafter they will always be worth an amount determinable by dividing the total (market) value of the fund by the number of units currently outstanding.[3]

DESIGN OF PROJECT

This paper is composed of four basic sections. In the first section (Chapter II), the method used for collection of data is analyzed. The reasons for use of a random sample are pointed out, and the manner in which this sampling process was carried out is described. Also, the particular parameters of interest are outlined and the reliability and precision of the estimates of these parameters are developed.

---

[3]Trust Division, American Bankers Association, Common Trust Funds (New York: Trust Division, American Bankers Association, 1956), p. 36.

The second section of the paper (Chapter III) is the development of a historical performance model. This model was designed to be of general use in analyzing the performance of any fund for which quarterly information is available. A computer program was written in BASIC[4] language to perform the calculations of the various performance measures and the associated risk measures.

Section three (Chapter IV) is devoted to the development of a performance prediction model. A multiple linear regression model is developed for one of the funds. This chapter is designed to serve as an example of how a predictive model can be developed for a particular Common Stock Common Trust Fund. In Chapter V, the fourth section of the paper, the author develops what he feels to be a new method for analyzing a multiple regression model. An analyst that uses these two models in conjunction with one another should be able to design an effective predictive model for his specific needs. It should be noted that Chapters IV and V are primarily devoted to development of the models rather than application of the models.

[4]BASIC - Beginners All purpose Symbolic Instruction Code.

CHAPTER II

ANALYSIS OF SAMPLE

The data to be analyzed in the first sections of this paper were gathered by a random sample survey of banks in the United States. The sampling frame (N) consisted of all banks in 1964 that had Equity Common Trust Funds (N = 216) according to a list provided by the Comptroller of Currency. A more recent list was not employed because many new funds would have been included that would have been in existence for only a few years.

A simple random sample was employed rather than some other sampling method for several reasons: (1) The sampling population was not large, and the samples were sent by mail; therefore, random sampling was feasible from a cost standpoint. (2) The population did not appear to be composed of identifiable homogeneous subgroups; therefore, stratification would have been fruitless. (3) Because the sampling frame was arranged in alphabetical order by states, there was a possibility of periodicity; hence, systematic sampling was not employed.

A previous sample taken by Dr. Edward K. Gill in 1968 provided an estimate of the population standard deviation associated with the average performance figures desired.[5] The largest standard deviation (associated with total average annual rate of return) was used to compute the necessary sample size (n) by the following formula:

$$n = \frac{(zC)^2}{(d')^2}$$

where: n - Necessary sample size

z - Reliability

C - Coefficient of variation or the square root of the relative variance

d' - Relative precision

The coefficient of variation of the total average annual rate of return was approximately 14 per cent. Therefore, with a desired relative precision of ± 5 per cent and 95 per cent reliability ($z = 1.96$), the required sample size would be $n = 30$. However, due to expected nonresponse, the sample size was increased to $n = 45$.[6]

COLLECTION OF DATA

The sample information was requested by a personalized letter to the Chief Investment Officer of each of the randomly drawn banks. The original letter, and a later

---

[5] Edward K. Gill, "Common Trust Funds: An Evaluation of Investment Performance" (Unpublished doctoral dissertation, College of Business Administration, University of Oregon, 1968), p. 74.

[6] It should be noted that Dr. Gill's sample was a nonprobability judgment sample.

nonresponse letter, refer to David C. Stegner's proposed professional paper, "The Evaluation of Growth in Equity Common Trust Funds." It was feared that the connotations associated with the mention of investment performance would tend to increase nonresponse, thus this paper was not mentioned. The nonresponse letter was a personalized letter signed by Dr. Edward K. Gill. It was presumed that Dr. Gill's personal letter would increase response. The two letters appear in Appendix I.

The initial sample resulted in a response of approximately 58 per cent (n = 26), and the second sample for nonrespondents increased this figure to approximately 69 per cent (n = 31); however, it was later discovered that only 19 of the initial respondents and 4 of the nonrespondents could be used. This occurred due to the lack of uniformity in the method used to calculate income yields and failure to report income yields as a dollar figure. The funds will be referred to by a number that was assigned as the information was received (funds 20 - 23 represent the nonresponse group).

PARAMETERS OF INTEREST

This section is a development of the reliability and precision associated with the various performance measures.[7]

---

[7]Taken from performance calculations in Appendix III.

A description of these measures and how they were calculated is deferred to Chapter III.

Let: Desired precision be ¼ of one percentage point

n - Actual sample size (19 initial, 4 non-response)

$n' = 45 - 8$[8] $= 37$

$n' = n_1 + n_2$

where n_1 - Initial response group (19)

n_2 - Nonresponse group (18)

r - Actual nonresponse sample size (4)

1. Average Last Year Unit Value Growth ($\hat{\bar{U}}$)[9]

$$\hat{\bar{U}} = \frac{n_1\bar{U}_1 + n_2\bar{U}_2}{n'}$$

where:

$$\bar{U}_1 = \frac{1}{n_1}\sum_{i=1}^{n_1} U_i = \underline{-1.23\%}$$

$$\bar{U}_2 = \frac{1}{r}\sum_{i=1}^{r} U_i = \underline{-2.38\%}$$

$$\therefore \hat{\bar{U}} = \underline{-1.72\%}$$

$$\hat{\sigma}^2 = \frac{1}{n-1}\sum_{i=1}^{n} (U_i - \hat{\bar{U}})^2$$

$$\hat{\sigma}^2 = \underline{5.43}, \quad \hat{\sigma} = \underline{2.33\%}$$

---

[8] Represents the unusable portion of data.

[9] Development of these formulas can be found in: William G. Cochran, Sampling Techniques (New York: John Wiley & Sons, Inc., 1967).

$\therefore$ Reliability (z) $= \frac{d\sqrt{n}}{\hat{\sigma}} = \frac{(.25)\sqrt{n}}{\hat{\sigma}} = \underline{.52}$

or 40 per cent confidence may be placed on this estimate of $\bar{U}$.

Required sample size for z = 1.96 (95 per cent)

$$n = \frac{(z\,\hat{\sigma})^2}{d^2} \simeq \underline{160}$$

2. Average Last Year Yield $(\hat{\bar{Y}})$[10]

$\bar{Y}_1 = \underline{4.00\%}$

$\bar{Y}_2 = \underline{4.99\%}$

$\therefore\ \hat{\bar{Y}} = \underline{4.48\%}$

$\hat{\sigma}^2 = \underline{1.10}$, $\hat{\sigma} = \underline{1.05\%}$

$\therefore$ Reliability (z) = $\underline{1.15}$

or 76 per cent confidence may be placed on this estimate of $\bar{Y}$.

Required sample size for z = 1.96 (95 per cent)

$n \simeq \underline{52}$

3. Average Last Year Total Return $(\hat{\bar{R}})$[11]

$\bar{R}_1 = \underline{2.76\%}$

$\bar{R}_2 = 2.61\%$

---

[10] Calculations follow the same format as those for $\bar{U}$.

[11] Ibid.

$\therefore \hat{\bar{R}} = \underline{2.69\%}$

$\hat{\sigma}^2 = \underline{5.48}, \hat{\sigma} = \underline{2.34\%}$

$\therefore$ Reliability (z) = $\underline{.51}$
or $\underline{40}$ per cent confidence may be placed on this estimate of $\bar{R}$.

Required sample size for z - 1.96 (95 per cent)

$n \approx \underline{161}$

Obviously the results of this sample are not up to expectation. The problem seems to have developed because the original estimate of the largest population variance was too small. This, then, resulted in an initial sample size that was too small to give the desired precision and reliability (confidence). It is possible, of course, to relax the required degree of precision ($\frac{1}{4}$ of one percentage point) and gain significant reliability, but the results would be so imprecise that the estimates would still not be representative of the true population parameters.

CHAPTER III

HISTORICAL PERFORMANCE MODEL

The first step in analyzing a fund or in comparing a group of funds is to analyze past performance. This chapter is devoted to the development of a model that will aid the analyst in this endeavor. The model has been incorporated in a computer program written in BASIC language. This program, named RANK 2, appears in Appendix II. Appendix III represents the historical performance figures for the 23 funds in the sample. These two appendixes will be referred to several times during the development of the historical performance model.

RISK MEASURES

Recently there have been several articles written relating certain measures of inherent portfolio risk to fund performance.[12] Many of the studies done have attempted to use some form of a model that would rank the funds in accordance with relatively good or bad performance. It is inferred, therefore, that the measures of risk are closely

---

[12]See, for example, Keith V. Smith and Dennis A. Tito, "Risk-Return Measures of ExPost Portfolio Performance" Journal of Financial and Quantitative Analysis (Seattle, Wash.: Graduate School of Business Administration, University of Washington, Dec. 1969), p. 449.

associated with the investment performance of the particular fund.

Two measures of risk have been incorporated, at several points, in RANK 2:

1. Variance (S^2)

$$S^2 = \frac{1}{n} \sum_{i=1}^{n} (Y_i - \overline{Y})^2$$

2. Semivariance ($S_m{}^2$)

$$S_m{}^2 = \frac{1}{n} \sum_{i=1}^{E(Y)} (Y_i - \overline{Y})^2$$

where E(Y) represents the expected value of Y.[13] These risk measures are computed for every performance measure in the historical performance model.

PERFORMANCE MEASURES

As stated in Chapter I, performance in this context refers to investment performance; therefore, we now require measures of investment performance. There are two basic forms of performance that require measurement: (1) appreciation or growth in the unit values, and, (2) income yield associated with each unit. A third measure, the total return, is a function of the first two. Before these

---

[13] Semivariance is a measure of only downside deviations; for a development of this measure see: Harry M. Markowitz, Portfolio Selection (New York, John Wiley and Sons, Inc., 1959), p. 188.

measures can be developed, however, certain initialization must take place.

Initializing Periods

Common Stock Common Trust funds are required, under Section 9.18 of Regulation 9 of the Comptroller of the Currency, to be revalued at least once during each three month period.[14] Investments or withdrawals from the funds can be made only on these valuation dates. Therefore, quarterly data is available for analysis for all Equity Common Trust Funds (some funds also value monthly). Unfortunately, however, uniform valuation dates are not required and this does cause some problem in comparability of the data. However, because additions to and withdrawals from the various funds must be made in accordance with the respective valuation dates, these are the only dates that should be considered. Obviously, if a particular fund consistently has a lower unit value growth than another, it must be considered the poorer of the two funds, even if the lower unit value growth is only due to the timing of the valuation dates. Therefore, differences in valuation dates will not be considered in this model.

The first step in the historical performance model is to initialize periods. The model is designed to accept

---

[14] United States, Comptroller of the Currency, Fiduciary Powers of National Banks and Collective Investment Funds, Regulation 9 as amended February 5, 1964, p. 5.

quarterly data and then to compute yearly and lifetime performance and risk figures. Therefore, the number of quarters must be evenly divisible by four so that yearly performance figures may be developed each composed of data for four quarters.[15]

Unit Value Growth

The measure used for appreciation of unit values is the geometric mean. This measure is equivalent to the compound growth rate that would appreciate the beginning value of a series to the ending value. In this model, the geometric growth rate is computed for the life of the fund and for each year in the life of the fund. The computation of the geometric mean involves finding the n^{th} root of the product of n unit values. Because this measure involves extremely large numbers, the computation was done using logarithms to avoid memory overflow as follows:

$$\text{LnGr} = \frac{\text{Ln}(1 + r_1) + \text{Ln}(1 + r_2) + \ . \ . \ . \ + \text{Ln}(1 + r_n)}{n}$$

$$\therefore \text{Gr} = (e^{\text{LnGr}})*100 = \%\ \text{growth}$$

where: r_i is the change in unit value from one period to the next.

[15]Lines 39 to 53 of RANK 2 adjust the initial periods so that the final result will be yearly performance figures ending with the most recent four-quarter period.

Income Yield

The measure used for income yield is a simple percentage based upon the initial unit value of the fund. The initial unit value was used as a base rather than the unit value each year to eliminate the advantage given to low unit value growth rates, e.g., if two funds were experiencing identical yields but varying unit value growth rates, the fund with the lowest growth rate would appear to have the better yield.[16]

---

[16]The results of these computations for the 23 funds appear in Appendix III. The lives of the funds end in the first quarter of 1970; however, the beginning periods vary with the earliest being first quarter 1960. (Note the # sign represents a % sign.)

CHAPTER IV

PERFORMANCE PREDICTION MODEL

This chapter is devoted to the development of a predictive model for one of the funds. It is designed to serve as an example of the method that should be employed by an analyst in designing a predictive model. Although there are several types of predictive models now used, this chapter will focus on a multiple linear least squares regression model.[17] The response variable (the value we are attempting to predict) will be the quarterly unit value of fund number four in the sample.[18]

SELECTION OF INDEPENDENT VARIABLES

The first step for the analyst in the development of the model is the selection of variables. "He should write down every conceivable variable and response that he considers has any possible effect on the problem."[19] As

[17]Development and explanation of the theoretical regression equation appear in Chapter V.

[18]Fund number four was selected for this example because its geometric growth rate for unit values in the most current year was very near the average growth of all funds in the sample.

[19]N. R. Draper and H. Smith, Applied Regression Analysis (New York: John Wiley and Sons, Inc., 1966), p. 237.

pointed out by Draper and Smith, this list will probably be very long; however, after initial analysis, it should be shortened considerably. For purposes of this example, five independent variables were selected initially:

X_1 - Dow-Jones Composite Index

X_2 - Standard and Poor's 500 Index

X_3 - New Residential Construction Rates

X_4 - All Commodity Wholesale Price Index

X_5 - Total Velocity of Bank Deposits

Preliminary plots proved variables X_4 and X_5 to be of little value to the predictive model, and they were excluded from further analysis. The plots also gave an indication of lead and lag periods that could be used for the specific variables, i.e., X_1 - lead one month, X_2 - lead one month, X_3 - lag three months. Although it would be preferred to have all lead variables, a lag variable can be of use if a good predictor for that variable can be found. For example, if New Residential Construction is found to be of use in the model, New Residential Construction Permits should be a very good substitute variable because building permits must be purchased in advance of actual construction. The data is shown in Table 1.

TABLE 1

INDEPENDENT AND DEPENDENT VARIABLES

Observation	Y	X_1	X_2	X_3
1	50.4	296	81	26.1
2	49.8	308	85	26.3
3	50.9	310	87	26.2
4	49.2	314	88	26.2
5	52.1	309	87	26.6
6	52.6	333	92	26.2
7	48.7	340	91	24.6
8	46.7	304	87	23.2
9	42.6	267	77	20.3
10	46.5	381	80	20.6
11	51.4	301	87	22.6
12	51.3	310	89	25.8
13	54.8	323	93	27.6
14	54.4	299	94	27.7
15	51.4	295	91	28.2
16	57.8	316	97	29.3
17	59.0	314	99	30.9
18	60.9	337	106	32.4
19	59.2	324	101	31.8
20	56.5	320	104	31.1
21	55.1	275	96	29.4
22	54.2	269	94	27.7
23	52.5	247	88	26.0

Source: <u>Trade and Securities Statistics</u> (New York: <u>Standard and Poor's Corporation</u>, May, 1970).

The second step in the development of the model is the computation of a correlation matrix for the independent and response variables.[20] This is necessary for two reasons: (1) to give an indication of the importance of the various independent variables in predicting response variables, and, (2) to show the amount of correlation that exists between the independent variables. The following correlation matrix was computed:

	Y	X_1	X_2	X_3
Y	1.000	.368	.906	.924
X_1	.368	1.000	.471	.389
X_2	.906	.471	1.000	.899
X_3	.924	.389	.899	1.000

Variables X_2 and X_3 appear to be the most important but there appears to be a high degree of correlation between the two (.899). At this point, a time series plot of the variables will be useful. Figures 1 and 2 demonstrate the movements of the response variable and the independent variables with their respective lead and lags. Analysis of these figures and the correlation matrix disclose that of the two variables X_2 and X_3, only X_3 should be used.

---

[20] Actual computations were performed by a computer program (MERG 1) taken from General Electric's program library; refer to: Regression Analysis (Bethesda, Md.: Information Service Department, Mark I Time-Sharing Service, General Electric Company, 1969), p. 35.

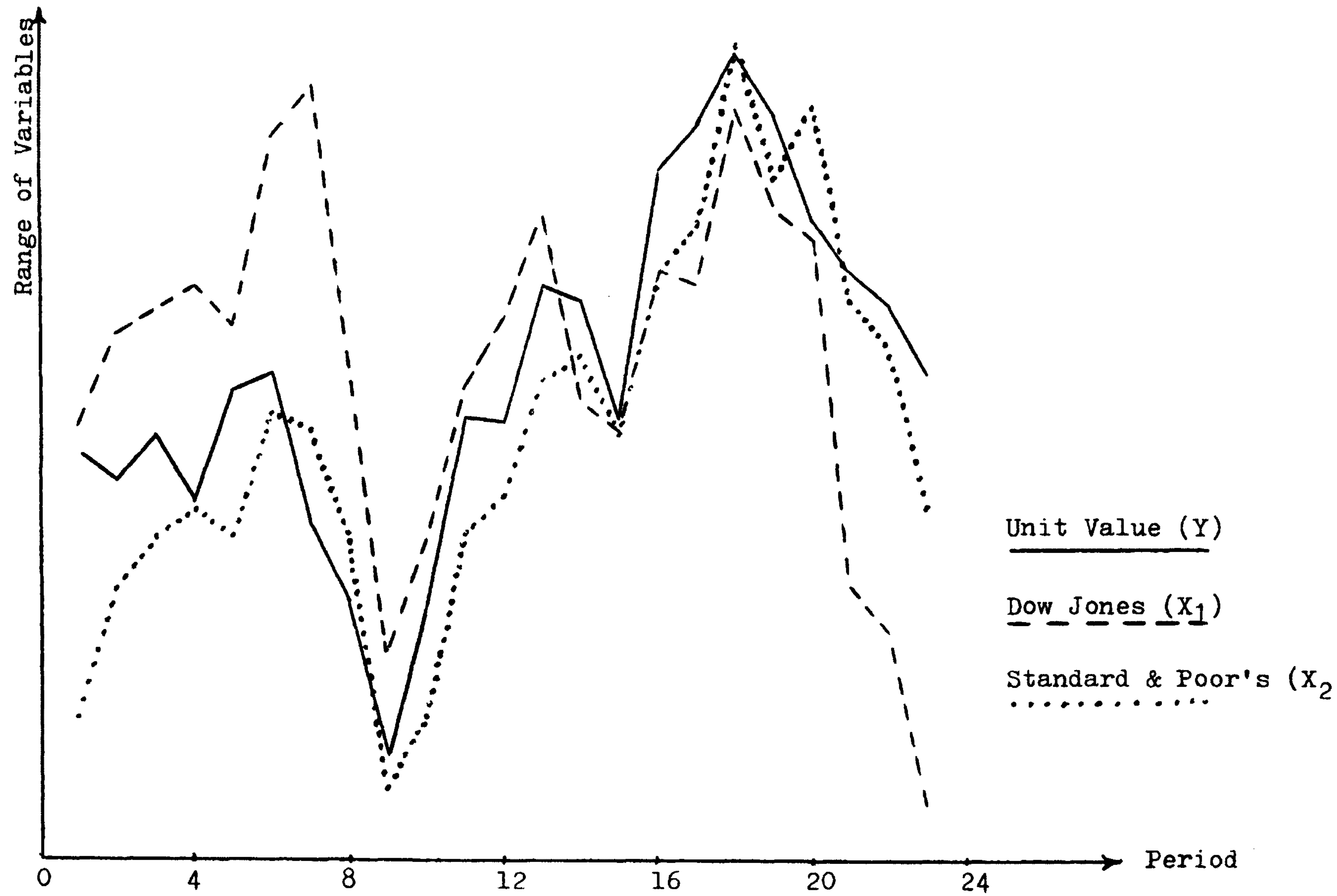

Figure 1.--Time Series - Y, X_1, X_2

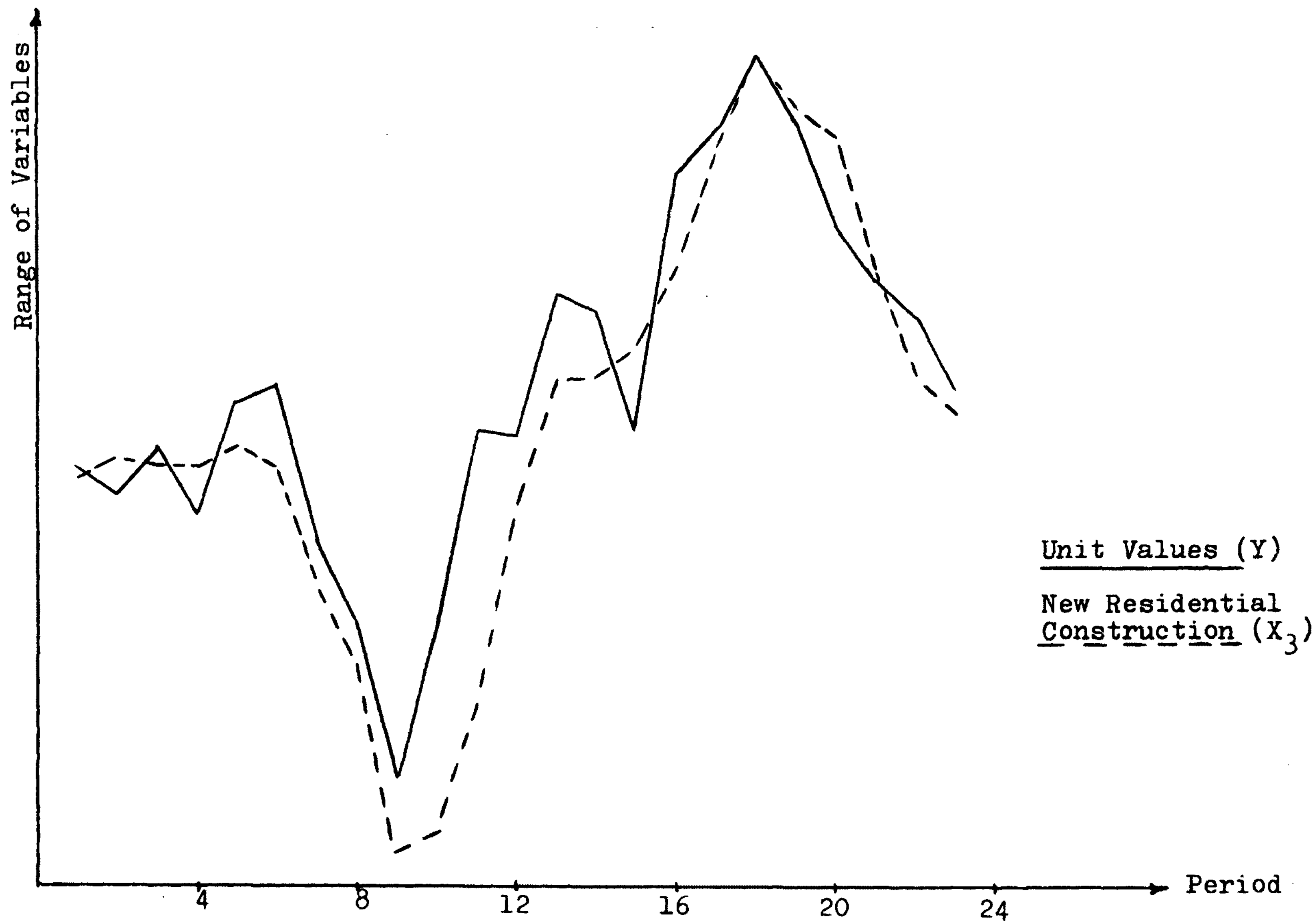

Figure 2.--Time Series - Y, X_3

We now must decide whether or not X_1 should be brought into the regression equation. To make this decision, we require results of actual regression runs, first using only X_3, then using both X_3 and X_1 as independent variables. Tables 2 and 3 show a portion of these results.

Obviously the inclusion of X_1 in the regression model has had little effect on the index of determination. Using only X_3, $R^2 = .8546$, whereas inclusion of X_3 and X_1, $R^2 = .8547$ (i.e., X_1 made only .01% change in the amount of variation explained by the model). To make the final decision concerning the value of X_1 to the model, we must examine the analysis of variance statistics.

1. For only X_3 in the model:

	Degrees of Freedom	Sum of Squares	Mean Square
Total	22	431.60	19.62
Regression	1	368.85	368.84
Residual	21	62.75	2.99

2. For both X_3 and X_1 in the model:

	Degrees of Freedom	Sum of Squares	Mean Square
Total	22	431.60	19.62
Regression	2	368.88	184.44
Residual	20	62.72	3.13

These figures show that by including X_1 in the model the precision of the model has decreased (i.e., the mean square has increased); therefore, our decision should be to exclude X_1 from the model.

TABLE 2

RESULTS OF FIRST REGRESSION RUN

Calculated	Observed	Residual
51.61	50.4	1.21
51.86	49.8	2.06
51.74	50.9	.84
51.74	49.2	2.54
52.25	52.1	.14
51.74	52.6	- .86
49.70	48.7	1.00
47.92	46.7	1.22
44.24	42.6	1.64
44.62	46.5	-1.88
47.16	51.4	-4.24
51.23	51.3	- .07
53.52	54.8	-1.28
53.64	54.4	- .75
54.28	51.4	2.88
55.67	57.8	-2.12
57.71	59.0	-1.29
59.61	60.9	-1.28
58.85	50.2	- .35
57.96	56.5	1.46
55.80	55.1	.70
53.64	54.2	- .55
51.48	52.5	-1.02

Index of determination = .8546, F-ratio = 123.436
b_0 = 18.451, b_1 = 1.270 and standard error = .1143

TABLE 3

RESULTS OF SECOND REGRESSION RUN

Calculated	Observed	Residual
51.60	50.4	1.20
51.87	49.8	2.07
51.75	50.9	.85
51.76	49.2	2.56
52.25	52.1	.15
51.79	52.6	- .81
49.78	48.7	1.08
47.94	46.7	1.24
44.21	42.6	1.51
44.61	46.5	-1.89
47.18	51.4	-4.22
51.24	51.3	- .05
53.54	54.8	-1.25
53.63	54.4	- .77
54.25	51.4	2.85
55.68	57.8	-2.11
57.70	59.0	-1.29
59.64	60.9	-1.25
58.86	59.2	- .34
57.97	56.5	1.47
55.74	55.1	.64
53.58	54.2	- .62
51.38	52.5	-1.11

Index of determination = .8547, F-ratio = 58.814
b_0 = 18.045, b_1 = .178 (X_1) and standard error = .0175,
b_2 = 1.265 (X_3) and standard error = .1272

ANALYSIS OF RESIDUALS

As will be pointed out in Chapter V, in regression analysis we assume that the residuals (or errors) "are independent, have zero mean, a constant variance, and follow a normal distribution."[21] Therefore, we now must plot the residuals to determine if these assumptions have been violated. Figure 3 is an overall plot to determine if the distribution varies significantly from normal. Figure 4 is a time sequence plot to determine long-term time effects. Figure 5, a plot against values of $\hat{Y}$, and Figure 6, a plot against values of X_3, are to determine abnormalities. Although the analysis of these residual plots is somewhat subjective, the assumptions do not appear to violated.

We now have the following regression model developed for unit values of fund number four:

$$\hat{Y} = 18.451 + 1.270\ X_3$$ [22]

where X_3 - New Residential Construction Rates (billions of dollars) lagged three months

It is rather unfortunate that our model is solely a function of a lagged variable but, as previously stated,

---

[21] N. R. Draper and H. Smith, Applied Regression Analysis, p. 86.

[22] Figure 7 is a graph of the observed and calculated values of the model.

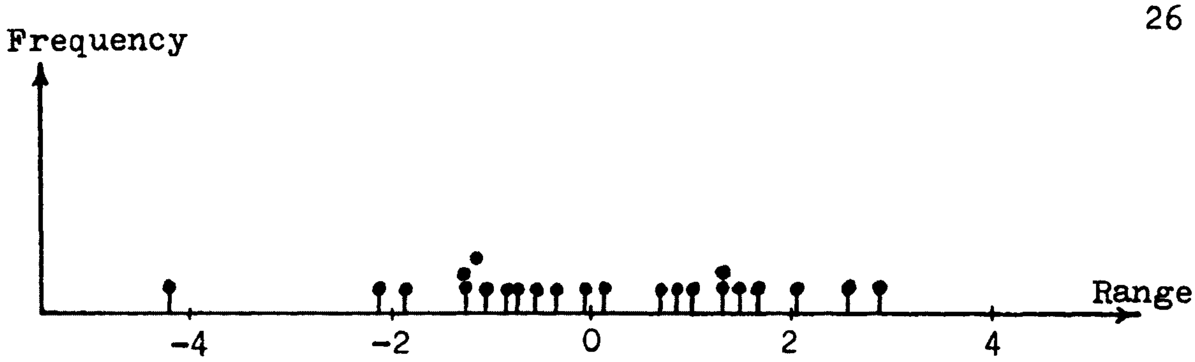

Figure 3.--Residuals Overall

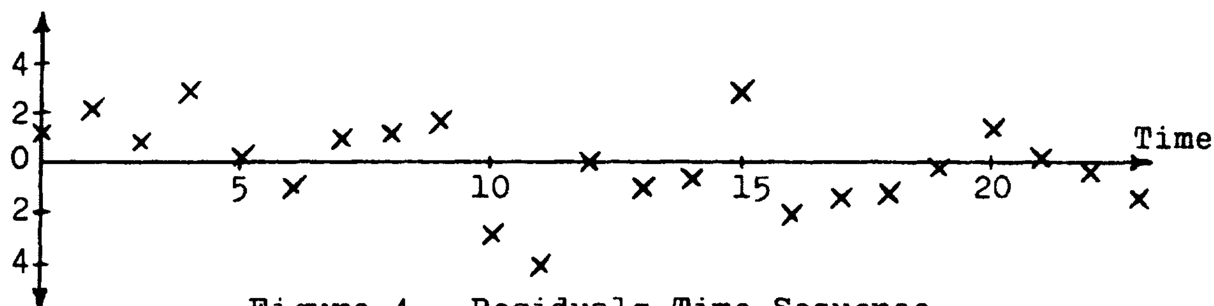

Figure 4.--Residuals Time Sequence

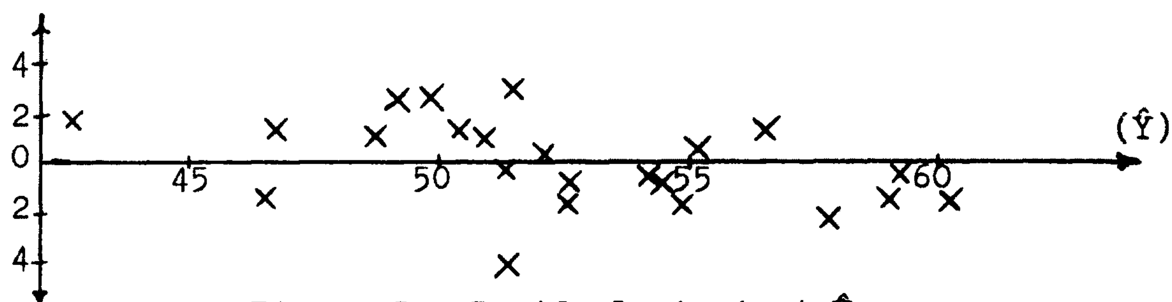

Figure 5.--Residuals Against Ŷ

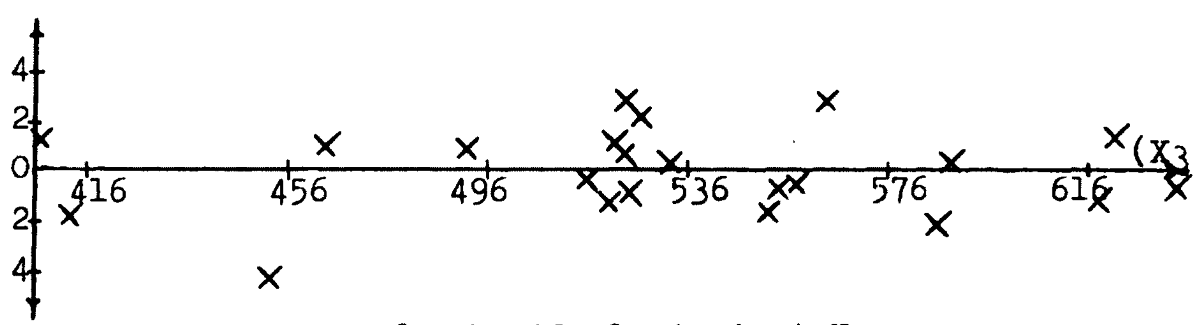

Figure 6.--Residuals Against X_3

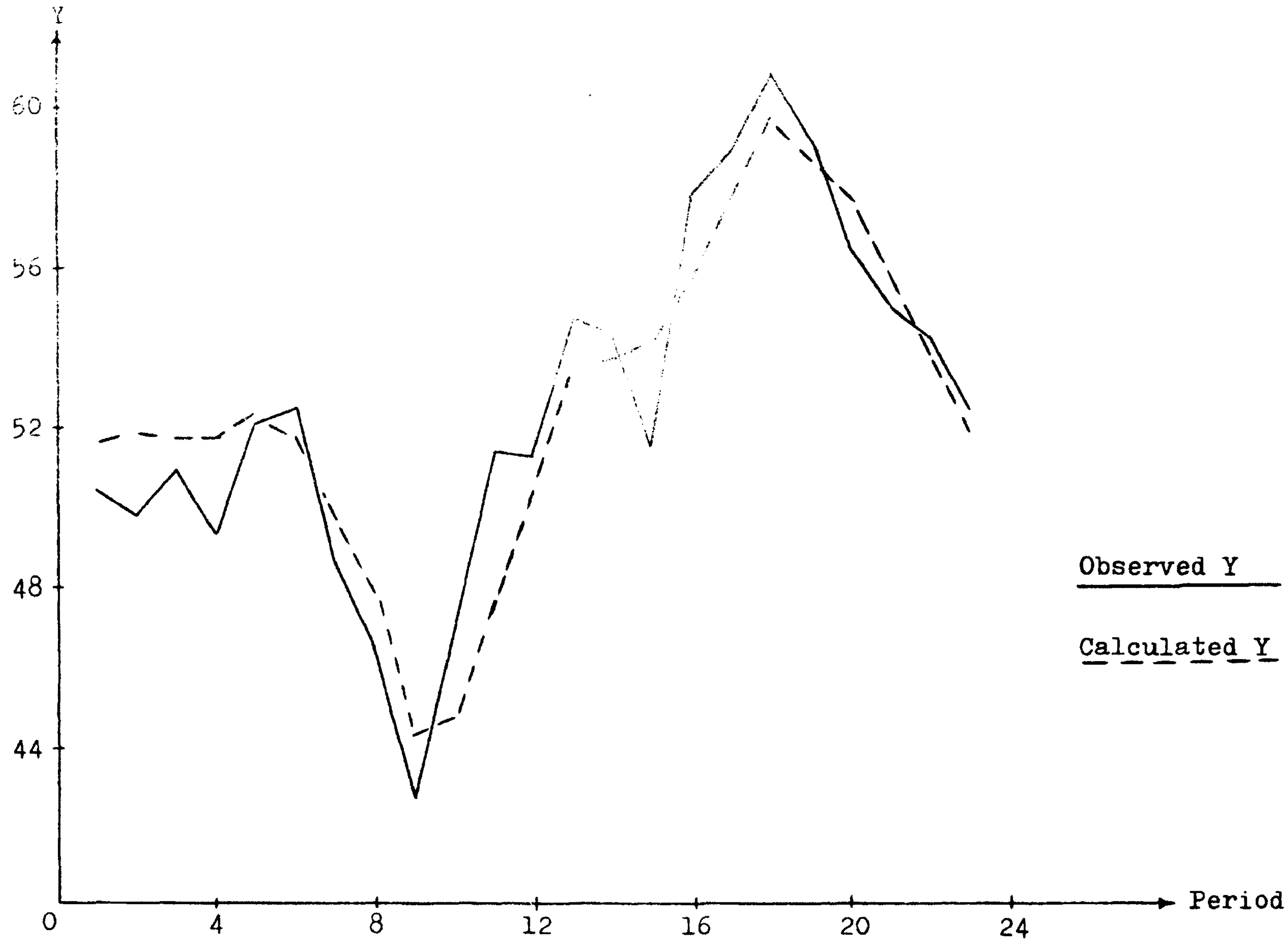

Figure 7.--Observed Y versus Calculated Y

this should be easily overcome. The analyst now would collect data for New Residential Construction permits, which should give very similar results to this model; however, the variable will be a lead variable. In the following chapter, a method will be developed for further analysis of a multiple regression model.

CHAPTER V

SIMULATED SENSITIVITY ANALYSIS

"Models are designed to represent the operations under study, by an idealized example of reality, in order to explain the essential relationships involved" Whereas: "Simulation is the process of manipulating a model of reality rather than reality itself."[23]

INTRODUCTION

The purpose of this chapter is to develop and analyze a simulation technique that will allow an analyst to simulate the responses of a multiple linear regression model. This simulation will serve to help determine the sensitivity of the regression model to changes in the environment in which the model exists. The term sensitivity, in this context, refers to the responses of the estimated dependent variable (response variable) to changes in the independent variables. As John Boot stated: "In sensitivity analysis the basic question is 'how do the results

---

[23]Walter J. Fabrycky and Paul E. Torgensen, Operations Economy: Industrial Applications of Operations Research (Englewood Cliffs, N. J.: Prentice-Hall, Inc., 1968), pp. 17-18.

change' rather than 'how does the solution change.'"[24] By this Boot is implying that the solution to a model may be different under varying circumstances; however, even though the solutions differ, the results may be very near the same. For example, in a linear programming problem, minor changes in one of the coefficients may bring about a new optimal solution at another corner of the feasible region although the results in terms of profit may be almost equal. A model that reacted in this manner would be considered insensitive. If, however, small changes in the coefficients brought about an optimal solution that was significantly different, the model would be considered sensitive to changes in these coefficients.

In this analysis we are interested in determining whether or not a particular regression model is too sensitive, i.e., do small changes (that may occur by chance or error) cause the results to be erroneous? In essence, will the regression model be a good representation of reality? The author is primarily concerned with predictive regression models--if a predictive model appears to be extremely sensitive, it must be considered a poor representation of reality.

---

[24]John C. G. Boot, Mathematical Reasoning in Economics and Management Science (Englewood Cliffs, N. J.: Prentice-Hall, Inc., 1967), p. 136.

THE REGRESSION MODEL

At this point it becomes necessary to describe the regression model for which the simulation model will be developed. It is assumed that the regression model is a multiple linear least squares model. It is further assumed that: (1) in the initial development, the regression model has explained some acceptable level of variation, (2) the model is statistically significant, (3) analysis of the residuals did not lead to the rejection of the hypothesis that $\varepsilon_i/\sigma \sim N(0,1)$, and (4) the independent variables are independent of one another.

Notation

Multiple Regression Model

$$Y = \beta_0 + \beta_1 X_1 + \ldots \beta_n X_n + \varepsilon$$

where: Y - True value of response variable

$X_1, X_2, \ldots, X_n$ - Independent variables

$\beta_0, \beta_1, \ldots, \beta_n$ - True but unknown coefficients

$\sigma_0, \sigma_1, \ldots, \sigma_n$ - True but unknown variances of β_i's

$\sigma_{Y \cdot X}$ - True but unknown variance of Y values

Estimated Regression Equation

$$\hat{Y} = b_0 + b_1 X_1 + b_2 X_2 + \ldots + b_n X_n$$

where: $\hat{Y}$ - Predicted value of Y

$X_1, X_2, \ldots, X_n$ - Independent variables

$b_0, b_1, \ldots, b_n$ - Estimates of $\beta_0, \beta_1, \ldots, \beta_n$

$s_1, s_2, \ldots, s_n$ - Variance of $b_1, b_2, \ldots, b_n$

$s_{Y \cdot X}$ - Variance of Y

Before the simulation model can be considered, certain parameters pertaining to the regression model must be established. First, the confidence interval for the coefficients will have to be set and second, an acceptable error tolerance on the estimate of the response variable will have to be fixed. Both of these parameters may be considered as an acceptable number of standard deviations from a mean. The error tolerance on $\hat{Y}$ refers to the amount by which the predicted value can be away from the true value of the response variable. This will depend, to a great extent, upon the circumstances surrounding the design of the original regression model and the amount of risk the person making the decision is willing to accept. If a very high cost is associated with errors in the predictive model, obviously this interval on $\hat{Y}$ must be very tight. However, if the interval is extremely small, it is very unlikely that an acceptable model can be developed for the fund.

SENSITIVITY SIMULATOR

Sensitivity, in this project, will be measured by two criteria. The first will deal with the reaction of the response variable to changes in the independent variables.

The second criterion will be the relative frequency (probability) that the model predicts $\hat{Y}$ values outside the acceptable error range. However, before this can be accomplished, a method of generating data for the simulation must be developed.

Synthetic Data Generation

In order to simulate reality, the model must be provided with data. Although it is possible to amass historical data for the simulation, in this section data will be generated for analysis. Robert Brown made this statement concerning the question of data generation: " . . . I strongly urge the use of synthetic data, which can provide much longer sequences and much more exacting tests of the alternatives."[25]

In the first criterion for sensitivity measurement (reactions of the response variable to changes in the independent variables), the data will be generated nonrandomly over specific ranges. This is done because we are interested in the degree of sensitivity of the model as the independent and dependent variables progress through some specified range. To accomplish this, a specific range, representative of reality, will be chosen for each independent variable, e.g., let one independent variable be the

[25]Robert G. Brown, Smoothing, Forecasting and Prediction of Discrete Time Series (Englewood Cliffs, N. J.: Prentice-Hall, Inc., 1962), p. 343.

Dow-Jones Average, a fairly realistic range would be 500 - 1000. Holding all other independent variables at the mean of their range, this (500, 1000) interval would be stepped through by some increment, say five points yielding one hundred values for this independent variable. At each one of these points the original regression equation will be solved for an estimate of Y, the response variable. This value of $\hat{Y}$ is the estimate of the mean of the normal distribution of $\hat{Y}$ values for which an estimate of the standard deviation was found in the original regression model. Therefore, a normal distribution can be generated for these $\hat{Y}$ values. Figure 8 demonstrates this relationship for a two dimensional case. This process would be repeated until the range of each independent variable has been stepped through with all other variables held at their mean.

SIMULATION

The First Measure

To determine the sensitivity of the model to changes in the values of each of the independent variables, the estimated value of Y will be forced to the tolerance limit each time it is calculated. At that point the coefficient on the specific independent variable will be considered unknown and solved for. Figure 9 demonstrates what is occurring for each $\hat{Y}$ value that has been calculated.

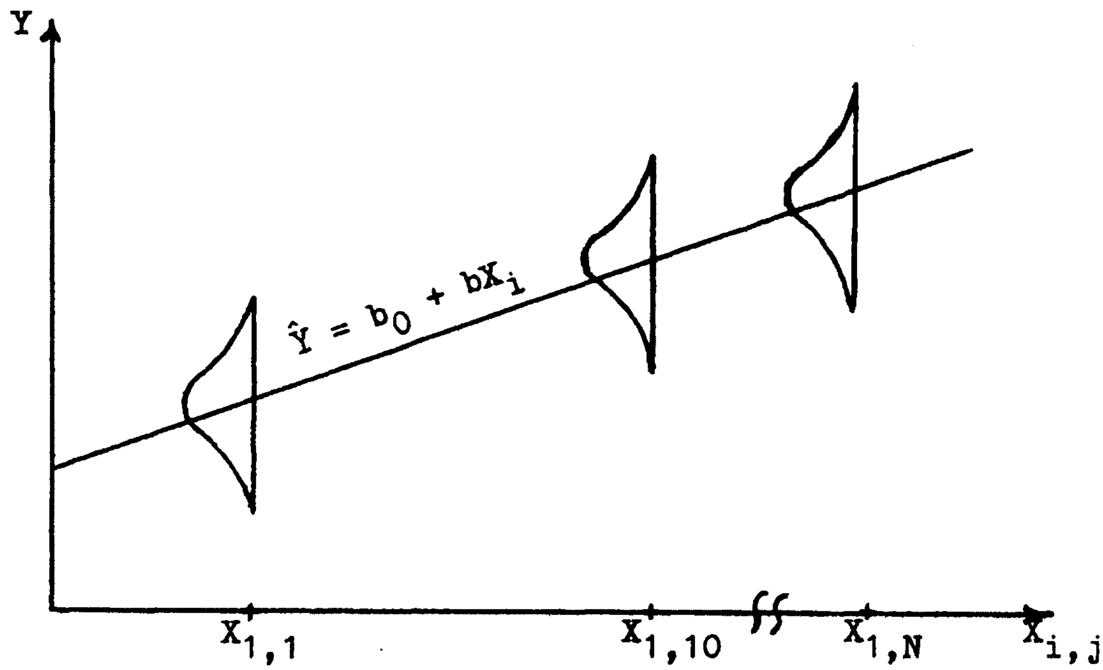

Figure 8.--The Independent Variable

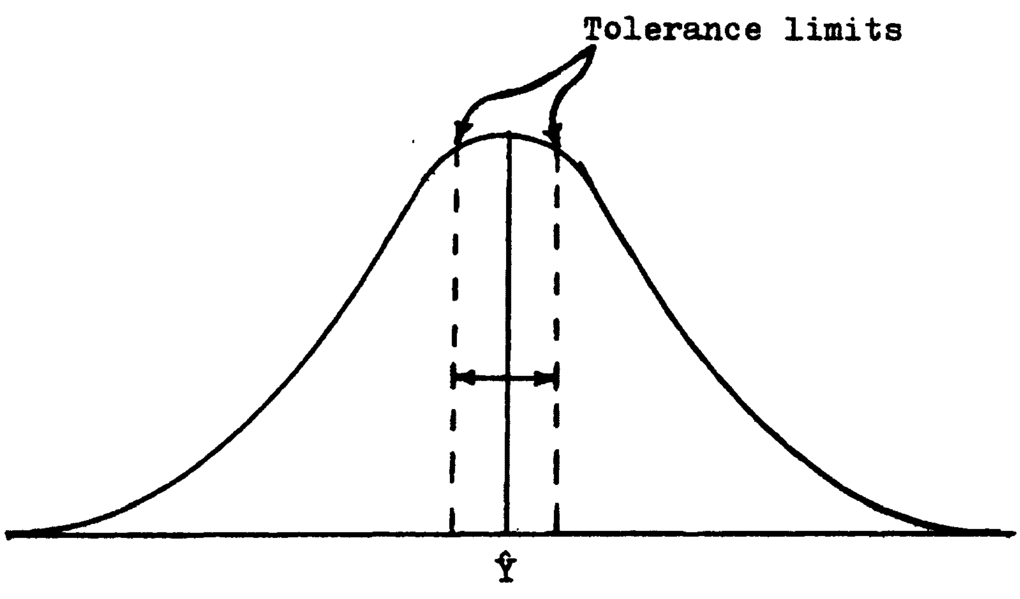

Figure 9.--Normal Distribution of Y

Thus far, we have begun stepping through a range of one independent variable (holding the others at some mean value). At each of these points we have solved our original regression equation for $\hat{Y}$, and we have forced this $\hat{Y}$ value to the accepted tolerance limit and then solved the regression equation for the coefficient on X_i. Therefore, this new coefficient represents the positive side of the interval to which b_i must be ranged to force the model out of tolerance.[26] In equation form we have performed the following:

(1) solved $\hat{Y} = b_0 + b_1X_1 + b_2X_2 + \ldots + b_nX_n$ for Y,

(2) then allowed $\hat{Y}$ to change by $+Z\hat{\sigma}_{Y \cdot X}$ where Z represents accepted tolerance limit on $\hat{Y}$, and

(3) solved $b_1 = \frac{1}{X_1}(-(\hat{Y} + Z\hat{\sigma}_{Y \cdot X}) + b_0 + b_2X_2 + \ldots + b_nX_n)$.

We now have a value (for one particular combination of X_i's and $\hat{Y}$) of the coefficient on X_1 that can be compared to the positive side of the confidence interval that was originally established on β_1 (e.g., 95 per cent). Intuitively, if this calculated value of b_1 falls within the confidence interval on β_1, the model at this point must be considered sensitive. This is because, for repeated samples, we are 95 per cent confident (in this example) that the true β_1 will lie within this interval; therefore, if the value of

[26] The distribution is assumed symetrical.

b_1 that will force the model out of tolerance also lies within this interval, it is very likely the model will be out of tolerance. Figure 10 depicts an example of a sensitive and an insensitive coefficient as the tolerance limit is approached.

Thus far we have only considered one combination of independent variables and the sensitivity of the coefficient on one of these X_i's. What we actually want is a measure that will demonstrate the sensitivity of each independent variable throughout its range. To accomplish this, sensitivity will be measured by the ratio of the positive end of the desired confidence interval on β_i to the calculated value of b_i at the tolerance limit of $\hat{Y}$. By this measure, if only a very small change in b_i is necessary to send the model out of tolerance, the ratio will result in a positive number greater than one. Whereas, if a very large change in b_i (outside the confidence interval on β_i) is necessary to send the response variable out of tolerance, the ratio will result in a positive number less than one. If the ratio is equal to unity, this implies that the model will go out of tolerance exactly at the end of the confidence interval on β_i, e.g.:

let: $(b_i + Z\sigma)$ = confidence interval on β_i

$(b_i + \Delta b_i)$ = value of b_i when out of tolerance

Sensitive Model:

$$(b_i + Z\sigma) > (b_i + \Delta b_i)$$

$$\therefore (b_i + Z\sigma) / (b_i + \Delta b_i) > 1$$

Insensitive Model:

$$(b_i + Z\sigma) < (b_i + \Delta b_i)$$

$$\therefore (b_i + Z\sigma) / (b_i + \Delta b_i) \leq 1$$

Figure 11 is an example of a sensitivity plot for the range of an independent variable. This example shows the model to be very sensitive to changes in this independent variable at the extreme points of its expected range. A plot such as this would be developed in the same manner for each independent variable.

A Second Measure

The second measure of sensitivity (the probability the model will go out of tolerance) is somewhat easier to develop, and in terms of the worth of the overall model, this measure may be more meaningful than the first. The data for this measure will also be generated synthetically but the method will differ somewhat from the first. The expected range of values for each independent variable will be retained, but the actual values will be generated randomly.[27] Rather than varying one of the independent variables, they will all be generated randomly. Using a

[27]Once again, independence is assumed.

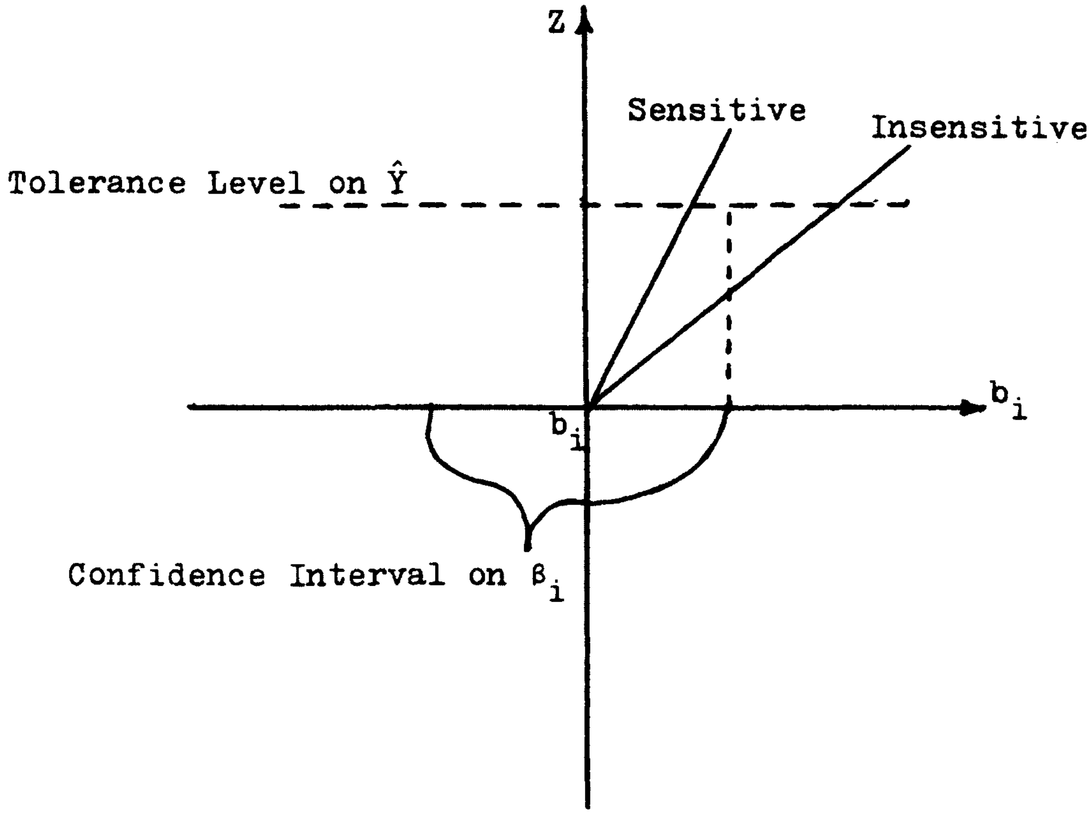

Figure 10.--Sensitive and Insensitive b_i

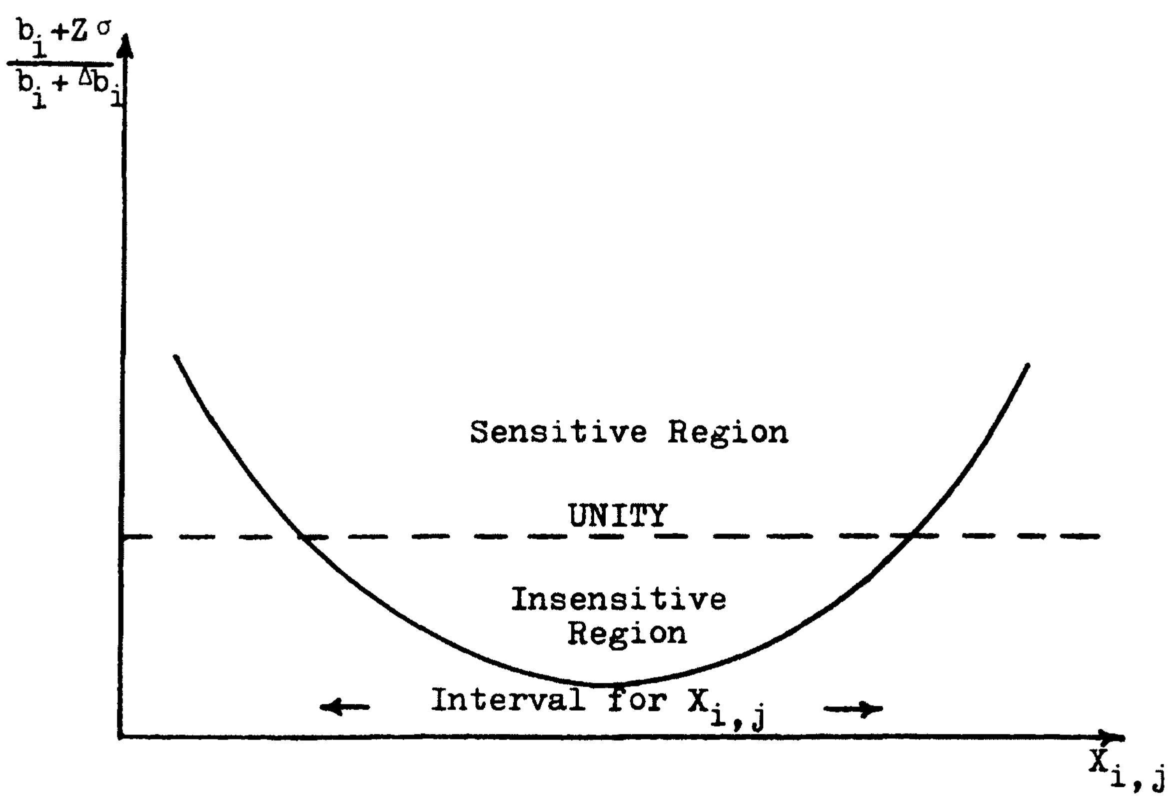

Figure 11.--Sensitivity Range for $X_{i,j}$

pseudo random-number generator on a digital computer, random numbers can be generated in any interval by the following method:

```
Let interval = B to A
    N = A + 1 - B
LET R = INT(N*RND(X)+B)
```
[28]

where: RND(X) generates random numbers between 0,1

After a random value is found for each independent variable (within a specified range for each X_i), the original regression equation is solved for $\hat{Y}$. As previously mentioned, this $\hat{Y}$ represents the mean of a normal distribution with an estimated standard deviation $S_{Y \cdot X}$. Now values in this normal distribution can be generated by the following method:

```
For: M = mean of distribution
     S = standard deviation
LET V1 = (-2*LOG(RND(X))↑(0.5)*COS(6.283*RND(X))*S+M
```
[29]

We now have the capability of randomly generating a combination of independent variables and then, for each of these combinations, generating a normal distribution of response variables. Each time a response variable is generated it will be compared to the acceptable tolerance range

---

[28] These statements are in BASIC language.

[29] These statements are in BASIC language. Adapted from: Claude McMillan and Richard F. Gonzales, Systems Analysis (Homewood, Ill.: Richard D. Irwin, 1968), p. 260.

on $\hat{Y}$ ($\hat{Y} \pm Zs_{Y.X}$). If it is found to be within the tolerance range, it will be recorded as such; if it is found to lie outside this range, it will be recorded as "out of tolerance."[30] By generating many combinations of independent variables (say 500) and many normally distributed Y values (say 50) for each of these combinations, the relative frequency for Y's "out of tolerance" can be found. This relative frequency may be considered the probability that the original regression model will go out of tolerance.

A FINAL NOTE

The use of these two measures of sensitivity should give an analyst a better indication of how well his model represents reality. In many cases the data used for designing the original model is not available for a long period; therefore, the independent variables may not have gone through a significant part of their expected range. By using synthetic data, as in this simulation model, the analyst can actually simulate how his model will react. If it is discovered that there is a relatively high probability that the model will go out of tolerance, the model may have to be modified.

---

[30] These "recordings" actually will be a summation process, $\sum_{i=1}^{N}$ (all values in tolerance), $\sum_{i=1}^{K}$ (all values out of tolerance).

By analyzing the sensitivity of the model to each independent variable, the analyst may decide to delete certain of these variables. If the model appears overly sensitive to all variables, it is very possible that the complete model will have to be considered unrepresentative of reality. Also, the sensitivity measures for each independent variable will forewarn the analyst of poor results when the variables approach a sensitive portion of their range.

CHAPTER VI

CONCLUSIONS

The primary objective of this paper was to develop analytical performance models for Common Stock Common Trust Funds. These models will be of general use to an analyst, whether he be a potential investor or a fund manager, in making investment decisions and analyzing performance. Although the relatively poor sample results did not allow statistical inferences pertaining to population parameters, it did provide excellent data for testing the historical performance model "RANK 2." Also, the results of this random sample should be very useful for further study and future samples in this area of interest.

The historical performance model is designed to provide an analyst with comparable performance figures for any number of funds. Differences in fund life can easily be allowed for by using data from comparable periods. The model should also be useful for comparing Common Stock Common Trust Funds with other types of funds, e.g., mutual funds. All that is required are quarterly valuations and income yields in dollars.

The example of the predictive model (Chapter IV) and the method of sensitivity simulation developed (Chapter V) are intended to provide an analyst with the necessary tools to design his own predictive model and then, more importantly, to test that model. The sensitivity simulator should also be of value in the maintenance of the predictive model; it should allow the analyst to adjust the predictive model so he may be certain the model continues being a good representation of reality.

B I B L I O G R A P H Y

Books

American Bankers Association. Common Trust Funds. New York: Trust Division, American Bankers Association, 1956.

__________. Trust Principles and Policies. New York: Trust Division, American Bankers Association, 1933.

Boot, John C. G. Mathematical Reasoning in Economics and Management Science. Englewood Cliffs, N. J.: Prentice-Hall, Inc., 1967.

Brabb, George J. Introduction to Quantitative Management. New York: Holt, Rinehart, and Winston, Inc., 1968.

Brown, Robert C. Smoothing, Forecasting and Prediction of Discrete Time Series. Englewood Cliffs, N. J.: Prentice-Hall, Incl, 1962.

Cochran, William G. Sampling Techniques. New York: John Wiley and Sons, Inc., 1967.

Draper, N. R. and Smith, H. Applied Regression Analysis. New York: John Wiley and Sons, Inc., 1966.

Fabrycky, Walter J. and Torgensen, Paul E. Operations Economy: Industrial Applications of Operations Research. Englewood Cliffs, N. J.: Prentice-Hall, Inc., 1968.

Markowitz, Harry M. Portfolio Selection. New York: John Wiley and Sons, Inc., 1959.

McMillan, Claude and Gonzales, Richard F. Systems Analysis. Homewood, Ill.: Richard D. Irwin, Inc., 1968.

Trade and Securities Statistics. New York: Standard and Poor's Corporation, May, 1970.

U. S. Comptroller of the Currency. Fiduciary Powers of National Banks and Collective Investment Funds. Regulation 9, as amended February 5, 1964.

Wonnacott, Thomas H. and Wonnacott, Ronald J. Introductory Statistics. New York: John Wiley and Sons, Inc., 1969.

Yamane, Taro. Elementary Sampling Theory. Englewood Cliffs, N. J.: Prentice-Hall, Inc., 1967.

Periodicals

Bower, Richard S. "Risk-Return Measurement in Portfolio Selection and Performance Appraisal Models: Progress Report," Journal of Financial and Quantitative Analysis (December, 1969), p. 417.

"Regression Analysis," Mark I Time-Sharing Service, General Electric (February, 1968).

Smith, Keith V. and Tito, Dennis A. "Risk-Return Measures of Ex Post Portfolio Performance," Journal of Financial and Quantitative Analysis (December, 1969), p. 449.

Treynor, Jack L. "How to Rate Management of Investment Funds," Harvard Business Review, Vol. 43, No. 1, (January-February, 1965), pp. 63-76.

Unpublished Material

Gill, Edward K. "Common Trust Funds: An Evaluation of Investment Performance." Unpublished doctoral dissertation, College of Business Administration, University of Oregon, 1968.

APPENDIX I

SCHOOL OF BUSINESS ADMINISTRATION

University of Montana
Missoula, Montana 59801
(406) 243-0211

March 18, 1970

Dear Sir:

I am a graduate student in the School of Business Administration at the University of Montana. As the topic for my MBA professional paper, I have chosen "The Evaluation of Growth in Common Equity Trust Funds." The paper will be concerned only with pure common stock funds, and it is my intention to accurately test the growth of all common stock funds presently in operation by the use of a random sample.

As the degree of validity for the sample results will be greater with a purely random sample, your reply is essential to my study. I fully appreciate the private nature of this information, and I assure you that it will not appear in the paper in any form which will identify it with your bank.

I am interested specifically in the following items:

(1) The value of one unit of your common stock fund on each of your monthly and/or quarterly valuation dates since 1960. (If your fund has not been in operation since 1960, the values from the beginning date of operation would be appreciated.)

(2) The income yield for each of these valuation dates.

(3) Whether there were any capital gains distributions since 1960, and if so, what was the date and amount per unit of each such distribution.

I would appreciate your sending this information to the chairman of my professional paper committee, Dr. Edward K. Gill, School of Business Administration, University of Montana. If you wish, I will be happy to send you a copy of the completed professional paper.

Thank you for your kind consideration.

Very truly yours,

David C. Stegner

be

School of Business Administration

University of Montana
Missoula, Montana 59801
(406) 243-0211

May 11, 1970

Sir:

Recently David C. Stegner, one of our graduate students here at the University of Montana, wrote to you requesting information relating to your Common Stock Common Trust Fund. He requires this information for his professional paper, entitled: "The Evaluation of Growth in Common Stock Common Trust Funds." It was unfortunate that at the time the requests were mailed the postal strike had just begun and may have caused a delay; however, as of this date your response has not been received.

The validity of a random sample depends on complete response. Thus I would appreciate your sending the information requested below. I assure you that this information will be used in strict confidence and no reference to your bank will be made.

The following information is desired:

(1) The value of one unit of your Common Stock Fund on each of your monthly and/or quarterly valuation dates since 1960. (If your fund has not been in operation since 1960, the values from the beginning date of operation would be appreciated.)

(2) The income payment per unit (dollars) for each of these valuation dates.

(3) Whether there were any capital gains distributions since 1960, and if so, what was the date and amount per unit of each such distribution.

Thank you for your kind consideration.

Very truly yours,

Edward K. Gill
Assistant Professor of Finance

be

APPENDIX II

PRØGRAM RANK2

```
001REM: PRØGRAM NAME:RANK2 (YEARLY)
002REM ENTER N AT 400,ENTER UNIT VALUES AT 500-99,ENTER
003REM INCØME PAYMENTS AT 600-99
007DIM U(100)
009DIM E(100)
011DIM X(100)
013DIM Y(100)
015DIM G(100)
017DIM V(100)
019DIM S(100)
021DIM A(100)
023DIM Z(100)
025READ N
027FØR I=1 TØ N
029READ X(I)
031NEXT I
033FØR I=1 TØ N
035READ Y(I)
037NEXT I
039LET P=1
041LET T=N
043LET N1=T/4
045LET N2=INT(N1)
047IF N2=N1 THEN 055
049LET T=T-1
051LET P=P+1
053GØ TØ 043
055FØR M=P TØ (N-3)STEP4
057LET J=M
059FØR I= J TØ (J+2)
061LET G1=G1+(LØG(1+(X(I+1)-X(I))/X(I)))
063NEXT I
065LET G2=G1/4
067LET K=K+1
069LET G(K)=((EXP(G2))-1)*100
070LET G1=0
071NEXT M
072LET M3=K
073LET K=0
075LET B=X(P)
077FØR M=P TØ (N-3)STEP4
079LET J=M
081LET A=0
083FØR I=J TØ (J+3)
085LET A=A+Y(I)
087NEXT I
089LET K=K+1
091LET Z(K)=A/B*100
```

RANK2 CØNTINUED

```
093NEXT M
095FØR I=P TØ N
097LET S1=S1+X(I)
099NEXT I
101LET A1=S1/T
103FØR I=P TØ N
105LET S2=S2+(X(I)-A1)↑2
107NEXT I
109LET V1=S2/T
111FØR I=P TØ N
113IF X(I)>A1 THEN 117
115LET S3=S3+(X(I)-A1)↑2
117NEXT I
119LET V2=S3/T
121LET G1=0
123FØR I=P TØ (N-1)
125LET G1=G1+(LØG(1+(X(I+1)-X(I))/X(I)))
127NEXT I
129LET G2=G1/T
131LET G3=((EXP(G2))-1)*100
133LET S1=0
135FØR K=1 TØ M3
137LET S1=S1+Z(K)
139NEXT K
141LET A2=S1/M3
143LET S2=0
145FØR K=1 TØ M3
147LET S2=S2+(Z(K)-A2)↑2
149NEXT K
151LET V3=S2/M3
153LET S3=0
155FØR K=1 TØ M3
157IF Z(K)>A2 THEN 161
159LET S3=S3+(Z(K)-A2)↑2
161NEXT K
163LET V4=S3/M3
165LET K=0
167FØR M=P TØ (N-3)STEP4
169LET S1=0
171LET S2=0
173LET S3=0
175LET J=M
177FØR I=J TØ (J+3)
179LET S1=S1+Y(I)
181NEXT I
183LET A=S1/4
185FØR I=J TØ (J+3)
187LET S2=S2+(Y(I)-A)↑2
189NEXT I
191LET K=K+1
193LET V(K)=S2/4
195FØR I=J TØ (J+3)
```

```
197IF Y(I)>A THEN 201
199LET S3=S3+(Y(I)-A)↑2
201NEXT I
203LET S(K)=S3/4
205NEXT M
207LET K=0
209FØR M=P TØ (N-3)STEP4
211LET S1=0
213LET S2=0
215LET S3=0
217LET J=M
219FØR I=J TØ (J+3)
221LET S1=S1+X(I)
223NEXT I
225LET A=S1/4
227FØR I=J TØ (J+3)
229LET S2=S2+(X(I)-A)↑2
231NEXT I
233LET K=K+1
235LET U(K)=S2/4
237FØR I=J TØ (J+3)
239IF X(I)>A THEN 243
241LET S3=S3+(X(I)-A)↑2
243NEXT I
245LET E(K)=S3/4
247NEXT M
249PRINT
251PRINT
253PRINT"ØVERALL FUND GRØWTH";G3;"#"
255PRINT"UNIT VALUE:VAR";V1;"SEMIVAR";V2;"AVE";A1
257PRINT
259PRINT
261PRINT"PERIØD     GEØMETRIC GRØWTH#    VARIANCE     SEMIVARIANCE"
263PRINT
265FØR K=1 TØ M3
267PRINT K,G(K),U(K),E(K)
269NEXT K
271PRINT
273PRINT
275PRINT
276PRINT
277PRINT"AVERAGE YIELD";A2;"#    VAR";V3;"SEMIVAR";V4
279PRINT
280PRINT
281PRINT
283PRINT
285PRINT"PERIØD        YIELD#            VARIANCE     SEMIVARIANCE"
287PRINT
289FØR K=1 TØ M3
291PRINT K,Z(K  (K),S(K)
293NEXT K
999END
```

APPENDIX III

FUND # 1

```
400DATA41
TAPE
READY.

500DATA50.9,51.1,52.7,52.0,55.4,56.5,57.2,59.1,58.1,57.6,54.1,
501DATA53.8,62.9,65.1,64.9,68.2,70.1,72.5,76.4,77.3,79.6,80.9,
502DATA76.6,81.1,79.9,77.2,72.3,70.3,74.3,79.2,78.2,75.6,74.8,
503DATA78.9,78.6,83.1,83.4,84.0,75.1,79.8,69.7
600DATA.54,.50,.50,.50,.52,.49,.51,.54,.54,.51,.54,.51,.53,.46,
601DATA.49,.49,.58,.49,.52,.52,.61,.54,.54,.55,.62,.58,.59,.60,
602DATA.67,.58,.59,.58,.65,.56,.61,.60,.61,.62,.65,.68,.73,

RANK2     17:38   LA 024 05/30/70
```

ØVERALL FUND GRØWTH .779058 #
UNIT VALUE:VAR 106.336 SEMIVAR 63.7801 AVE 69.94

PERIØD	GEØMETRIC GRØWTH#	VARIANCE	SEMIVARIANCE
1	2.04041	2.575	.885
2	.700568	.951875	.444062
3	2.22498	13.445	4.9725
4	1.86717	4.76187	2.15781
5	2.36318	6.5625	3.90125
6	-.310466	3.25688	2.28766
7	-.952646	6.50187	2.97531
8	-1.4188	3.2675	1.61125
9	1.39634	5.085	2.5425
10	-4.55825	28.4125	14.9263

AVERAGE YIELD 4.40313 # VAR .165747 SEMIVAR .066023

PERIØD	YIELD#	VARIANCE	SEMIVARIANCE
1	3.95303	.000075	1.87500E-05
2	4.07045	.00045	.00025
3	4.09002	1.68750E-04	7.81250E-05
4	3.95303	.002025	6.18750E-04
5	4.18787	.002025	6.18750E-04
6	4.40313	1.11875E-03	2.92187E-04
7	4.77495	.00125	.00035
8	4.69667	.00085	.000225
9	4.65753	.000425	3.06250E-04
10	5.24462	.00165	.000725

FUND # 2

```
400DATA41
TAPE
READY.

500DATA33.62047,33.63154,34.19914,34.11893,38.42120,39.98439,
501DATA41.56623,43.73529,42.28251,36.88734,36.31563,38.12981,
502DATA39.71058,43.52490,45.17819,44.67242,47.58865,49.14735,
503DATA50.38247,52.58882,54.78934,55.06142,53.57773,55.75243,
504DATA53.69926,51.35930,46.35950,47.87820,50.42187,50.60190,
505DATA52.83242,51.05167,50.14194,53.91612,54.33022,58.99305,
506DATA53.84148,56.46148,51.88393,51.26648,49.98085
600DATA.31261,.29218,.30092,.30763,.30044,.30298,.29195,.33428,
601DATA.31318,.31045,.31618,.34842,.32863,.32420,.32295,.37801,
602DATA.34341,.35237,.36192,.41077,.35677,.39129,.38891,.46315,
603DATA.38959,.43413,.42195,.46981,.40790,.43888,.40989,.47294,
604DATA.43453,.45120,.44395,.47668,.45106,.46581,.47729,.48520,
605DATA.47966
```

RANK2 17:43 LA 024 05/30/70

ØVERALL FUND GRØWTH .99536 #
UNIT VALUE:VAR 48.3018 SEMIVAR 28.9498 AVE 47.4066

PERIØD	GEØMETRIC GRØWTH#	VARIANCE	SEMIVARIANCE
1	3.38465	3.74014	.970421
2	1.40691	1.82383	.936393
3	1.86083	1.69731	.712909
4	2.25661	2.19592	.818104
5	2.75406	4.64575	2.11558
6	-.624295	.843369	.392764
7	-.459467	3.95465	2.06655
8	-.228023	1.03915	.33738
9	-3.46273E-02	4.65449	1.18962
10	-3.00199	5.97477	1.84718

FUND # 2 CØNTINUED

AVERAGE YIELD 4.59434 #   VAR .530559 SEMIVAR .268305

PERIØD	YIELD#	VARIANCE	SEMIVARIANCE
1	3.57156	3.00168E-05	1.64532E-05
2	3.69412	2.43321E-04	1.01439E-04
3	3.87636	2.11946E-04	8.35471E-05
4	4.06931	4.94592E-04	1.72571E-04
5	4.40607	5.53123E-04	1.46849E-04
6	4.85538	1.00597E-03	2.52056E-04
7	5.15525	5.26891E-04	1.96217E-04
8	5.222	5.04824E-04	2.17861E-04
9	5.42018	.000155	4.51959E-05
10	5.67313	4.99039E-05	3.12481E-05

FUND # 3

```
400DATA39
TAPE
READY.

500DATA100.00,98.72,105.50,115.17,120.24,127.73,124.23,106.29,
501DATA108.64,115.01,119.43,131.38,136.87,137.10,146.95,152.77,
502DATA156.32,162.54,167.77,169.04,166.46,173.89,170.30,164.13,
503DATA148.39,157.67,172.15,179.48,189.55,189.16,188.04,207.91,
504DATA210.78,235.62,212.80,224.42,215.50,217.40,215.20,
600DATA0.00,.72,.59,.73,.83,.91,.84,.86,.77,.94,.82,.87,.86,1.05,
601DATA.90,.96,.98,1.06,1.05,1.04,1.13,1.28,1.10,1.30,1.10,1.24,
602DATA1.30,1.34,1.37,1.50,1.38,1.38,1.58,1.52,1.39,1.75,1.50,
603DATA1.80,.60
```

RANK2 17:47 LA 024 05/30/70

ØVERALL FUND GRØWTH 1.75172 #
UNIT VALUE:VAR 1305.3 SEMIVAR 617.058 AVE 164.898

PERIØD	GEØMETRIC GRØWTH#	VARIANCE	SEMIVARIANCE
1	1.91117	21.8633	11.7726
2	2.95685	26.9224	12.5853
3	2.83953	31.4978	11.8064
4	2.36914	33.1375	15.6468
5	.185828	7.16282	3.19193
6	1.19983	75.8829	39.3038
7	1.17158	17.0042	12.5228
8	.582879	121.366	32.6058
9	-1.04331	13.8997	4.00867

AVERAGE YIELD 3.9584 # VAR .676469 SEMIVAR .331514

PERIØD	YIELD#	VARIANCE	SEMIVARIANCE
1	2.87401	4.11875E-03	2.37656E-03
2	2.94347	3.86875E-03	1.69062E-03
3	3.19528	.00585	.001625
4	3.51654	1.86875E-03	9.53125E-04
5	3.95068	7.81875E-03	2.74219E-03
6	4.28931	.006675	4.55625E-03
7	4.85369	3.71875E-03	1.09219E-03
8	5.09681	7.26875E-03	3.41562E-03
9	4.90579	.232969	.165039

FUND # 4

```
400DATA24
TAPE
READY.

500DATA50.00,50.38,49.79,50.86,49.23,52.13,52.57,48.72,46.75,
501DATA42.58,46.47,51.42,51.27,54.82,54.41,51.38,57.84,59.03,
502DATA60.90,59.20,56.47,55.13,54.18,52.49,
600DATA.00,.22,.35,.33,.33,.32,.37,.34,.34,.32,.35,.32,.34,.33,
601DATA.38,.35,.38,.35,.41,.37,.36,.34,.60,.42
```

RANK2 17:51 LA 024 05/30/70

ØVERALL FUND GRØWTH .202704 #
UNIT VALUE:VAR 18.2766 SEMIVAR 8.78739 AVE 52.4175

PERIØD	GEØMETRIC GRØWTH#	VARIANCE	SEMIVARIANCE
1	.427254	.165719	7.12156E-02
2	-.260001	2.90437	1.45634
3	2.40888	9.81602	4.49147
4	5.35944E-02	2.72855	1.35452
5	.582715	1.19032	.503492
6	-1.81058	2.10052	1.11654

AVERAGE YIELD 2.74 # VAR .243733 SEMIVAR .1484

PERIØD	YIELD#	VARIANCE	SEMIVARIANCE
1	1.8	.019325	1.26625E-02
2	2.72	.00035	.000125
3	2.66	1.68750E-04	7.81250E-05
4	2.8	.00035	.000125
5	3.02	4.68750E-04	2.03125E-04
6	3.44	.0105	.003275

FUND # 5

```
400DATA41
TAPE
READY.

500DATA12.845,13.038,13.513,13.276,15.055,15.889,16.539,17.861,
501DATA17.066,14.393,14.228,15.218,15.865,17.231,17.740,17.412,
502DATA18.409,19.171,19.463,20.377,20.947,20.947,20.716,21.322,
503DATA20.560,19.358,17.068,18.038,19.208,19.239,20.312,19.841,
504DATA19.196,20.968,21.445,23.658,21.407,22.462,21.155,20.705,
505DATA20.259

600DATA.12169,.10830,.11214,.11384,.11400,.09637,.12179,.12127,
601DATA.12332,.11473,.12433,.14070,.10530,.15500,.12152,.15247,
602DATA.13755,.14294,.12592,.16262,.14866,.13469,.15548,.17997,
603DATA.15132,.14972,.16390,.17791,.16145,.14943,.16789,.18180,
604DATA.17253,.15056,.16835,.17762,.16802,.16164,.17881,.18780,
605DATA.17833

RANK2      17:55    LA 024 05/30/70


ØVERALL FUND GRØWTH 1.10792 #
UNIT VALUE:VAR 7.1831   SEMIVAR 4.16806 AVE 18.5139
```

PERIØD	GEØMETRIC GRØWTH#	VARIANCE	SEMIVARIANCE
1	3.66149	.621833	.176611
2	1.80258	.522128	.247969
3	2.46421	.43457	.192823
4	1.66698	.201793	7.49712E-02
5	2.23963	.503527	.236786
6	-.465115	8.22482E-02	.033856
7	-.194284	.86865	.491725
8	-.055923	.212432	9.24662E-02
9	.519356	1.10139	.301702
10	-2.54763	.678296	.244815

AVERAGE YIELD 4.49455 #   VAR .462079 SEMIVAR .263302

PERIØD	YIELD#	VARIANCE	SEMIVARIANCE
1	3.43826	5.26890E-06	3.55322E-06
2	3.54924	1.24956E-04	9.32915E-05
3	3.72036	1.71175E-04	7.43969E-05
4	4.3453	1.79330E-04	1.05325E-04
5	4.44961	1.73036E-04	9.24431E-05
6	4.76653	2.62309E-04	1.10954E-04
7	5.00828	1.00410E-04	4.65369E-05
8	5.15148	1.38947E-04	8.54008E-05
9	5.09702	9.57363E-05	6.06646E-05
10	5.41939	8.92776E-05	5.62875E-05

FUND # 6

```
400DATA41
500DATA12.42,12.34,12.85,12.52,14.52,15.11,15.73,16.59,16.14,
501DATA15.16,13.28,12.92,15.12,15.89,15.76,16.55,17.02,17.64,
502DATA18.58,18.98,19.61,19.44,19.22,19.55,19.35,18.53,18.81,
503DATA19.09,19.36,19.57,19.45,19.58,19.33,18.64,18.23,18.32,
504DATA17.65,17.09,17.11,15.89,16.11,17.29,17.20,17.41,18.33,
505DATA18.22,18.79,19.20,18.35,18.50,19.17,18.97,19.33,18.36,
506DATA18.25,18.94,18.66,18.31,18.02,19.06,19.04,20.06,19.94,
507DATA20.10,20.84,21.30,22.32,21.68,21.52,20.42,20.88,20.89,
508DATA21.08,19.86,18.30,18.90,18.35,19.34,18.74,18.61,17.16,
509DATA18.12,
600DATA.1100,.1100,.1125,.1150,.1150,.1100,.1125,.1125,.1175,
601DATA.1150,.1150,.1225,.1225,.1200,.1225,.1250,.1275,.1250,
602DATA.1250,.1350,.1350,.1275,.1275,.1275,.1275,.1300,.1325,
603DATA.1350,.1375,.1600,.1625,.1575,.1575,.1600,.1625,.1575,
604DATA.1650,.1600,.1575,.1650,.1625,.1675,.1700,.1725,.1725,
605DATA.1725,.1725,.1750,.1750,.1750,.1750,.1800,.1800,.1875,
606DATA1875,.1875,.1875,.1875,.1875,.1875,.1875,.1875,.1875,.
607DATA.1950,.1950,.1875,.1875,.1850,.1775,.1850,.1850,.1850,
606DATA.1875,.1875,.1875,.1875,.1875,.1875,.1875,.1875,.1875,
608DATA.1900,.1875,.1775,.1800,.1825,.1825,.1850,.1925,.1925,
609DATA.1950
```

RANK2 13:54 024 06/06/70

ØVERALL FUND GRØWTH .668711 #
UNIT VALUE:VAR 4.91652 SEMIVAR 2.96327 AVE 17.0658

PERIØD	GEØMETRIC GRØWTH#	VARIANCE	SEMIVARIANCE
1	4.15086	.746419	.211692
2	1.66226	.296619	.159678
3	-6.60283E-02	1.0568	.5364
4	1.73231	.260125	.117312
5	2.6821	.511119	.285978
6	-.115942	.01465	.007625
7	1.10147	9.59188E-02	4.83031E-02
8	-.308012	1.03688E-02	6.07813E-03
9	-1.35509	.12775	.0784
10	-1.46549	.3086	.1573

FUND # 6 CØNTINUED

AVERAGE YIELD 4.08743 #   VAR 8.66728E-02   SEMIVAR 6.48721E-02

PERIØD	YIELD#	VARIANCE	SEMIVARIANCE
1	3.54281	5.02934E-05	2.49512E-05
2	3.65482	4.93217E-05	2.39471E-05
3	3.62345	4.76531E-05	2.47584E-05
4	3.61003	5.17342E-05	2.50101E-05
5	3.64692	4.00965E-05	2.01456E-05
6	3.74519	4.43213E-05	2.31845E-05
7	3.91273	5.72193E-05	2.37456E-05
8	4.03451	5.46713E-05	1.99324E-05
9	4.26371	7.38219E-05	3.54213E-05
10	4.46431	6.43617E-05	3.85432E-05

FUND # 7

```
400DATA13
500DATA13.6619614,14.257670,13.988829,14.2471601,14.255490,
501DATA13.348317,14.845694,14.7071885,14.277574,14.274778,
502DATA14.1192347,13.81340660,14.73942411,
600DATA.10796309,.0974959,.10507314,.1069480,.117092,.096612,
601DATA.0880909,.0854579,.0951178,.0925988,.0757057,.10515278,
602DATA.10572059
```

```
RANK2     18:31   LA 024 05/30/70


ØVERALL FUND GRØWTH .277307 #
UNIT VALUE:VAR .157711 SEMIVAR 8.77731E-02   AVE 14.2396
```

PERIØD	GEØMETRIC GRØWTH#	VARIANCE	SEMIVARIANCE
1	-3.82261E-03	1.31439E-02	9.84642E-03
2	1.69673	.342419	.22398
3	.804005	.111789	4.82468E-02

AVERAGE YIELD 2.73786 #   VAR 3.39121E-02   SEMIVAR .01236

PERIØD	YIELD#	VARIANCE	SEMIVARIANCE
1	2.99214	4.88520E-05	2.15831E-05
2	2.56198	2.18050E-05	1.11962E-05
3	2.65947	1.48969E-04	9.23005E-05

FUND # 8

```
400DATA20
TAPE
READY.

500DATA8.56,8.29,8.65,8.55,8.21,7.41,7.77,8.36,8.43,8.77,8.81,
501DATA8.43,9.52,9.50,10.39,9.45,10.18,9.73,9.91,9.76,
600DATA.0587,.058286,.070552,.059560,.065016,.061719,.066078,
601DATA.056075,.062576,.061138,.063371,.062860,.060358,.061360,
602DATA.065921,.068706,.053275,.064668,.061715,.058353
```

RANK2 18:33 LA 024 05/30/70

ØVERALL FUND GRØWTH .658117 #
UNIT VALUE:VAR .636754 SEMIVAR .293208 AVE 8.934

PERIØD	GEØMETRIC GRØWTH#	VARIANCE	SEMIVARIANCE
1	-2.92183E-02	1.80188E-02	1.23766E-02
2	.453663	.139769	7.65781E-02
3	0	.0326	.0162
4	-.184333	.152525	3.86187E-02
5	-1.04779	.031725	1.13625E-02

AVERAGE YIELD 2.89787 # VAR 4.77083E-03 SEMIVAR 2.78001E-03

PERIØD	YIELD#	VARIANCE	SEMIVARIANCE
1	2.88666	2.58927E-05	6.63155E-06
2	2.90757	1.51784E-05	9.50965E-06
3	2.91992	6.87076E-07	4.54444E-07
4	2.99468	1.15102E-05	5.33307E-06
5	2.7805	1.79202E-05	1.00267E-05

FUND # 9

```
500DATA10.13,10.41,10.29,10.02,8.89,8.54,10.02,10.48,10.44,
501DATA10.69,10.98,11.34,11.71,11.95,12.31,12.59,12.26,13.75,
502DATA14.70,15.03,13.70,12.53,14.54,16.65,16.21,15.76,15.07,
503DATA15.84,15.99,16.71,16.89,16.62,14.62,16.06,14.19,
600DATA.05200,.07500,.09000,.07255,.08255,.07570,.09325
601DATA.07054,.09313,.08130,.07896,.07740,.08418,.07739
602DATA.09215,.08120,.08650,.08600,.07965,.08707,.09709
603DATA.08399,.09425,.08428,.09976,.09962,.10819,.10785
604DATA.12131,.13007,.12771,.12515,.11845,.09333,.10995
400DATA35
```

RANK2 12:41 024 06/06/70

ØVERALL FUND GRØWTH 1.09329 #
UNIT VALUE:VAR 6.19806 SEMIVAR 3.32957 AVE 13.3463

PERIØD	GEØMETRIC GRØWTH#	VARIANCE	SEMIVARIANCE
1	0	.441069	.228191
2	1.17198	4.58687E-02	1.77781E-02
3	2.07309	.124819	6.28656E-02
4	3.94962	.936425	.418613
5	-.825195	.89835	.519725
6	-2.4618	.341269	.188291
7	1.61753	.202669	.100716
8	-3.87467	.998369	.491141

AVERAGE YIELD 3.74316 # VAR .336206 SEMIVAR .112662

PERIØD	YIELD#	VARIANCE	SEMIVARIANCE
1	3.23403	6.29892E-05	2.49591E-05
2	3.23283	6.51997E-05	2.82841E-05
3	3.30459	3.69384E-05	1.44991E-05
4	3.32685	8.81422E-06	4.54164E-06
5	3.61677	2.78989E-05	1.40382E-05
6	3.91068	7.44477E-05	4.68027E-05
7	4.85968	7.45367E-05	4.82435E-05
8	4.45988	1.41746E-04	8.53313E-05

FUND # 10

```
400DATA40

500DATA18.762,18.948,19.123,18.820,20.979,21.545,21.987,22.703,
501DATA21.862,18.990,18.304,19.189,19.738,21.686,22.037,21.652,
502DATA22.657,23.601,23.718,24.615,25.615,26.190,25.873,26.732,
503DATA26.256,24.969,22.171,23.650,25.154,25.895,26.904,27.226,
504DATA25.263,30.519,35.943,31.506,33.395,30.314,31.136,29.668,
600DATA.16025,.16730,.16932,.17166,.16008,.16224,.16574,.18135,
601DATA.16824,.16252,.16622,.19248,.17042,.17407,.18278,.20235,
600DATA.16025,.16730,.16932,.17166,.16008,.16224,.16574,.18135,
602DATA.18928,.17415,.18712,.20091,.18197,.20431,.19530,.22639,
603DATA.19572,.19875,.20364,.21819,.18094,.19706,.17243,.18517,
604DATA.16325,.14766,.16307,.17996,.16673,.18510,.18490,.20375,
```

RANK2 19:21 LA 024 05/30/70

ØVERRALL FUND GRØWTH 1.15218 #
UNIT VALUE:VAR 18.6267 SEMIVAR 7.46284 AVE 24.3824

PERIØD	GEØMETRIC GRØWTH#	VARIANCE	SEMIVARIANCE
1	7.71943E-02	1.91937E-02	7.89303E-03
2	1.994	.397349	.186656
3	-3.20774	1.83413	.539372
4	2.34078	.813505	.593092
5	2.0938	.48107	.245943
6	1.07279	.173563	7.25816E-02
7	-2.57943	2.30568	1.18603
8	1.9986	.674881	.365278
9	5.67618	14.4215	7.70691
10	-2.9151	1.98339	.698833

FUND # 10 CØNTINUED

AVERAGE YIELD 3.871 # VAR 8.20101E-02 SEMIVAR 3.73757E-02

PERIØD	YIELD#	VARIANCE	SEMIVARIANCE
1	3.56321	1.81701E-05	1.18422E-05
2	3.5679	6.93893E-05	2.04068E-05
3	3.67477	1.39078E-04	3.79252E-05
4	3.88882	1.52764E-04	5.32781E-05
5	4.00522	9.02076E-05	4.71641E-05
6	4.30642	2.61575E-04	1.11423E-04
7	4.35082	7.43960E-05	2.45877E-05
8	3.92069	7.87803E-05	3.50806E-05
9	3.48545	1.30521E-04	6.26645E-05
10	3.9467	1.71329E-04	8.45602E-05

FUND # 11

```
400DATA16
500DATA9.781,8.588,9.532,10.417,10.982,10.977,11.432,10.260,11.910
501DATA12.019,14.857,12.941,13.896,13.208,13.849,12.964

600DATA.04406,.05183,.04880,.06790,.05612,.05216,.06120,.04805
601DATA.04466,.04369,.03339,.03497,.03947,.05410,.05671,.07067
RUN
```

RANK2 23:16 LA 024 06/09/70

ØVERALL FUND GRØWTH 1.77644 #
UNIT VALUE:VAR 2.99071 SEMIVAR 1.46893 AVE 11.7258

PERIØD	GEØMETRIC GRØWTH#	VARIANCE	SEMIVARIANCE
1	1.5874	.431834	.246332
2	-1.68575	.176157	.106521
3	2.09724	1.39594	.469271
4	-1.72064	.162364	8.47648E-02

AVERAGE YIELD 2.06467 # VAR 7.22186E-02 SEMIVAR 5.34715E-02

PERIØD	YIELD#	VARIANCE	SEMIVARIANCE
1	2.1735	8.02139E-05	2.58048E-05
2	2.22401	2.36343E-05	1.12600E-05
3	1.60219	2.54047E-05	1.27996E-05
4	2.25897	1.22560E-04	6.24770E-05

FUND # 12

```
400DATA22
TAPE
READY.

500DATA10.000,10.105,9.742,9.505,9.760,9.485,8.914,7.988,8.408,
501DATA8.800,8.806,9.219,9.245,8.899,9.757,9.996,11.110,10.030,
502DATA10.475,9.577,9.516,9.106,
600DATA.000,.074,.070,.068,.070,.066,.073,.069,.076,.075,.071,
601DATA.070,.076,.075,.076,.072,.068,.084,.087,.074,.085,.095,
```

RANK2 19:30 LA 024 05/30/70

ØVERALL FUND GRØWTH-.336995 #
UNIT VALUE:VAR .479212 SEMIVAR .224995 AVE 9.4169

PERIØD	GEØMETRIC GRØWTH#	VARIANCE	SEMIVARIANCE
1	-.666142	1.64745E-02	.008242
2	-.321267	.132245	7.63351E-02
3	.262985	3.71707E-02	1.90837E-02
4	.692276	.273176	7.65943E-02
5	-3.44086	.249619	8.70087E-02

AVERAGE YIELD 3.07945 # VAR 5.20512E-02 SEMIVAR 1.66269E-02

PERIØD	YIELD#	VARIANCE	SEMIVARIANCE
1	2.81256	2.75000E-06	1.62500E-06
2	3.0076	7.18750E-06	4.53125E-06
3	2.99733	6.50000E-06	3.25000E-06
4	3.07945	.000035	1.45000E-05
5	3.50031	5.61875E-05	3.16563E-05

FUND # 13

```
400DATA6
TAPE
READY.

500DATA10.854,10.285,10.906,10.675,10.971,10.317
600DATA.02844,.07928,.08656,.09524,.08078,.08767
```

RANK2 19:33 LA 024 05/30/70

ØVERALL FUND GRØWTH-1.37841 #
UNIT VALUE:VAR 6.55002E-02 SEMIVAR 4.04963E-02 AVE 10.7173

PERIØD	GEØMETRIC GRØWTH#	VARIANCE	SEMIVARIANCE
1	-1.37841	6.55002E-02	4.04963E-02

AVERAGE YIELD 3.21153 # VAR 0 SEMIVAR 0

PERIØD	YIELD#	VARIANCE	SEMIVARIANCE
1	3.21153	2.64907E-05	1.17518E-05

FUND # 14

```
400DATA33
TAPE
READY.

500DATA9.999,8.662,8.878,9.414,9.879,10.743,11.084,10.928,11.762
501DATA12.390,12.748,13.283,13.597,13.532,13.532,13.924,13.687
502DATA13.123,11.879,13.025,13.636,14.180,14.580,14.536,14.122
503DATA15.918,15.935,18.017,16.205,17.209,16.407,16.979,16.115
600DATA.04029,.06605,.07266,.08302,.07279,.08081,.07857,.09725
601DATA.08239,.08808,.09710,.09521,.09498,.10028,.10250,.10661
602DATA.11306,.10849,.11209,.11580,.11450,.10559,.11502,.10627
603DATA.11020,.10208,.08846,.09200,.09252,.09428,.09844,.11177
604DATA.11670
```

RANK2 19:36 LA 024 05/30/70

ØVERALL FUND GRØWTH 1.95896 #
UNIT VALUE:VAR 5.82289 SEMIVAR 3.07726 AVE 13.4347

PERIØD	GEØMETRIC GRØWTH#	VARIANCE	SEMIVARIANCE
1	3.34125	.224923	.101864
2	2.29135	.148028	4.79345E-02
3	2.3512	.218005	.110851
4	.285136	2.57217E-02	9.35028E-03
5	.963283	.412125	.268713
6	-.102414	4.20748E-02	2.11266E-02
7	.447732	.761214	.200026
8	-1.62864	.190743	9.73941E-02

AVERAGE YIELD 4.49603 # VAR .334847 SEMIVAR .19;235

PERIØD	YIELD#	VARIANCE	SEMIVARIANCE
1	3.40014	3.68188E-05	1.47757E-05
2	3.91388	5.38839E-05	1.48526E-05
3	4.33353	1.17454E-05	8.30160E-06
4	4.87705	2.36459E-05	9.53080E-06
5	5.20526	7.73615E-06	4.57245E-06
6	5.04595	1.41175E-05	5.63560E-06
7	4.32995	2.54869E-05	8.20207E-06
8	4.8625	8.50802E-05	4.21027E-05

FUND # 15

```
400DATA4
TAPE
READY.

500DATA12.839,13.661,12.316,12.324
600DATA.08428,.09409,.09259,.09379



RANK2      19:39   LA 024 05/30/70



ØVERALL FUND GRØWTH-1.01825 #
UNIT VALUE:VAR .300694 SEMIVAR .10812  AVE 12.785


PERIØD      GEØMETRIC GRØWTH#    VARIANCE     SEMIVARIANCE

 1               -1.01825          .300694         .10812



AVERAGE YIELD 2.84095 #    VAR 0 SEMIVAR 0



PERIØD          YIELD#           VARIANCE     SEMIVARIANCE

 1                2.84095        1.62195E-05    1.19284E-05
```

FUND # 16

```
400DATA39
TAPE
READY.
500DATA9.672,9.953,9.481,10.796,11.398,11.684,12.355,12.003,11.468,
501DATA10.299,10.014,11.686,12.103,12.093,12.673,12.978,13.379,
502DATA14.099,14.334,14.936,15.164,14.277,15.104,15.009,14.452,
503DATA13.498,13.339,13.968,14.793,14.949,14.457,14.362,15.309,
504DATA15.505,16.536,16.660,16.675,14.688,15.730,
600DATA.06933,.07795,.08347,.09428,.07674,.08425,.09237,.10232,
601DATA.07358,.08940,.09554,.10231,.08425,.10034,.09266,.10547,
602DATA.09521,.09856,.10038,.11346,.10268,.10742,.10536,.12663,
603DATA.11506,.11560,.11055,.13276,.11192,.11958,.12562,.14324,
604DATA.11746,.12798,.13142,.13030,.12775,.12581,.13427,
```

RANK2 19:41 LA 024 05/30/70

ØVERALL FUND GRØWTH 1.05102 #
UNIT VALUE:VAR 3.13631 SEMIVAR 1.75032 AVE 13.6881

PERIØD	GEØMETRIC GRØWTH#	VARIANCE	SEMIVARIANCE
1	3.42963	.314332	.151676
2	-4.42827	.669242	.321808
3	2.04774	.123444	5.20884E-02
4	2.51559	.296364	.154781
5	.280021	.124299	8.79864E-02
6	-2.90589	.472277	.218328
7	.863954	.141338	8.40929E-02
8	3.58667	.596028	.287629
9	-1.42576	.667554	.401623

AVERAGE YIELD 4.02673 # VAR .340673 SEMIVAR .16542

PERIØD	YIELD#	VARIANCE	SEMIVARIANCE
1	3.22008	4.86583E-05	2.76261E-05
2	3.34235	1.13069E-04	6.93032E-05
3	3.51575	5.07353E-05	2.95456E-05
4	3.70156	1.37617E-05	5.96301E-06
5	3.97295	1.57621E-05	6.04985E-06
6	4.33346	3.50141E-05	1.16369E-05
7	4.53761	5.88653E-05	2.99136E-05
8	4.81753	8.46609E-05	4.05153E-05
9	4.79928	1.00168E-05	4.25858E-06

FUND #17

```
400DATA20
TAPE
READY.

500DATA11.66,12.11,11.66,12.36,12.57,11.92,11.35,10.24,10.92
501DATA11.99,11.58,12.30,12.07,11.15,12.38,12.95,12.84,12.53
502DATA12.32,12.25
600DATA.0855,.0867,.0899,.0883,.1039,.0937,.0956,.0936,.1030
601DATA.0936,.0891,.0894,.0956,.0873,.0868,.0881,.0968,.0867
602DATA.0841,.0878
```

RANK2 19:47 LA 024 05/30/70

ØVERALL FUND GRØWTH .247114 #
UNIT VALUE:VAR .427339 SEMIVAR .268412 AVE 11.9575

PERIØD	GEØMETRIC GRØWTH#	VARIANCE	SEMIVARIANCE
1	1.46821	9.04688E-02	4.13281E-02
2	-4.99616	.73245	.416825
3	3.01978	.266719	.154578
4	1.77489	.424669	.244928
5	-1.1691	.052625	2.06125E-02

AVERAGE YIELD 3.13122 # VAR 1.37451E-02 SEMIVAR 5.34689E-03

PERIØD	YIELD#	VARIANCE	SEMIVARIANCE
1	3.00515	2.75000E-06	1.30500E-06
2	3.31732	1.79150E-05	4.95500E-06
3	3.21698	3.15319E-05	1.02567E-05
4	3.06861	1.28225E-05	3.36687E-06
5	3.04803	2.28725E-05	7.07187E-06

FUND # 18

```
400DATA28
TAPE
READY.

500DATA9.529,7.918,7.900,8.465,8.866,9.482,9.558,9.419,9.840,
501DATA10.144,10.478,10.921,11.131,11.152,10.811,11.138,11.102,
502DATA10.580,9.440,9.811,10.241,10.384,10.707,10.452,10.306,
503DATA11.017,11.532,12.764,
600DATA.07868,.07666,.07643,.08574,.07698,.08264,.08296,.09344,
601DATA.09076,.08905,.09044,.11279,.10058,.10222,.09394,.11030,
602DATA.11066,.10389,.10112,.11489,.10354,.11469,.11573,.12385,
603DATA.12112,.11176,.11132,.11856,
```

RANK2 19:55 LA 024 05/30/70

ØVERALL FUND GRØWTH 1.04936 #
UNIT VALUE:VAR 1.14614 SEMIVAR .632178 AVE 10.1817

PERIØD	GEØMETRIC GRØWTH#	VARIANCE	SEMIVARIANCE
1	-2.91662	.437488	.148008
2	1.52413	7.45747E-02	5.41144E-02
3	2.64004	.161222	7.41215E-02
4	1.57181E-02	2.03935EE-02	1.52522E-02
5	-3.04326	.420626	.201885
6	.511154	2.85065E-02	1.14673E-02
7	5.49313	.805339	.3394

AVERAGE YIELD 4.18983 # VAR .305941 SEMIVAR .172145

PERIØD	YIELD#	VARIANCE	SEMIVARIANCE
1	3.33204	1.42601E-05	4.13977E-06
2	3.52629	3.53313E-05	1.30765E-05
3	4.01973	9.70869E-05	2.45816E-05
4	4.27159	3.39220E-05	1.56362E-05
5	4.51842	2.95640E-05	1.41432E-05
6	4.80439	5.22710E-05	2.97707E-05
7	4.85633	1.80659E-05	8.63545E-06

FUND # 19

```
400DATA27
500DATA7.719,7.766,8.132,8.553,9.285,9.489,9.356,9.819,10.084,
501DATA10.169,10.675,11.088,11.143,11.040,11.668,11.689,11.305,
502DATA10.335,11.081,11.788,12.364,13.137,13.245,12.493,14.332,
503DATA13.906,14.803,
600DATA.03889,.03728,.04254,.03880,.04027,.04841,.05071,.04508,
601DATA.05724,.06218,.05494,.06696,.05756,.06889,.06856,.08604,
602DATA.07346,.07114,.08627,.09289,.09678,.07378,.07375,.07280,
603DATA.07780,.07981,.08665,.05725,
```

RANK2 20:17 LA 024 05/30/70

ØVERALL FUND GRØWTH 2.31194 #
UNIT VALUE:VAR 2.64597 SEMIVAR 1.13406 AVE 11.3686

PERIØD	GEØMETRIC GRØWTH#	VARIANCE	SEMIVARIANCE
1	2.26875	.132567	9.54038E-02
2	2.11162	9.61252E-02	3.65282E-02
3	1.28282	6.38967E-02	1.69703E-02
4	-1.32653	.243627	.14738
5	2.95631	.353736	.196875
6	4.33277	.745157	.483373

AVERAGE YIELD 3.17777 # VAR .454785 SEMIVAR .264271

PERIØD	YIELD#	VARIANCE	SEMIVARIANCE
1	2.08336	2.60565E-05	1.28327E-05
2	2.56565	3.87254E-05	2.39121E-05
3	3.0629	2.15077E-05	1.57311E-05
4	3.70525	4.86697E-05	2.46679E-05
5	3.94248	1.12878E-04	5.54932E-05
6	3.707	2.46944E-05	1.09856E-05

FUND # 20

```
400DATA27
500DATA10.000,10.069,10.397,10.706,11.607,12.029,12.289,12.742
501DATA11.902,13.191,13.609,14.014,12.707,11.993,13.130,14.187
502DATA14.741,15.001,14.667,15.247,15.673,16.368,16.468,16.186
503DATA14.973,15.936,14.908,13.937
600DATA.0035,.0739,.0387,.0648,.0695,.0811,.0800,.0892,.0889
601DATA.1068,.0995,.1130,.1245,.1160,.0934,.1100,.1086,.1264
602DATA.1234,.1338,.1266,.1418,.1135,.1308,.1563,.1679,.1609
```

RANK2 20:28 LA 024 05/30/70

ØVERALL FUND GRØWTH 1.38912 #
UNIT VALUE:VAR 2.70395 SEMIVAR 1.42049 AVE 13.9281

PERIØD	GEØMETRIC GRØWTH#	VARIANCE	SEMIVARIANCE
1	3.50762	.361177	.227101
2	1.65931	.400562	.23346
3	-1.61573	.534728	.250385
4	.83532	.086534	.053361
5	1.94457	.253375	.137405
6	-2.03522	.322221	.157468

AVERAGE YIELD 4.05458 # VAR .930623 SEMIVAR .540639

PERIØD	YIELD#	VARIANCE	SEMIVARIANCE
1	2.37344	2.40622E-04	1.54070E-04
2	3.40837	9.45219E-05	3.38767E-05
3	4.23127	8.08125E-05	4.72812E-05
4	4.0949	1.36460E-04	6.58600E-05
5	4.9094	5.02400E-05	2.17600E-05
6	5.31011	4.53232E-04	2.36912E-04

FUND # 21

```
400DATA42
TAPE
READY.

500DATA13.253,12.932,13.048,12.789,14.356,14.941,15.341,16.279
501DATA15.941,15.497,13.739,13.494,15.395,16.088,16.042,16.813
502DATA17.182,17.879,18.513,18.826,19.354,19.538,18.360,19.231
503DATA19.320,18.796,17.351,16.852,18.092,19.013,19.342,18.935
504DATA18.617,18.770,20.164,21.074,20.765,20.610,18.858,19.998
505DATA18.228,18.000
600DATA.1209,.1152,.1118,.1154,.1646,.1187,.1089,.1195,.1200
601DATA.1163,.1133,.1218,.1298,.1178,.1317,.1239,.1273,.1230
602DATA.1393,.1421,.1442,.1449,.1255,.1525,.1579,.1411,.1493
603DATA.1417,.1519,.1484,.1692,.1297,.1622,.1673,.1611,.1537
604DATA.1427,.1585,.1533,.1440,.1580,..1837
```

RANK2 20:32 LA 024 05/30/70

ØVERALL FUND GRØWTH .807586 #
UNIT VALUE:VAR 4.75039 SEMIVAR 2.83558 AVE 17.5358

PERIØD	GEØMETRIC GRØWTH#	VARIANCE	SEMIVARIANCE
1	3.44486	.799388	.382498
2	.253257	.136693	6.27271E-02
3	4.02476	1.19644	.571956
4	2.74748	.439183	.226381
5	1.35632	.167216	8.76151E-02
6	.588467	.146379	8.45753E-02
7	2.31317	.663506	.2943
8	-.747667	7.31385E-02	2.76792E-02
9	.548437	.107689	.060309
10	-1.15739	.600597	.222322

AVERAGE YIELD 4.28112 # VAR .210568 SEMIVAR .115529

PERIØD	YIELD#	VARIANCE	SEMIVARIANCE
1	3.91248	4.61672E-04	1.19884E-04
2	3.56147	1.96569E-05	1.32314E-05
3	3.69942	3.67969E-05	1.56641E-05
4	3.87722	1.16719E-05	4.67656E-06
5	4.37232	4.74688E-06	2.83281E-06
6	4.42213	1.53968E-04	9.03712E-05
7	4.53173	1.41569E-05	9.37891E-06
8	4.81606	2.56805E-04	1.87690E-04
9	4.72103	4.96100E-05	3.19450E-05
10	4.8973	2.16583E-04	7.31819E-05

FUND # 22

```
400DATA31
TAPE
READY.

500DATA9.73,11.20,11.66,11.54,11.93,12.02,12.48,13.13,13.36
501DATA13.81,14.12,13.42,14.10,14.33,13.72,12.73,12.46,13.14
502DATA13.54,13.47,13.17,13.12,13.49,13.87,14.74,14.74,14.92
503DATA13.13,14.06,12.33,11.78
600DATA.1031,.1157,.0955,.1107,.0999,.1132,.1030,.1044,.1116
601DATA.1325,.1186,.1185,.1186,.1289,.1352,.1294,.1303,.1553
602DATA.1346,.1340,.1461,.1495,.1286,.1299,.1325,.1222,.1270
603DATA.1166,.1258,.1165,.1087
```

RANK2 20:36 LA 024 05/30/70

ØVERALL FUND GRØWTH 7.35408E-02 #
UNIT VALUE:VAR .797217 SEMIVAR .424226 AVE 13.3089

PERIØD	GEØMETRIC GRØWTH#	VARIANCE	SEMIVARIANCE
1	1.97699	.111769	5.21656E-02
2	1.83393	.148225	7.14125E-02
3	.554242	.121869	6.32531E-02
4	1.55412	.167869	7.84906E-02
5	3.70987E-02	2.84188E-02	1.43406E-02
6	1.8411	.167569	.121627
7	-2.67596	.738825	.334262

AVERAGE YIELD 4.3106 # VAR .144047 SEMIVAR 7.29638E-02

PERIØD	YIELD#	VARIANCE	SEMIVARIANCE
1	3.69844	2.95450E-05	1.49825E-05
2	4.04766	1.07632E-04	4.49803E-05
3	4.34315	5.05250E-05	2.27825E-05
4	4.76257	1.10665E-04	3.05625E-05
5	4.83709	7.31525E-05	3.76762E-05
6	4.43328	1.46150E-05	8.32500E-06
7	4.05199	3.66750E-05	1.68725E-05

FUND # 23

```
400DATA41
TAPE
READY.

500DATA10.69,10.70,10.85,10.35,11.73,12.35,12.44,13.35,13.39
501DATA11.82,11.53,12.13,12.63,13.50,13.79,13.70,14.34,14.94
502DATA15.54,16.31,16.90,17.05,16.67,17.62,17.39,16.22,14.68
503DATA15.55,16.21,16.35,17.06,16.67,16.20,17.75,18.42,20.20
504DATA18.31,19.41,17.65,17.63,16.72
600DATA.12,.11,.11,.11,.12,.11,.11,.13,.11,.11,.11,.13,.12
601DATA.11,.11,.13,.12,.12,.12,.13,.13,.13,.13,.15,.14,.15
602DATA.15,.15,.15,.16,.15,.16,.15,.15,.15,.16,.15,.15,.15
603DATA.16,.15
```

RANK2 20:40 LA 024 05/30/70

ØVERALL FUND GRØWTH 1.12215 #
UNIT VALUE:VAR 6.50732 SEMIVAR 3.54804 AVE 15.1513

PERIØD	GEØMETRIC GRØWTH#	VARIANCE	SEMIVARIANCE
1	2.32425	.258419	8.92922E-02
2	2.04187	.238869	.119841
3	1.67085	.166019	7.26406E-02
4	1.52052	9.68687E-02	3.24797E-02
5	3.12976	.554319	.277903
6	.494848	.128669	7.00531E-02
7	-1.54168E-02	.397125	.245862
8	-.230151	.10885	.046325
9	.779569	.84485	.259625
10	-3.66088	.949719	.343267

AVERAGE YIELD 4.99065 # VAR .396891 SEMIVAR .191108

PERIØD	YIELD#	VARIANCE	SEMIVARIANCE
1	4.20561	1.87500E-05	4.68750E-06
2	4.29907	.000075	1.87500E-05
3	4.39252	6.87500E-05	2.81250E-05
4	4.39252	6.87500E-05	2.81250E-05
5	4.6729	.000025	1.25000E-05
6	5.14019	6.87500E-05	2.81250E-05
7	5.60748	0	0
8	5.79439	.000025	1.25000E-05
9	5.70093	1.87500E-05	4.68750E-06
10	5.70093	1.87500E-05	4.68750E-06