Order Number 9513139

Financial patterns of government-owned manufacturing firms in Taiwan

Tu, Yu-Chen, Ph.D.

Lehigh University, 1994

U·M·I
300 N. Zeeb Rd.
Ann Arbor, MI 48106

Financial Patterns of Government-Owned Manufacturing Firms in Taiwan

by

Yu-Chen Tu

Presented to the Graduate and Research Committee

of Lehigh University

in Candidacy for the Degree of

Doctor of Philosophy

in the

College of Business and Economics

Lehigh University

September 1994

Approved and recommended for acceptance as a dissertation in partial fulfillment of the requirements for the degree of Doctor of Philosophy.

September 23, 1994
Date

Geraldo M. de Vasconcellos
Prof. Geraldo M. Vasconcellos
(Dissertation Director)

September 23, 1994
Accepted Date

Committee Members:

Geraldo M. de Vasconcellos
Prof. Geraldo M. Vasconcellos
(Committee Chair)

S G Buell
Prof. Stephen G. Buell

Richard J Kish
Prof. Richard J. Kish

Wei-Min Huang
Prof. Wei-Min Huang

Acknowledgements

I wish to sincerely thank the chairman of my committee Professor Vasconcellos for his continuous encouragement and invaluable suggestions throughout the whole process of preparing this dissertation. Without his patient guidance, this study could never have been completed.

I am grateful to Professor Kish for his helpful comments and recommendations that proved to be very useful. His prompt feedback was an important factor in finishing this study within the limited time period.

Professor Huang was very instrumental in improving and polishing the econometric techniques used in this work. I offer him my sincere gratitude.

I would like to also thank Professor Buell for his critical comments and advice as to how to improve this study.

I am thankful to the Ministry of Audit, Republic of China, for providing invaluable financial data. Mrs. Yueh-Nu Wei, Director of the Statistics Sector, Examination Department, Republic of China, was extremely cooperative in helping me to collect most of the data. I thank her for her help and generosity.

I am indebted to everyone who has added meaning to my life with his or her presence and who has helped me to become the person I am today. My special thanks belong to my wife, Shu-Chen Cheng, who stood by me and provided strong encouragement during the pursuit of my doctorate. To Nien-Tzu and Ming-Han, my two lovely children who have grown up and learned about the United States while I was here during my Ph.D. study. They mean so much in my life.

Finally, I would like to thank my parents, Lu Tu and Yen-Shuai Wu. Even though they died more than twelve years ago, without their hard work and support in my youth, I could not have continued my education, considering that I came from a poor family. If I have success in my life, it will be attributable to them. Especially, I am eternally grateful to my sister, Chiu-Yu Tu, even though there are several thousand miles between us. Her continuous support and encouragement after our parents' death was very important in the accomplishment of this goal.

Table of Contents

List of Tables

List of Figures

Abstract

Empirically-based financial patterns, the long-term stability of these patterns, and distributional properties of financial ratios have received a considerable amount of attention in recent years for both US and UK firms. However, to the best of our knowledge, no study concerning the financial patterns for government-owned firms in Taiwan exists. Moreover, the prior studies offered no evidence about the probability functions of the actual distributions of financial ratios. Using data from twelve government-owned manufacturing firms in Taiwan during the period 1978-1993, the financial patterns of six classifications are developed. The analysis identifies that these patterns are relatively stable over the empirical period even though the magnitude of many underlying ratios changed. Six major ratios are not normally distributed, which is consistent with prior studies. The distributions are either J-shaped, regular, or skewed. The probability functions developed in this study could help to refine the rating processes in performance evaluation. It should be emphasized that this study has developed a generalized empirical model using financial ratios for evaluating the performance of the firms in the industry.

Financial Patterns of Government-Owned Manufacturing Firms in Taiwan

Chapter 1: Introduction

1.1 Significance of Financial Ratio Analysis

Financial statements serve as the primary financial reporting mechanism for a firm, both internally and externally. These statements are the method by which a firm's management communicates financial information to its stockholders. Financial statement analysis is an information-processing system developed to provide relevant data for decision makers. There are some influential and well-known analytical methods in financial statement analysis: Comparative Financial Statement Analysis, Common-size Financial Statement Analysis, Ratio Analysis and other specific methods, such as Working Capital Flow Analysis. In summary, financial ratios have been utilized for both finance and accounting research, and have performed an important role in the field of financial analysis. Therefore, ratio analysis will be the central focus of this study.

What are financial ratios? In general, there are three key categories of financial ratios. First, there are ratios arising from the relationship between various accounting items found in a firm's balance sheet. These accounting items, which include both the assets and claims, i.e. liabilities and equity, are the firm's factors of production. This is the basis for determining the firm's income given its specific costs. Economic theory tells us that the proper combination of inputs, which will minimize costs, is such that for any two inputs, the ratio of marginal products must equal the inverse ratio of the same inputs' price among others. In other words, each firm may discern a certain optimal combination of its assets and claims, represented by ratios of various balance sheet items. In a dynamic world, the firm will at any moment deviate from this optimal structure of ratios, either because of random or other temporary shocks, or because the relative prices (costs) of production factors may change, or due to improvements in technology. Management should then reevaluate its own tactics and resources so as to restore the optimal structure. Therefore, the ratios summarize some aspect of the firm's financial condition at a point in time, and tell how efficiently the firm allocated factors of production in the adjustment process. The second set of ratios are the financial ratios that, in addition to weighing balance sheet factors, include items from a firm's income statement and are used to measure the firm's performance. These ratios reflect both management activity to improve performance and changing market conditions, which may entail the activity of competitors. The third set of ratios expands the information content from the above conventional statements and include items from a firm's fund statement, the statement of changes in financial position, or cash flows statement. This set of ratios reveals how the firm finances its operation by debt, equity, and cash. These ratios reflect the firm's operating, investing and financing activities.

1.2 Research Questions

(1) Financial ratios have been used extensively by researchers for many purposes, such as prediction of corporate failure (Beaver, 1966; Altman, 1968; Taffler, 1982); estimation of

accounting-based measures of risk (Beaver et al., 1970); capital adequacy (Dince and Fortson, 1972); commercial credit scoring (Apilado et al., 1974); takeover targets (Belkaoui, 1978; Rege, 1984); security analysis (Bernhard, 1979); bond rating (Copeland and Ingram, 1982); and evaluation of corporate performance (Giacomino and Mielke, 1988). However, specific sets of financial ratios were developed for the different purposes in each of these studies. As a result, the previous studies are difficult to compare because of the differences in the ratios used, definitions for the constituents of a given ratio, the time periods covered, the industrial classifications of the samples, and the sizes of the companies utilized (Ezzamel and Mar-Molinero, 1990). For example, there are more than one hundred financial ratios documented in the studies (Chen and Shimerda, 1981). Unfortunately, the literature fails to show a consensus on which ratios to use or how they should be defined. Moreover, the majority of evidence is based on the data from US firms and thus may not be generalized to the context of another country or even another industry. With this in mind, the first research question of this paper asks: Which financial ratios are the most significant in the financial analysis for the government-owned firms in Taiwan?

(2) Prior empirical studies of financial ratios have found that financial ratios can be grouped according to some common factors and that ratios within such groups are highly correlated. One consequence of this result is that it is sufficient to select a few ratios from each group to represent the entire class of ratios. Employing data reduction techniques, Pinches, Mingo and Caruthers (1973) developed an empirically-based classification system for financial ratios using factor analysis. This approach has been applied by many researchers to the data from different countries, e.g. Johnson (1979) in the US and Ezzamel et al. (1987) in the UK. However,

the various classifications of financial ratios have been extracted by different studies and a consensus of which classifications of financial ratios to use does not exist.

Furthermore, the standard assumption in financial theory is that the primary objective of a firm is to maximize stockholders' wealth. On the other hand, the reason for the existence of the government-owned firms in Taiwan is not only to assist the development of the private sector, but also to prevent a monopoly in essential goods. This means that wealth maximization may not be the primary objective of the government-owned firms and using the financial patterns of the private sector to measure the performance of the government-owned firms may be inappropriate. But hitherto, most researchers chose to study the private sector instead of the public sector in the field of financial ratio analysis. Therefore, the second research question of this paper is this: Which classifications of financial ratios are particularly appropriate to the government-owned firms in Taiwan?

(3) Even though the results of many studies using data reduction techniques emphasized that a few selected ratios could be used to represent the much larger number of ratios with relatively little loss of information, many of these benefits would be eroded if the patterns underlying financial ratios were not stable over time. Dombolena and Khoury (1980), Richardson and Davidson (1984), and Ezzamel et al. (1987) have showed that the extracted financial patterns were generally unstable over the period. This raises the third research question of this paper: Are the classifications of financial ratios of government-owned firms in Taiwan stable in the long run?

(4) Statistical information about financial ratios can be used by regulatory agencies to evaluate a firm's performance. A further step towards making financial ratios more useful in helping to evaluate a firm's performance would be to produce for a given ratio not only the mean but also higher statistical moments. These distribution characteristics may have important implications for the interpretation of financial ratios. Financial ratios in time-series and cross-sectional analysis revealing non-normai distributions were documented by many studies, such as Deakin (1976), Barnes (1982), and Beecher (1987). However, there is not much evidence concerning the actual type and shapes of these distributions. One exception is Kolari, McInish and Saniga (1989). A clearer understanding of the nature of the distribution of financial ratios could help regulatory agencies evaluate a firm's performance more accurately.

Every January for the past several years, the employees of the government-owned firms in Taiwan have demonstrated against the government about their bonus because the paid bonus has lacked a reasonable tie to the prior year's performance. The contention of this study is that the distribution of financial ratios can be used to eliminate this discrepancy in the government-owned firms. This brings us to the fourth research question of this paper: How can we use financial ratio analysis to evaluate the performance of the government-owned firms in Taiwan?

1.3 The Purposes of this Study

There are three specific purposes of this paper:

(1) To develop empirically-based classifications of financial ratios for government-owned manufacturing firms in Taiwan;

(2) To measure the long-term stability or lack of stability in these classifications over the 1978-1993 time period; and

(3) To determine the probability distributions and their implications for the major financial ratios during the time period.

1.4 The Organization of this Study

This paper is organized into five chapters. Chapter 1 states the research questions and the purposes of the study. In Chapter 2 an overview of the previous evidence and five problems caused by the applications of financial ratios are provided. Chapter 3 explains the statistical methods and the data used. Chapter 4 reports and discusses the results relating to the financial patterns, long-term stability, and probability distributions. The final chapter contains the conclusions and proposes future areas for research.

Chapter 2: Review of the Literature

2.1 Brief History of Financial Ratio Analysis

It is difficult to say when financial ratios were first used. In simple form, some have undoubtedly been around as long as humans have engaged in commerce. During the 1890's, US commercial banks began to use the current ratio for lending purposes. By 1919, the DuPont Company began to use a ratio "triangle" system[1] in the evaluation of its operations.

Bliss (1923) presented the first coherent system of ratios which were cited in a logical a priori fashion. Foulke (1931) developed a group of fourteen ratios which became the most influential and well-known industry average ratio series in the 1930's. Winakor and Smith (1935) indicated that the ratio of net working capital to total assets could be used to predict the failure of firms. In 1942, Merwin compared industry mean ratios of 'discontinuing' firms against 'estimated normal' ratios to predict discontinuance. In 1957, Walter was the first to specifically incorporate the funds statement into ratio analysis. Hickman (1958) used ratios as variables for examining and describing economic activities and predicted the default experience of corporate bond issues. In 1966, Beaver analyzed the ability of ratios to predict the failure of firms. Beaver's study has become a landmark for future research in ratio analysis because he used some powerful statistical techniques in his work. In 1968, Horrigan claimed that the ratio analysis was needed to establish

[1] The top of the triangle was a return on investment ratio (profits / total assets) and the base consisted of a profit margin ratio (profits / sales) and a capital turnover ratio (sales / total assets). This system held promise for providing a framework wherein ratios could be developed in a logical fashion.

an explicit theoretical structure in the future. From that time on, the study of ratios in both empirical and theoretical fields has grown dramatically.

2.2 Problems Caused by the Application of Financial Ratios

2.2.1 The Problem of the Proportionality Assumption Caused by Size and Sector Effects in Ratio Analysis

An important assumption underlying the use of ratios as a control for size differences is strict proportionality between the numerator and the denominator, e.g. Y/X = b. This strict proportionality is assumed both in comparisons of ratios across firms at a point in time and in comparisons of the ratios of firms over time (Foster 1986). For instance, in the context of cross-sectional analysis, we might consider the case where the ratio of two accounting variables Y and X is compared to some characteristic value b. If Y is proportional to X, then for the ith firm the difference between Y_i / X_i and b can be interpreted as an effect attributable to the individual firm --- that is, as an indication of that particular firm's departure from the norm. Thus, under the assumption of proportionality, inferences may be drawn directly from financial ratios.

Although Lev (1974) touched on the size effect in the assumption of the proportionality, it was not until Lev and Sunder (1979) that the full ramifications were examined. They said the use of ratios was necessarily based on a hypothesis (either explicitly specified or implicitly assumed) about the relationship between the numerator variable (e.g., income) and the denominator size variable (e.g., equity). Control for size by ratio was only satisfactory in certain restricted conditions; elsewhere important biases resulted. They showed that in addition to a non-zero intercept term and the non-linear relationship between two variables, the presence of an error term or the dependence of Y on variables other than size will cause bias. The bias will vary with firm size. It was large for small firms and relatively small for large firms. Barnes (1982) found that a cross-sectional distribution of financial ratios revealed skewness as evidence for a non-zero intercept. Fieldsend et al. (1987) concluded that the departure from proportionality was observed by virtue of sector effects and some extent of size effect. The results of Fieldsend et al. (1987) do not support the hypothesis of proportionality, but indicate that the inference about an average-size company's financial structure may be drawn directly from the financial ratio by comparing it with an industry benchmark. As companies become larger, ratios will tend toward the norm for the economy as a whole. Osteryoung, Constand and Nast (1992) concluded that there are significant differences between many of the industry average ratios for small private and large public firms across a large number of well-defined industry groups.

Is the proportionality assumption usually violated? There have also been a number of recent empirical studies testing the proportionality assumption. McDonald and Morris (1984, 1985) presented evidence that the proportionality assumption was not violated. Lee (1985) found that by controlling the effect of firm size and operating sector, some improvement in the normal approximation was made.

In summary, Yli-Olli and Virtanen (1989), Buijink and Jegers (1986), and Lee (1985) have supported the importance of sample selection in studying the behavior of the cross-sectional distribution. Ezzamel and Mar-Molinero (1990) stated that in order to reduce sample heterogeneity, it is better to perform the analysis on only one or on similar industries. Lee (1985) also suggested that large samples are necessarily less homogeneous than small samples and that the lack of homogeneity will show up in the form of non-normality in the distribution of a ratio.

2.2.2 The Problem of the Normal Distribution Assumption in Ratio Analysis

The causal use of industry averages or time series data, without regard to the form of distribution, is inappropriate. A clearer understanding of the nature of the distribution of these ratios could alter the conclusions that are based on the assumption of a normal distribution.

In the early studies, Horrigan (1965) suggested that most ratios tended to be normally distributed, but that there was some evidence of positive skewness. O'Connor (1973) observed that although most of the ratios distributions were skewed, the central area of the distribution was approximately symmetrical. Deakin (1976) concluded that the normality assumption was untenable for eleven well-known ratios, except for the debt/total asset ratio. Then he claimed that a better approximation to normality was obtained by applying a square root or logarithmic transformation to the raw data.

Eisenbeis (1977) said that the transformation may change the interrelationships among the variables and affect the relative positions of the observations of the group. Frecka and Hopwood (1983) assumed a gamma distribution and expressed that the skewness and non-normality of ratios may be caused by the outliners. They used Deakin's original ratios and found that by deleting outliers normality could be achieved for most ratios. So (1987) revealed that the gamma distribution does not fit the distribution of most ratios. Therefore, it is possible that the non-normality of ratios may be due to factors other than outliers. Ezzamel, Mar-Molinero and Beecher (1987) conducted a similar test on the same eleven ratios used in the Deakin study but used the non-normal stable asymmetric Paretian distribution, and concluded that after removing the outliers, many of the distributions were found to be still non-normally and asymmetrically distributed. They argued that it is often impossible to determine the correct transformation to be applied. Therefore, it may be better not to use transformations of the raw data because (1) many decision makers and researchers make use of financial ratios in their raw data form, and (2) there is no general consensus to which transformation method is best.

Information concerning the distribution characteristics of financial ratios has implications for the monitoring of the firm's financial condition by regulatory agencies. Kolari et al.(1989) argued that even though most previous studies demonstrated that ratios are not normally distributed, they offered no evidence concerning the actual types and shapes of these distributions. Kolari et al. used techniques proposed by Pearson and described in Elderton and Johnson (1969) and other techniques proposed by Johnson (1949). All of the distributions turned out to be either J-shaped, regular, skewed, or U-shaped. These distribution characteristics may have essential implications for the interpretation of financial ratios.

2.2.3 The Problem of the Multicollinearity in Ratio Analysis

Kuh and Meyer (1955) demonstrated that the use of financial ratios in multivariate analysis will cause the problem of multicollinearity. Since ratios within classes are very highly correlated, the financial information conveyed may overlap. On the one hand, if all ratios were used, the decision model would contain repetitive-redundant data, e.g. both ratios A/B and B/A were included. On the other hand, if only fully independent ratios were included, the information content of the semi-independent ratios, such as A/B and C/B, would be lost (Benishay, 1971). Identifying those ratios which contain complete information about a firm while minimizing duplication cannot be achieved purely by logic. In fact, it is an empirical matter in which the correlation coefficient is used as a statistical criterion.

2.2.3.1 Data Reduction Techniques Used in Ratio Analysis

In published literature about financial ratios, some empirical rules have been used to remove the multicollineary problem: O'Connor (1973) used correlation analysis; Altman (1968) used discriminant analysis; Libby (1975) used principal component analysis; and Pinches and Mingo (1973) used factor analysis. O'Connor used correlation analysis to select variables with relatively small values of the correlation in his study. However, this technique was very rough because the critical values of the correlations were not reported. Although the results of Altman's study are convincing, the variables used in multiple discriminant analysis were not tested to determine whether the variables were normally distributed and the populations have equal variance-covariance matrices.

To alleviate both the problems of the non-normal distribution and multicollinearity, principal component and factor analysis could be used. These techniques take an original set of correlated financial ratios and reduce it to a smaller set of uncorrelated principal component or factors. These two methods have asymptotic normal distributions, improving with the number of observations (Marascuilo and Levin, 1983).

Even though many researchers treat principal components analysis as just another type of factor analysis, the basic difference is that the factor analysis' assumption is made about the data having common and unique parts, and the principal component analysis simply defines the basic dimensions of the data and makes no assumption about common factors. Strictly speaking, factor analysis is more suitable for the study of ratio analysis than principal component analysis because there are some firm-specific and economy-wide effects in the ratio analysis. (Martikainen, 1992).

2.2.3.2 Comparison of Results of the Literature Using Factor Analysis

Studies employing factor analysis in financial analysis are many. The results from five such studies indicated that the fewer number of factors extracted from the original variables were extremely powerful in explaining most of the information (see Table 1).

The classifications of financial ratios and the most significant ratios, extracted by the above five studies, were rearranged by the structure analysis of financial statements[2] suggested by Bernstein (1989) as Table 2 and Table 3 indicated. The results obtained from the studies vary

[2] In the structure analysis of financial statements, Bernstein (1989) divided the analysis into three categories: (1) Profitability Analysis—analysis of revenue, expense and cost, (2) Activity Analysis— turnover analysis of capital and assets, and (3) Structure Analysis— structure analysis of capital and assets.

widely, such as in the content of classifications and significant ratios used. This disparity may, in part, be attributed to differences in sample size, numbers and types of ratios used, limits imposed on the number of factors extracted, periods of study, and country of study. However, even though using factor analysis could not get the generalized results about financial patterns, factor analysis is still the most common of the data reduction techniques in financial ratio analysis.

Table 1: Results of the Literature Employing Factor Analysis

Authors	# of variables	# of factors	% of reduction	% of explanation
Pinches & Mingo, 1973 in USA	35	7	80	63
Caruthers, Pinches & Mingo, 1973 in USA	48	7	85	92
Stevens, 1973 in USA	20	6	70	82
Ju-Ping Lai, 1983 in Taiwan	29	7	76	90
Ezzamel, Brodie & Mar-Molinero, 1987 in UK	53	10	81	76

Table 2: Classifications of Financial Ratios Extracted by the Literature

Methods / Authors	Profitability Analysis	Activity Analysis	Structure Analysis
Pinches & Mingo, 1973 in USA (#1)	Return of investment	L-T capital intensiveness S-T capital intensiveness	Financial leverage
Caruthers, Pinches & Mingo, 1973 in USA	Return of investment	Capital intensiveness Inventory intensiveness Receivable intensiveness	Financial leverage S-T liquidity Cash position
Stevens, 1973 in USA (#2)	Profitability	Activity	Liquidity Leverage
Ju-Ping Lai, 1983 in Taiwan (#3)	Profitability	Total asset turnover Current asset turnover Status of inventory	Leverage Cash position
Ezzamel, Brodie & Mar-Molinero, 1987 in UK	Profitability I Profitability II	Capital intensiveness Asset turnover I Asset turnover II	Liquidity I Liquidity II L-T debt Working capital Inventory

Notes: #1: Three classifications, "size", "earnings stability" and "debt and coverage stability", are eliminated because they are not formatted by ratio.

#2: Two classifications, "dividend policy" and "price earnings", are eliminated because they are not formatted by ratio.

#3: One classification, "index of market", is eliminated because it is not formatted by ratio.

Table 3: The Most Significant Financial Ratios Extracted by the Literature

Methods / Authors	Profitability Analysis	Activity Analysis	Structure Analysis
Pinches & Mingo, 1973 in USA	net income / total assets	sales / total assets working capital / sales	long-term debt / net worth
Caruthers, Pinches & Mingo, 1973 in USA	net income / net worth	sales / total assets inventory / sales receivable / sales	debt / total capital current assets / current liability cash / fund expenditure
Stevens, 1973 in USA	earning / sales	receivable / earnings	working capital / total assets long-term debt / total assets
Ju-Ping Lai, 1983 in Taiwan	net income / sales	sales / total assets sales / current assets receivable / inventory	total liability / net worth cash / current liability
Ezzamel, Brodie & Mar-Molinero, 1987 in UK	cash flow / total assets cash flow / net capital employed	total debt / net worth intensiveness cash / sales net profit / sales	working capital / total assets quick assets / total assets long-term debt / net capital employed total debt / working capital current liability / inventory

2.2.4 The Problem of the Stability Over Time in Ratio Analysis

A model is only useful for predictive purposes if the underlying relationships and parameters are stable over time. This raises the question of the stationarity of the model and of the ratios themselves over time. Pinches et al. (1973) suggested that even though the magnitude of many ratios in the sample changed, the patterns underlying them remained reasonably stable over time. Johnson (1978) found a high degree of stability in term of the consistency of factor loadings across two industrial groups. However, Dombolena and Khoury (1980) found a substantial amount of instability in the financial ratios between bankrupt and non-bankrupt firms. Richardson and Davidson (1984) have also observed instability in some factor loadings both in terms of ratios and coefficients. Ezzamel et al. (1987) concluded that the financial patterns of the UK manufacturing firms were generally unstable over the empirical period. Clearly, more research is needed in this area particularly as it relates to Taiwanese data.

2.2.5 The Problem of the Sensitivity to Using Alternative Accounting Methods in Ratio Analysis

Are financial ratios and prediction models sensitive to the use of alternative accounting methods? Ketz (1978) found that the general price-level data improved performance slightly over the traditional historical cost data. Norton and Smith (1979) compared the performance of a MDA model using both sets of data and found these were similar. Short (1980) used factor analysis to test whether empirical classifications were similar under both sets of data and found that the results were unaffected.

Chapter 3: Research Plan , Methods, and Data Description

3.1 Outline of the Research Plan

As was discussed in the last chapter, there are five problems caused by the application of financial ratios in previous studies. To avoid these problems, the following procedures will be employed in the empirical analysis performed in this study:

(1) To alleviate the problems of size and sector effects that violate the assumption of proportionality, only twelve large government-owned firms in manufacturing industries will be utilized in the sample.

(2) Even though the distribution of the financial ratios was non-normal as previous studies indicated, there is no consensus as to which transformation method is correct. Therefore, the raw data, which will be used in this study without transformations, are the annual audited financial statements from 1978 to 1993 relating to the above manufacturing firms.

(3) Relying on the previous studies that showed similar results between using the adjusted general price-level data and using the historical cost data, only the historical cost data of the above financial statements will be used as raw data.

(4) To avoid the problem of multicollinearity caused by a high correlation between variables, forty-nine selected ratios (as discussed later in the variables selection) will be studied through principal factor analysis in order to extract the smaller number of independent common

factors. From the financial patterns, this will result in a set of the most significant ratios corresponding to all factors.

(5) To identify the stability of the financial pattern and the major ratios over the empirical time period, the sixteen years of data were divided into three groups. Three statistical methods, i.e., ANOVA, correlation coefficient of factors' loadings, and the Kruskal-Wallis test, were applied in order to demonstrate if the financial patterns are stable in the three different time periods. If any of the three methods showed that the financial patterns were unstable during the empirical period, then the mean averages of each ratio for each year will be calculated to look for the changes of financial trends.

(6) Following the Pearson System[3], each major ratio will reveal a particular type of distribution. Once the distribution is determined, the probability of a firm's ratio can be calculated by the equations suggested by Elderton and Johnson (1969). The probability of a firm's ratio indicates the location of the distribution. This is utilized in ranking the performance of the government-owned firms..

3.2 Research Methods

3.2.1 Factor analysis

The essential purpose of factor analysis is to describe the covariance relationships among many variables in terms of a few underlying, but unobservable, random quantities called 'factors".

[3] See Elderton and Johnson, 1969.

The factor model is motivated by the following argument. Suppose variables can be grouped by their correlations. That is, all variables within a particular group are highly correlated among themselves but have relatively small correlations with variables from a different group. It is conceivable that each group of variables represents a single underlying construct, or factor, that is responsible for the observed correlations.

3.2.1.1 Basic Model of Factor Analysis

Suppose the observable random vector X, with p components, has mean μ and covariance matrix Σ. The factor model postulates that X is linearly dependent upon a few unobservable random variables $F_1, F_2, \ldots, F_m$, called "common factors" and p additional sources of variation $\varepsilon_1, \varepsilon_2, \ldots, \varepsilon_p$, called errors or, "specific factors".

In particular, the factor analysis model is

$$
\begin{aligned}
X_1 - \mu_1 &= a_{11} F_1 + a_{12} F_2 + \cdots + a_{1m} F_m + \varepsilon_1 \\
X_2 - \mu_2 &= a_{21} F_1 + a_{22} F_2 + \cdots + a_{2m} F_m + \varepsilon_2 \\
&\vdots \\
&\vdots \\
X_p - \mu_p &= a_{p1} F_1 + a_{p2} F_2 + \cdots + a_{pm} F_m + \varepsilon_p
\end{aligned}
\qquad \textbf{(3-1)}
$$

or, in matrix notation,

$$
\underset{(P\times 1)}{X - \mu} = \underset{(p\times m)}{A}\ \underset{(m\times 1)}{F} + \underset{(p\times 1)}{\varepsilon} \qquad \textbf{(3-2)}
$$

where $m \leq p$; m is the number of factors, and p is the number of variables; a_{ij} is called the "factor loading" of the ith variable on the jth factor.

We also assume that

$$\underset{(m\times 1)}{E(F)} = 0, \quad \underset{(m\times m)}{Cov(F) = E(FF')} = I \quad ; \text{and } \underset{(p\times 1)}{E(\varepsilon)} = 0,$$

$$Cov(\varepsilon) = E(\varepsilon\varepsilon') = \Psi = \underset{(p\times p)}{\begin{vmatrix} \Psi_1 & 0 & \cdots\cdots & 0 \\ 0 & : & & \\ : & & & \\ 0 & 0 & \cdots\cdots & \Psi_p \end{vmatrix}} \qquad \textbf{(3-3)}$$

and $\underset{(p\times m)}{Cov(\varepsilon,F)} = 0$

From (3-2) and (3-3), the covariance structure for X is

$$\Sigma = Cov(X) = E(X - \mu)(X - \mu)'$$
$$=E[(AF + \varepsilon)(AF + \varepsilon)']$$
$$=E[AF(AF)' + \varepsilon(AF)' + AF\varepsilon' + \varepsilon\varepsilon']$$
$$=AE(FF')A' + E(\varepsilon F')A' + AE(F\varepsilon') + E(\varepsilon\varepsilon')$$
$$= \underset{(p\times m)}{A} \; \underset{(m\times p)}{A'} + \underset{(p\times p)}{\Psi} \qquad \textbf{(3-4)}$$

The expression in (3-4) also can be presented as

$$Var(X_i) = a_{i1}^2 + a_{i2}^2 + \text{------------} + a_{im}^2 + \Psi_i$$
$$= h_i^2 \qquad + \qquad \Psi_i$$

where h_i^2 and Ψ_i are commonly called the communality and specific variance respectively. For example, that portion of the variance of the ith variable contributed by the m common factors is called the ith communality (h_i^2), that portion of Var(X_i) due to the specific factor is often called the uniqueness, or specific variance(Ψ_i).

Similarly, from (3-2) and (3-3), the covariance of X and F is

$$\begin{aligned} \mathrm{Cov}(X,F) &= E(X - \mu) F' \\ &= E(AF + \varepsilon) F' \\ &= E(AFF' + \varepsilon F') \\ &= AE(FF') + E(\varepsilon F') \\ &= \underset{(p\times m)}{A} \end{aligned} \qquad (3\text{-}5)$$

, and hence $\mathrm{Cov}(X_i, F_j) = a_{ij}$.

From (3-4), we know that the factor model assumes $p+p(p-1)/2=p(p+1)/2$ variances and covariances for X can be produced from the p×m factor loading a_{ij} and the p specific variances Ψ_i. When the total number of common factors m is small relative to the total number of variables p, then factor analysis is most useful. In this case the factor model provides a "simple" explanation of the covariation in X with fewer parameters than the $p(p+1)/2$ parameters in Σ.

3.2.1.2 Principal Factor Model

If we start the principal factor model on the basis of the sample correlation matrix R rather than the sample covariance matrix S, the factor model $\rho = AA' + \psi$ will be correctly specified. The m common factors should account for the off-diagonal elements of ρ, as well as the communality portions of the diagonal elements $\rho_{ii} = 1 = h_i^2 + \psi_i$. If the specific contribution ψ_i is removed from the diagonal, or the 1 replaced by h_i^2, the resulting matrix is $\rho - \psi = AA'$.

Suppose initial estimates, ψ_i^* , of the specific variances are available. Then by replacing the ith diagonal element of R by $h_i^{*2} = 1 - \psi_i^*$, we obtain a ' reduced' sample correlation matrix

$$\mathbf{R_r} = \begin{vmatrix} h_1^{*2} & r_{12} & \cdots\cdots & r_{1p} \\ r_{21} & h_2^{*2} & \cdots\cdots & r_{2p} \\ \vdots & \vdots & & \\ r_{p1} & r_{p2} & \cdots\cdots & h_p^{*2} \end{vmatrix}$$

Now, R_r is factored as $R_r \approx A_r^* A_r^{*\prime}$.

According to the spectral decomposition, when we only select the number of factors m, $A_r^* = \{a_{ij}^*\} = [\sqrt{\lambda_1^*}\ e_1^* \mid \sqrt{\lambda_2^*}\ e_2^* \mid \ldots\ldots\ldots \mid \sqrt{\lambda_m^*}\ e_m^*\ ]$; the reestimated specific contribution $\Psi_i^* = 1 - \sum_{j=1}^{m} a_{ij}^{*2}$, and reestimated communality would be $h_i^{*2} = \sum_{j=1}^{m} a_{ij}^{*2}$.

Ideally, the contribution of the first few factors to the sample variances of the variables should be large. The contribution to the sample variance p, due to the process of standardization, from the first common factor is $\sum_{i=1}^{p} a_{i1}^{*2} = a_{11}^{*2} + a_{21}^{*2} + \text{------} + a_{p1}^{*2} = [\sqrt{\lambda_1^*}\ e_1^*\ ]' [\sqrt{\lambda_1^*}\ e_1^*\ ] = \lambda_1^*$. Therefore, the proportion of total sample variance due to the jth factor is λ_j^* / p, consequently highlighting the explanatory ability of the jth factor in the total information of the sample.

3.2.1.3 Flowchart of Factor Analysis[4]

The basic steps in a Factor Analysis are as follows:

(1) The raw data are entered.

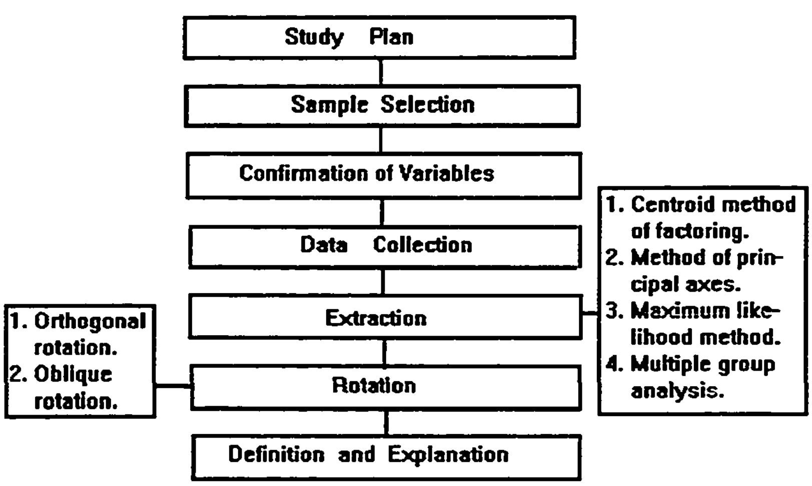
(2) The variance-covariance or correlation matrix is obtained from the raw data.

(3) An initial component solution of the extracted method is obtained.

(4) A simple structure is obtained by the appropriate method of factor rotation.

(5) Factor definition and explanation.

The following flowchart may clearly show the procedures of applying Factor Analysis:



[4] For more discussions about the procedures of Factor Analysis, refer to Bernstein, Garbin and Teng (1988), pp. 157-197.

3.2.2 ANOVA, Correlation Coefficient of Factors' Loadings, and the Kruskal-Wallis Test

To gain further insight into the extent of long-term stability of financial patterns, (a) the standard normal theory based one-way ANOVA will be used to test whether the underlying structure of the financial patterns is different within the different time periods, (b) the correlation coefficient of the loadings on each defined factor will be used to test whether the individual classifications are stable over the whole time period, (c) a rank theory based on the Kruskal-Wallis statistics will be used to test whether the individual ratio is stable during the empirical period, and finally (d) the mean average ratios will be used to compare the differences between the different periods and to capture the financial trends in the empirical period.

3.2.2.1 ANOVA (Analysis of Variance)

ANOVA is a statistical technique designed to determine whether or not a particular classification of the data is meaningful. The total variation in the dependent variable can be expressed as the sum of the variation between classes and the variation within each class. This decomposition is used to structure an F test to test the hypothesis that the between-class variation is large relative to the within-class variation, which implies that the classification is meaningful, i.e., that there is a significant variation in the dependent variable between classes.

3.2.2.2 Correlation Coefficient of Factors' Loadings

Correlation coefficient is a measure of the linear association between two variables, calculated as the square root of the R^2 obtained by regressing one variable on the other and signed to indicate whether the relationship is positive or negative. As discussed earlier in Factor Analysis, the factor loadings represent the relationship between variables and factors. The higher the correlation coefficient between two sets of loadings, the higher the correlation between the two factors. Therefore, calculating the correlation coefficient of the loadings on a defined factor for some pairs of data sets could test the stability of the factor over time.

3.2.2.3 Kruskal-Wallis Test

The Kruskal-Wallis Test is a kind of nonparametric ANOVA. If the usual assumptions of normality and homogeneity of variance are not satisfied, the commonly used procedure for equality of group means is the Kruskal-Wallis Test which uses the ranks of the observations. All of the observations X_{ij} are ranked jointly. Let R_{ij} equals the rank of X_{ij} in the combined sample, $\overline{R_{i.}} = (1/J_i)\sum_{j=1}^{J_i} R_{ij}$ be the average rank in the ith group, where J_i is the number of observations of the ith group; and $\overline{R_{..}} = \frac{1}{N}\sum_{i=1}^{I}\sum_{j=1}^{J_i} R_{ij} = \frac{N+1}{2}$ be the average rank of the total sample, where N is the total number of observations. As in the analysis of variance, let $SS_B = \sum_{i=1}^{I} J_i(\overline{R_{i.}} - \overline{R_{..}})^2$, the variation of the treatment means among treatments, be a measure of the dispersion of the $\overline{R_{i.}}$. SS_B may be used to test the null hypothesis that the probability distributions generating the observations under the various treatments are identical. The larger SS_B is, the stronger is the evidence against the null hypothesis.

Under the null hypothesis that the probability distributions of the I groups are identical, the statistic $K = [12/N(N+1)]SS_B = [12/N(N+1)](\sum_{i=1}^{I}\frac{\overline{R_i^2}}{J_i}) - 3(N+1)$ is approximately distributed as a chi-square random variable with I - 1 degrees of freedom.

3.2.3 Pearson and Johnson Distribution Models and the Kolmogorov-Smirnov Test

3.2.3.1 Pearson and Johnson Distribution Models

A well-known system to represent distribution shapes was developed by Karl Pearson. Pearson's model is a solution to a single differential equation where the distribution parameters depend on the population variance, skewness and kurtosis. The Pearson System can be used to classify distributions into thirteen types. In this study, only eight of the thirteen types of Pearson distributions are considered because the other five are special cases of these eight. We can use the criterion k to distinguish the eight main types, where $k = \beta_1(\beta_2 + 3)^2 / 4(4\beta_2 - 3\beta_1)(2\beta_2 - 3\beta_1 - 6)$, $\beta_1 = \mu_3^2 / \mu_2^3$ and $\beta_2 = \mu_4 / \mu_2^2$; where μ_i is ith central moments. This k may have any value from $-\infty$ to $+\infty$, and from the following diagram it will be seen how the types cover all the possible values of the criterion and do not overlap.

$k = -\infty$ $k = 0$ $k = 1$ $k = \infty$

type 1   type 4   type 6

|<--------------------------------|----------------------------------|--------------------------->|

type 3   normal curve (β_2=3)   type 5   type 3

type 2 (β_2<3)

type 7 (β_2>3)

The Pearson System is one of the most common systems for modeling the type and shape of an observed frequency distribution. There is another system, the Johnson System, which is even more efficient in calculating probabilities. The Johnson System classifies an observed distribution as bounded or unbounded. The thirteen shapes depend upon the particular combination of variance, skewness and kurtosis, and probability density functions that assign shape are given in Elderton and Johnson(1969). For the eight main types utilized in this study, a graph of each distribution, the characterization of its shape in the Pearson system and the Pearson type are rearranged in Table 4. Once an initial type is made, the probability density functions can be calculated directly from the matched equations (as in Table 5).

When the probability density functions are calculated from the various types of frequency curves, it is necessary to test whether or not the functions obtained are reasonable. A statistical technique for testing the goodness of fit between a set of sample observations and a theoretical distribution called the Kolmogorov-Smirnov Test can work out this matter.

Table 4:

The Taxonomy of the Pearson System

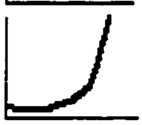
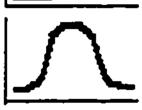
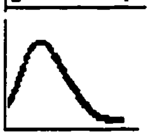
Graph	Shape	Pearson type	Nature of bound
	U	Type 1, 2	bounded both sides
	J	Type 1, 3, 6	right side bounded
	Reverse J	Type 1	left side bounded
	Normal	Normal curve	unbounded both sides
	Skew	Type 4	unbounded both sides
	Symmetric	Type 7 Type 2	unbounded both sides bounder both sides
	Regular (cocked-hat)	Type 1, 3, 5, 6	one side bounded

Table 5: Equations to Curves in Form Used by Elderton & Johnson (1969)

Type	Equation	Origin for x	Limits for x
1	$y = y_0(x)^{m_1}(1 - x/a)^{m_2}$	At start	$0 \le x \le a$
2	$y = y_0(1 - x^2/a^2)^m$	At mode(= mean)	$-a \le x \le a$
3	$y = y_0(1 + x/a)^{\gamma a} e^{-\gamma x}$	At mode	$-a \le x < \infty$
4	$y = y_0(1 + x^2/a^2)^{-m} e^{-v \tan^{-1} x/a}$	$va/(2m-2)$ after mean	$-\infty < x < \infty$
5	$y = y_0 x^{-p} e^{-\gamma/x}$	At start	$0 \le x < \infty$
6	$y = y_0(x)^{q_1}(1 + x/a)^{-q_2}$	At start	$0 \le x < \infty$
7	$y = y_0(1 + x^2/a^2)^{-m}$	At mode(=mean)	$-\infty < x < \infty$
Normal curve	$y = y_0{}^{e^{-x^2/2\sigma^2}}$	At mode(=mean)	$-\infty < x < \infty$

Note: (1) For type 1, when m_1>0 and m_2>0, the curve is regular-shaped; when m_1<0 and m_2>0, the curve is J-shaped; when m_1>0 and m_2<0, the curve is reversed J-shaped; and when m_1<0 and m_2<0, the curve is U-shaped. The parameters are defined as follows:

$a = a_1 + a_2 = 1/2\sqrt{\mu_2}\sqrt{\beta_1(r+2)^2 + 16(r+1)}$, where $r = 6(\beta_2 - \beta_1 - 1)/(6 + 3\beta_1 - 2\beta_2)$;

$m_i = 1/2\{r - 2 \pm r(r+2)\sqrt{\beta_1 / \beta_1(r+2)^2 + 16(r+1)}\ \}$;

when $\mu_3 > 0$, then m_2 is the positive root, and $m_1/a_1 = m_2/a_2$.

(2) For type 2, $m_1 = m_2$. When m_1>0, the curve is symmetric; when m_1<0, the curve is U-shaped.

(3) For type 3, when γa<0, the curve is J-shaped; otherwise the curve is regular-shaped. The parameters are defined as follows: $\gamma = 2\mu_2/\mu_3$; $a = (2\mu_2^2/\mu_3) - (\mu_3/2\mu_2)$.

(4) The parameters of type 4 are defined as follows:

$m = 1/2(r+1)$, where r is the same as that of type 1;

$v = -r(r-2)\sqrt{\beta_1} / \sqrt{16(r-1) - \beta_1(r-2)^2}$.

(5) The parameters of type 5 are defined as follows:

$p = 4 + (8 + 4\sqrt{4 + \beta_1})/\beta_1$; $\gamma = (p-2)\sqrt{\mu_2(p-3)}$.

(6) For type 6, when $q_2 < 0$, the curve is J-shaped; otherwise the curve is regular-shaped.

The parameters of q_1 ,q_2 and a are the same as those of $-m_1$, m_2 and a of type 1.

(7) The parameters of type 7 are defined as follows: $m = (5\beta_2 - 9)/2(\beta_2 - 3)$; $a^2 = 2\mu_2\beta_2/(\beta_2 - 3)$.

3.2.3.2 Kolmogorov-Smirnov Goodness-of-Fit Test

The Kolmogorov-Smirnov Test is named after two Russian mathematicians, A.N. Kolmogorov and N.V. Smirnov, who were primarily responsible for its development. The test for the one-sample case is defined in the following way. If n sample values $X_1, X_2, \ldots\ldots, X_n$ are available, the sample (or empirical) cumulative distribution function, $S_n(x)$, is the proportion of X's which are less than or equal to x. Graphically, we can describe $S_n(x)$ as a step function, which takes a jump at each different observed value x and is constant in between jumps. The amount of the jump at any point is the proportional number of observations having that value.

Let $X_1, X_2, \ldots\ldots, X_n$ also be a random sample from a population with unknown cumulative distribution function F(x), and $F_0(x)$ be a completely specified cumulative distribution function. The hypothesis set is

$$H_0: F(x) = F_0(x) \quad \text{for all } x, \qquad \text{vs.} \qquad H_1: F(x) \neq F_0(x).$$

Kolmogorov and Smirnov suggested considering the statistic

$$D_n = \underset{x}{\text{supremum}} \mid S_n(x) - F_0(x) \mid = \underset{1 \le i \le n}{\text{Max}} \mid S_n(x_i) - F_0(x_i) \mid$$

as a measure of agreement between the empirical and theorized cumulative distribution functions. Note that D_n is the maximum vertical distance between the empirical cumulative distribution function $S_n(x)$ and the theorized cumulative distribution function $F_0(x)$ and occurs at or just before a jump point of $S_n(x)$.

If $F_0(x)$ is the true cumulative distribution function, there should be reasonable agreement between $S_n(x)$ and $F_0(x)$ for all values of x, since $S_n(x)$ is the sample image of the true distribution. Equivalently, the deviations (absolute differences) between $S_n(x)$ and $F_0(x)$ should be small for all x. The Kolmogorov-Smirnov Test statistic is the largest deviation. If the largest deviation is small, it follows that all deviations are small. Thus, under H_0, D_n is expected to be small (as $n \to \infty$, $D_n \to 0$), and $S_n(x)$ resembles $F_0(x)$ more and more with increasing n. It can be shown that under H_0, for $z > 0$, $\lim_{n\to\infty} \Pr(\sqrt{n}D_n \le z) = 1 - 2\sum_{i=1}^{\infty}(-1)^{i-1}e^{-2i^2z^2}$. The Kolmogorov-Smirnov Test then rejects H_0 at level α if $D_n > d_{n,\alpha}$, where $d_{n,\alpha}$, the critical value, is such that $\Pr_{H_0}(D_n > d_{n,\alpha}) = \alpha$.

3.3 Data Description

3.3.1 Time Period

According to "Yearly Statistics of the Republic of China" from 1974 to 1993 edited by Directorate-General of Budget, Accounting and Statistics, Executive Yuan, Republic of China, we can obviously find that there were two periods of business cycles in the past twenty years in Taiwanese industry as the following illustrates.

Year	'74	'75	'76	'77	'78	'79	'80	'81	'82	'83
Growth rate(%)	-4.51	9.46	23.31	13.33	22.53	6.35	6.84	3.54	-0.9	12.7
Year	'84	'85	'86	'87	'88	'89	'90	'91	'92	'93
Growth rate (%)	11.8	2.7	13.9	10.7	4.3	3.7	-1.2	7.2	3.6	2.52

In the first business cycle, the growth rate of industrial production in 1974 was -4.51% at the trough of the economy, 22.53% at the peak in 1978, and 3.54% at the recession in 1981. In the second cycle, the rate again declined to -0.9% in 1982 at the trough, rose to 13.9% in 1986 at the peak, and fell to 3.7% in 1989 at the recession. In the present cycle, the rate was -1.2% in 1990 at the trough followed by small increases in the following years.

In general, the period of a business cycle in Taiwan is approximately eight years. The time period used in this study covered two time periods of business cycle, sixteen years (1978-1993), and were divided into three subsets (as discussed later in the sample design) to test the stability of the financial ratios during the empirical period.

3.3.2 Sample Selection

The characteristics of financial ratios differ by industry and by the scale of business. To avoid the sector and size effects, the large manufacturing firms, with total assets over $1 billion in NT dollars (approximately $40 million US dollars), were selected from the government-owned firms in Taiwan as a sample.

In 1993, the total number of government-owned companies was 39, but only 12 manufacturing firms existed whose total assets were over $1 billion N.T. dollars. The twelve companies are: (1) Taiwan Sugar Co., (2) Taiwan Fertilizer Co., (3) Taiwan Salt Co., (4) Taiwan Agricultural and Industrial Development Co., (5) Taiwan Chung Hsing Paper Co., (6) China Petroleum Co., (7) China Petrochemical Industry Co., (8) China steel Co., (9) China Shipbuilding

Co., (10) Taiwan Machinery Manufacturing Co., (11) Tang-Eng Iron Works , and (12) Kaohsiung Ammonium Sulphate Co.

3.3.3 Data Collection

The financial statements of government-owned firms in Taiwan must be audited by the Ministry of Audit. Therefore, for authenticity only annual audited financial statements from 1978 to 1993 of government-owned manufacturing firms were included in the sample set.

3.3.4 Variables Selection

The variables (financial ratios) were chosen on the basis of their (a) popularity in the literature(Pinches, Eubank, Mingo and Caruthers, 1975; Barlev and Livnat, 1990), (b) popularity in the Ministry of Audit, Republic of China, and (c) potential relevancy to this study. Forty-nine financial ratios were defined in Table 6 and selected as variables to launch into factor analysis.

There are 38, from R1 to R38, of 48 ratios in PEMC (1975) used in this study. The other 10 ratios are eliminated because (1) we use earning before taxes instead of net income, total income and earning before taxes and interest used in PEMC (1975) to compute the profitability ratios in this study; (2) unlike PEMC (1975), we consider that total assets and total capital are the same components; (3) we remove the ratio of Receivables / Inventory because some receivables come from not only the goods sold but also the labor service in the government-owned firms in Taiwan; and (4) we consider that two ratios, net worth / total assets and total liabilities / total assets, are the same ratios because they contain complete overlap information.

Table 6: Financial Ratios (Original Variables) of this Study[5]

R1(CF/OR): Cash flow / Operation revenue	R26(EBT/NW): Earnings before taxes / Net worth*
R2(CL/FA): Current liabilities / Fixed assets	R27(EBT/TL): Earnings before taxes / Total liabilities*
R3(CL/NW): Current liabilities / Net worth	R28(OR/NW): Operation revenue / Net worth*
R4(LL/FA): (Long-term debt + Other liabilities) / Fixed assets	R29(OR/WC): Operation revenue / Working capital*
R5(LL/TA): (Long-term debt + Other liabilities) / Total assets	R30(OR/TA): Operation revenue / Total assets*
R6(TL/NW): Total liabilities / Net worth	R31(CGS/Inv): Cost of goods sold / Inventories*
R7(WC/TA): Working capital / Total assets	R32(EBT/TA): Earnings before taxes / Total assets*
R8(CM/TA): (Cash + Marketable securities) / Total assets	R33(EBT/OR): Earnings before taxes / Operation revenue
R9(CM/CL): (Cash + Marketable securities) / Current liabilities	R34(EBIT/Int): (Earnings before taxes + Interest expense) / Interest expense
R10(CA/TA): Current assets / Total assets	R35(CGS/S): Cost of good sold / Sales
R11(CA/CL): Current assets / Current liabilities; or Working capital / Current liabilities	R36(OR/FA): Operation revenue / Fixed assets*
R12(Inv/CA): Inventories / Current assets	R37(CL/TA): Current liabilities / Total assets
R13(Inv/WC): Inventories / Working capital	R38(TL/TA): Total liabilities / Total assets; or Net worth / Total assets
R14(QA/TA): Quick assets / Total assets	R39(CUI/FA): Cash used in investing activities / Fixed assets
R15(QA/CL): Quick assets / Current liabilities; or (Current liabilities - Quick assets) / Current liabilities	R40(CUI/TUC): Cash used in investing activities / Total uses of cash
R16(OR/Rec): Operation revenue / Accounts receivable*	R41(CWC/TUC): Change in working capital / Total uses of cash
R17(OR/CM): Operation revenue / (Cash + Marketable securities)*	R42(NCFI/TSC): Net cash flows in investing activities / Total sources of cash
R18(OR/CA): Operation revenue / Current assets*	R43(OR2/OR1): Operation revenue(year 2) / Operation revenue(year 1)
R19(S/Inv): Sales / Inventories*	R44(TA2/TA1):Total assets(year 2)/Total assets(year 1)
R20(OR/QA): Operation revenue / Quick assets*	R45(FA2/FA1):Fixed assets(year 2)/Fixed assets(year 1)
R21(QA/TUC): Quick assets / Total uses of cash	R46(TL2/TL1): Total liabilities(year 2) / Total liabilities(year 1)
R22(CM/TUC): (Cash + Marketable securities) / Total uses of cash	R47(NW2/NW1): Net worth(year 2) / Net worth(year 1)
R23(CF/TA): Cash flow / Total assets*	R48(FA/NW): Fixed assets / Net worth
R24(CF/NW): Cash flow / Net worth*	R49(OI/OR): Operation income / Operation revenue; or Operation expense / Operation revenue
R25(CF/TL): Cash flow / Total liabilities*	

[5] (1) The accounting items were chosen from the financial statements listed in Appendix A.
(2) * An average of the begining and the ending, rather than an ending, balance was used in this study.
(3) Components of the ratios were defined as:
Working capital = Current assets - Current liabilities;
Quick assets = Cash + Marketable + Accounts receivable;
Cash flow = Earnings after taxes + Depreciation + Depletion + Amortization + Nonrecurring income / expenses.

The next four ratios, R39 through R42, were selected from Barlev and Livnat (1990). Barlev and Livnat considered that these ratios may measure a unique dimension not captured by ratios based on the balance sheet and income statement alone. The final ratios, R43 through R49, are not included in the literature but are used by the Ministry of Audit, Republic of China, to evaluate the performance of the government-owned firms in Taiwan. Thus, the final ratios should be of particular importance to our study.

Some definitions of ratios in this study are different from those used in the previous studies for two key reasons. First, most of the literature reports the functions containing the items of the balance sheet divided by sales to get the turn-over ratios. In this study, the total operation revenue of some government-owned firms come from not only the revenue of goods sold but also the revenue of labor service. The reason is that the objectives of the government-owned firms are different from those of private sectors as we discussed before. Therefore, we use operational revenue rather than sales to calculate the turn-over ratios. Second, some government-owned firms in this study have no long-term debt but a large amount of other liabilities, such as refundable deposits. The length of the time period for these other liabilities is always longer than one year. We, therefore, combine the long-term debt and other liabilities to be our long-term liabilities.

3.3.5 Sample Design

The empirical time period in this study covered sixteen years form 1978 to 1993. The set consisting of the data from the six years, '78, '81, '84, '87, '90, '93, was used to develop the financial patterns in the whole period. However, financial patterns might change in the sub-periods because of temporary shocks to the economy. To increase the reliability of the financial patterns during the empirical period, the financial patterns from the data of the sub-periods were also developed. Because the whole period covered two business cycles, one set of years, '79, '80, '82, '83, '85, were selected during the first cycle and the set of years, '86, '88, '89, '91, '92, were selected during the second cycle. The subsamples were used to test whether the financial patterns changed during the two cycles. Comparing the results of the three mutually independent data samples could test whether the patterns were stable in the long run.

Chapter 4: Empirical Results and Discussion

The results of applying the statistical methods to financial ratio data are presented in three parts: (1) defining the financial ratio classifications, (2) testing the stability of financial patterns, and (3) determining the types, shapes, and probabilities of the major ratios' distribution.

4.1 The Results of Financial Ratio Classifications

4.1.1 Determination of the Number of Factors

Before applying the formal process of factor analysis, a decision on the number of factors is needed for the analysis. The basic principle of the decision rule for the number of factors is that the fewer the factors and the greater the proportion of the total sample variance explained by the factors we extracted the better the results obtained. In this study, we followed the three methods most often proposed by the literature. (a) Choose only those eigenvectors whose associated eigenvalues are 1.0 or greater (Guttman, 1954; Kaiser, 1958). The eigenvalue of 1 is the arithmetic mean of the eigenvalues of a correlation matrix. The value of 1 is also the variance of each of the variables, and hence the eigenvalue-one-criterion suggests that a factor be retained if it explains at least as much as a single variable. (b) Infer the number of factors from the relations among successive eigenvalues. This inference is usually made graphically by presenting eigenvalues along the Y axis and their serial positions along the X axis. It is known as a scree plot, after the geological term for the rubble at the bottom of a cliff (Cattell, 1966). The goal is to separate the overall curve into two functions with the early eigenvalues representing important factors and the later ones unimportant factors. (c) Use the variance explained as a criterion. This means that we will discard factors whose proportions of total sample variance are less than 5% when 75% of total sample variance has been explained by the extracted factors.

Factor analysis was performed using the statistical package SAS (Statistical Analysis System). Based on the yearly sample correlation matrices of the 49 selected financial ratios in the years ‘78, ‘81, ‘84, ‘87, ‘90, ‘93, and calculated by the SAS procedure of METHOD=PRIN (Principal Factor Analysis) PRIORS=MAX (Maximum absolute correlation coefficient as the estimated communities), Table 7 (refer to Appendix B) summarizes the number of factors extracted by the above three methods. For discussion purposes, the better approach the simpler the results developed, even though the factor analysis indicated that the contents of the factors in different years are sufficiently differentiated. We find that the numbers of factors in the six years extracted by criterion (c) are the most consistent over the whole empirical period. Therefore, method (c) was accepted and the number of factors of six would be appropriate in our study.

Table 7: The Number of Factors Extracted by Different Methods

Year / Method	‘78	‘81	‘84	‘87	‘90	‘93
(a) Scree Test	8	9	8	8	7	8
(b) Eigenvalue > 1	8	8	8	8	7	8
(c) Proportion of Total Variance > 5%	6	6	6	6	6	6

4.1.2 Factor Rotations and the Results

Since the original factor loadings are not readily interpretable, the usual practice is to rotate them until a simple structure is achieved. In this study, we employed both orthogonal and oblique rotation. Orthogonal rotations are appropriate for a factor model in which the common factors are assumed to be independent, whereas oblique rotations are for a model with dependent factors. In reality, the classification of financial ratios are always dependent to some degree. Therefore, for convenience of interpretation, oblique rotations were useful in this analysis because they provided relatively better clustering of variables.

Employing Principal Factor Analysis on the data for the above six years and extracting six factors, the estimated factor loadings[6] of the financial ratios on each of the six factors in each of the six years using oblique rotation are reported in Table 8. The six classifications of financial ratios are defined as (a) Return on Investment, (b) Short-Term Liquidity, (c) Short-Term Capital Turnover, (d) Financial Leverage, (e) Long-Term Capital Turnover, and (f) Growth Rate.

Table 8: Factor Loadings[7] of Financial Ratios for Government-Owned Firms in Taiwan

Classifications & Financial Ratios	Factor Loadings						# of Year That Absolute Factor Loadings > 0.7[8]
	'78	'81	'84	'87	'90	'93	

[6] In oblique rotation, the factor pattern (regression coefficients) is no longer the same as the structure (correlations). Therefore, the correlation matrix of the factor structure were used for the factor loadings because it is less affected by sampling error than the pattern matrix.

[7] For more details, see Appendix C.

[8] (1) With very high factor correlation, it is quite possible for a variable to be explained by one factor. A loading of 0.7 was chosen since the square of this times 100 equals approximately 50 percent. Variables with less than 50 % common variation with the rotated factor structure were considered too weak to report.

(2) *** indicated that the ratio is the most significantly correlated with the corresponding factor.

Factor 1: Return on Investment								
R1(CF/OR)	-.73	.97	.96	.77	.85	.98	6	
R23(CF/TA)	-.79	.87	.96	.89	.98	.88	6	
R24(CF/NW)	-.88	.72	.94	.97	.97	.55	5	
R25(CF/TL)	-.33	.97	.92	.73	.48	.96	4	
R26(EBT/NW)	-.90	.73	.95	.96	.97	.51	5	
R27(EBT/TL)	-.45	.97	.94	.78	.52	.95	4	
R32(EBT/TA)	-.78	.92	.98	.91	.98	.90	6	***
R33(EBT/OR)	-.69	.98	.98	.84	.90	.96	5	
R35(CGS/S)	.23	-.71	-.67	-.82	-.69	-.85	3	
R49(OI/OR)	-.30	.41	.78	.86	.76	.82	4	
Factor 2: Short-Term Liquidity								
R2(CL/FA)	.93	.69	.80	-.08	-.35	-.12	2	
R3(CL/NW)	.75	.32	.80	-.27	-.39	-.26	2	
R7(WC/TA)	-.05	-.14	-.54	.62	.65	.78	1	
R8(CM/TA)	-.34	-.03	-.26	.89	.65	.89	2	
R9(CM/CL)	-.62	-.58	-.84	.60	.88	.93	3	***
R10(CA/TA)	.94	.87	.67	.75	.20	.54	3	
R11(CA/CL)	-.18	-.48	-.83	.48	.83	.92	3	
R12(Inv/CA)	.28	-.09	-.05	-.80	-.33	-.71	2	
R14(QA/TA)	.83	.55	.45	.93	.51	.81	3	
R15(QA/CL)	-.04	-.44	-.78	.59	.88	.93	3	
R21(QA/TUC)	.42	.72	.28	-.14	.97	.95	3	
R22(CM/TUC)	-.55	.39	-.14	.74	.98	.95	3	
R34(EBIT/Int)	-.12	-.04	-.75	.80	.97	.13	3	
R37(CL/TA)	.85	.81	.89	-.24	-.55	-.48	3	
R41(CWC/TUC)	-.45	-.38	-.12	-.41	.95	-.04	1	
Factor 3: Long-Term Capital Turnover								
R28(OR/NW)	-.37	.55	.51	.44	.89	.72	2	
R30(OR/TA)	-.09	.96	.94	-.30	.28	.53	2	

R36(OR/FA)	-.05	.91	.81	-.20	.55	.86	3	***
Factor 4: Financial Leverage								
R4(LL/FA)	-.64	.88	.83	.46	.38	.35	2	
R5(LL/TA)	-.68	.70	.85	.40	.68	.58	2	
R6(TL/NW)	-.64	.97	.66	.80	.27	.96	3	
R38(TL/TA)	-.86	.91	.62	.89	.38	.70	4	
R48(FA/NW)	-.76	.86	.78	.74	.89	.95	6	***
Factor 5: Growth Rate								
R39(CUI/FA)	-.49	.91	.85	.84	.61	.12	3	
R40(CUI/TUC)	-.39	.86	.78	.23	-.04	-.06	2	
R42(NCFI/TSC)	.37	-.90	-.63	-.95	-.47	.37	2	
R43(OR2/OR1)	-.17	-.53	.27	.28	.84	.11	1	
R44(TA2/TA1)	-.25	.81	-.01	.72	.93	.95	4	***
R45(FA2/FA1)	-.51	.93	.69	.89	.67	.90	3	
R46(TL2/TL1)	-.24	.72	-.03	.72	.61	.91	3	
R47(NW2/NW1)	-.29	.41	.30	.24	.93	.24	1	
Factor 6: Short-Term Capital Turnover								
R13(Inv/WC)	-.14	-.13	.18	.72	-.82	-.51	2	
R18(OR/CA)	.88	.14	.14	-.37	.77	.94	3	
R19(S/Inv)	.97	.67	.76	-.37	.81	.85	4	***
R20(OR/QA)	.45	-.32	-.09	-.28	.45	.86	1	
R29(OR/WC)	.29	.26	.06	-.86	.55	-.61	1	
R31(CGS/Inv)	.96	.65	.79	-.22	.73	.86	4	

4.1.3 The Significance of the Extracted Classifications of Financial Ratios

4.1.3.1 Return on Investment (Factor 1)

The Ratios of Return on Investment are divided into two types: (1) those showing profitability in relation to sales, such as the ratios of R1 (CF/OR), R33 (EBT/OR), R35 (CGS/S) and R49 (OI/OR), and (2) those showing profitability in relation to capital investment, such as the ratios of R23 (CF/TA), R24 (CF/NW), R25 (CF/TL), R26 (EBT/NW), R27 (EBT/TL), R32 (EBT/TA). Together, these ratios indicate the firm's overall effectiveness of operation.

4.1.3.2 Short-Term Liquidity (Factor 2)

The classification of Short-Term Liquidity indicates the relationship between current assets and current liabilities. The ratios of Short-Term Liquidity are used to measure a firm's ability to meet short-term obligations. Liquidity has two dimensions: (1) the time required to convert the assets into money, and (2) the certainty of the realized price. A firm having current assets composed principally of cash and non-overdue receivables is generally regarded as more liquid than a firm whose current assets consist primarily of inventories. Therefore, the quick ratio R15 (QA/CL) would provide a more penetrating measure of liquidity than did the current ratio R11(CA/CL), and the cash position ratio R9 (CM/CL) would provide a more penetrating measure of liquidity than did the quick ratio R15 (QA/CL). From ratios of this classification, much insight can be obtained into the present cash solvency of the firm and the firm's ability to remain solvent in the event of adversity.

4.1.3.3 Long-Term Capital Turnover (Factor 3)

Turnover ratios, also known as activity or efficiency ratios, measure how effectively the firm is using its assets. The classification of Long-Term Capital Turnover focuses on only the operating efficiency of fixed assets and long-term capital, e.g., R30 (OR/TA) called the total asset turnover ratio tells us the relative efficiency with which a firm utilizes its total assets to operation revenue. The destination of utilizing assets or capital is to create operating income, and this classification is also a complementary indicator of profitability. For example, R30 (OR/TA) in this classification together with two ratios, R33 (EBT/OR) and R32 (EBT/TA), in the classification of Return on Investment comprises the so-called DuPont triangle system of ratio analysis to evaluate a firm's operations.

4.1.3.4 Financial Leverage (Factor 4)

The ratios of Financial Leverage tell us the relative structure of the long-term capital. A firm may finance its activity either through the use of borrowed funds or through investment of the owners' money. Net worth is the basic reserve, not warranting payment to the interest or dividend of capital and not limited to a period of solvency. Long-Term debt borrowed outside needs to pay fixed interest and has a limited period of payment. The greater the net worth, the more security the firm provides to the creditor. The longer the debt, the more debt capacity the firm has in the capital structure. The relative use of these two forms of finance is the result of an equilibrium between risk and profitability. Several studies have reported theoretical links between financial leverage (debt) ratios and "beta" (or "systematic risk") measure of a security, and the ratios and the variance of security returns. The higher the financial leverage (debt), the higher the theory predicts both "beta" and the variance of security returns (Hamada, 1972; Bowman, 1980)

4.1.3.5 Growth Rate (Factor 5)

The ratios of Growth Rate measure the relationship of financial structure between this year and the previous year. "Grow or die" is familiar advice. Most management recognizes the importance of staying in the race by staying ahead. For instance, even if a firm's management are satisfied with no growth in real terms of R43 (OR2/OR1), keeping up with inflation requires an annual increase in operation revenue. Furthermore, in this study the main products of the government-owned manufacturing firms in Taiwan are all different from each other. The ratios of this classification could also test whether a firm has the ability to overcome the changes in the economy and potential developments in its production lines because of producing different products and facing different environments of markets.

4.1.3.6 Short-Term Capital Turnover (Factor 6)

The definition of Short-Term Capital Turnover, relative the Long-Term Capital Turnover, implies the specific significance of current assets. The utilization of long-term capital may be based on the firm's policy, whereas the efficiency of current assets reflects the management of the firm. For example, R31 (CGS/Inv) called the inventory turnover ratio indicates the efficiency of inventory management. An increasing inventory may be a healthy concomitant to growing sales, or an accumulation of goods resulting from reduced sales and inefficient purchasing. The problem to be solved by inventory management is to determine and maintain an optimal inventory level.

4.1.4 Discussion of the Results of Factor Analysis

The factor model assumed that variables could be grouped by their correlations. It means that all variables within a particular group are highly correlated among themselves but have relatively small correlations with variables in the different groups. From Table 9 (refer to Appendix D), we find that the most significant ratios extracted from different classifications have relatively small correlations with each other. For example, the smallest absolute correlation coefficient between R32 (EBT/TA) and the other ratios in the same classification of Factor 1 is 0.53144, correlation between R32 (EBT/TA) and R49 (OI/OR) (see Appendix D). The value of 0.53144 is still larger than 0.36856 which is the largest correlation coefficient between R32 (EBT/TA) and the other significant ratios in the different classifications (see Table 9). Therefore, the results indeed satisfy the purpose of applying Principal Factor Analysis in this study.

Table 9: The Correlation Matrix of the Significant Ratios (in the Pool Sample of Year '78, '81, '84, '87, '90, '93)

Ratio(Factor)	R32 (F1)	R9 (F2)	R36 (F3)	R48 (F4)	R44 (F5)	R19 (F6)
R32 (F1)	1	0.08137	0.23324	-0.35356	0.00683	0.36856
R9 (F2)	0.08137	1	-0.20709	-0.23916	-0.10364	0.18994
R36 (F3)	0.23324	-0.20709	1	-0.20910	0.06569	0.20039
R48 (F4)	-0.35356	-0.23916	-0.20910	1	0.28451	-0.15106
R44 (F5)	0.00683	-0.10364	0.06569	0.28451	1	-0.02353
R19 (F6)	0.36856	0.18994	0.20039	-0.15106	-0.02353	1

4.1.5 Comparing the Financial Patterns with Those of the Previous Studies

An interesting feature of the results of this study is that among the classifications extracted, two have been previously identified by all the studies reviewed in the second section (Table 2): Return on Investment (profitability) and Financial Leverage (long-term debt). In addition, the Short-Term Liquidity has also been extracted by all the studies except for Pinches and Mingo (1973), and Lai (1983).

With respect to the Short-Term and Long-Term Capital Turnover (Intensiveness), the two classifications extracted in this study are still similar to those shown by previous studies. In the US data, Pinches and Mingo (1973) obtained the same results. Caruthers, Pinches and Mingo (1973) divided these two classifications into four classifications: Capital Intensiveness, Inventory Intensiveness, Receivable Intensiveness, and Cash Position; however, Pinches, Eubank, Mingo and Caruthers (1975) combined the last three classifications into the Short-Term Capital Turnover at the hierarchical level; Stevens (1973) combined the two classifications into the Activity. In the UK data, Ezzamel, Brodie and Mar-Molinero (1987) divided them into five classifications: Capital Intensiveness, Asset Turnover I, Asset Turnover II, Working Capital, and Inventory. In the Taiwanese data, Ju-Ping Lai (1983) also divided them into four classifications: Total Asset Turnover, Current Asset Turnover, Status of Inventory, and Cash Position.

Only the Growth Rate extracted in this study has not been identified by the above studies. There was evidence in Hutchinson, I. Meric and G. Meric (1988) which extracted the Growth Rate by principal component analysis to evaluate whether the small firms in the UK achieved quotations on the UK unlisted securities market. However, the Growth Rate specifically used by the Ministry of Audit in Taiwan may be considered as the evaluated indices for not only the performance, but also the public welfare supported by the government-owned firms.

Even though all of the financial classifications extracted in this study are separately listed in the previous studies, the whole financial patterns are somewhat different, lending support to the earlier research question of the inconsistency of the available evidence.

Finally, it is worth noting that the return on investment is the most important financial classification in the government-owned firms, the same as the previous studies showed in the private sectors. It means that the government-owned firms in Taiwan not only need to run their businesses and survive by themselves without subsidies, but also have fiscal demands similar to the resources of government revenue.

4.2 Evaluation of the Stability of Financial Patterns and Ratios

4.2.1 Stability of the Financial Patterns During the Empirical Period

As reported earlier in the sample design, the data were divided into three groups: (1) a subsample of the whole period (years '78, '81, '84 '87, '90 and '93); (2) a subsample of the first business cycle (years '79, '80, '82, '83 and '85); (3) a subsample of the second business cycle (years '86, '88, '89, '91 and '92). Repeating our empirical process above in each subsample, one finds that the contents of the extracted classifications in these three pool samples are the same as those of the above results. The variances[9] and the explanatory ability of six defined classifications (factors) are given as Table 10. The reduced space (systematic variance) represented by the six factors accounts for a consistently high amount of information (variance) contained in the original data matrix --- 86.9% in Set 1, 89.6% in Set 2, and 87.3% in Set 3. The proportions of the systematic variances (total variances of common factors) of each factors also are reported as Table 11. For example, the proportion of contribution to the systematic variance from F1 (Return on Investment) is 20.7% in Set 1, 23.7% in Set 2, and 22.9% in Set 3. The proportion of systematic variance also indicates the relative position of each factor among the whole patterns. If the proportions of each factor in the three subsamples are not significantly different, this means that the underlying structure of the patterns are stable over time.

ANOVA was employed to test whether the underlying structure of the financial patterns was significantly different between the three subsamples over the whole empirical period. Before applying the ANOVA procedure, the following four assumptions of ANOVA: (1) independence, (2) normality, (3) homoscedasticity, e.g., homogeneity of variances, and (4) additivity were tested (see Appendix E). The independence assumption was not violated, because the data came from three mutually independent samples as the sample design stated. In Appendix E, the test results showed that the normality of the each sample was accepted by the Shapiro & Wilk W-statistic at the 5% level, that the homoscedasticity of the three subsamples was accepted by the F_{max} procedure developed by Hartley (1950) at the 5% level, and that the additivity of the three

[9] In oblique rotation, because the factors are correlated, the sum of the individual factor variances is no longer the total variance of common factors. However, the components of each factor are very similar in both orthogonal and oblique rotation. Therefore, the variance accounted for by an individual factor could be obtained in the orthogonal case.

samples was also accepted by a posteriori analysis, Tukey T method, at the 5% level. Since none of the assumptions was violated, the ANOVA procedure seemed valid.

Setting the confidence level at 5%, the results (Table 12) indicated that there is no significant difference between the three subsamples. It supported the view that the relative explanatory abilities within undefined factors of the financial patterns were stable even though the rank of the defined factors might change during the empirical period.

Calculating the correlation coefficient of the loadings on each defined factor for Set 1 with Set 2, Set 2 with Set 3, and Set 1 with Set 1, could provide an overall indication of the extent of stability in the interrelationships between factor loadings over time. This means that we could know whether the individual classifications are stable over the different time periods. Table 13 showed that factor one (Return on Investment), factor four (Financial Leverage), factor five (Growth Rate) and factor six (Short-Term Capital Turnover) were relatively stable (highly correlated), but factor two (Short-Term Liquidity) and factor three (Long-Term Capital Turnover) were relatively unstable (weakly correlated) over the empirical period.

Table 10: The Variance of Each Factor in Three Pool Samples

Factor / Variance / Sample	F1	F2	F3	F4	F5	F6	Total Variance of Common Factors	Total Explanatory Ability of Six Factors
Set 1	8.0747	7.9698	5.1929	5.0159	4.0412	3.6036	38.9956	86.9%
Set 2	9.4406	7.0429	4.3109	5.5866	4.7262	4.6234	39.8873	89.6%
Set 3	9.4460	9.2272	5.0537	3.9780	3.2419	4.9945	41.1928	87.3%

Table 11: The Proportion of Systematic Variance of Each Factor in Three Pool Samples

Factor / Proportion / Sample	F1	F2	F3	F4	F5	F6	Total Variance of Common Factors
Set 1	.20707	.20438	.13317	.12863	.10363	.09241	1
Set 2	.23668	.17657	.10808	.14006	.11849	.11591	1
Set 3	.22931	.22400	.12268	.09657	.07870	.12125	1

Table 12: ANOVA[10] for Stability of Financial Patterns Between Three Pool Samples

Source of Variation	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	0.00006970	0.00003485	0.01	0.9886
Error	15	0.04564275	0.00304285		
Total	17	0.04571245			

[10] For more details, see Appendix E.

Table 13: Correlation Coefficients of Financial Patterns: Set 1, Set 2, And Set 3

Factors / Sets	F1	F2	F3	F4	F5	F6
Set 1; Set 2	0.96109	-0.40873	-0.11288	0.77160	0.72593	0.89917
Set 2; Set 3	0.93260	-0.46519	-0.10908	0.84269	0.83421	0.76764
Set 1; Set 3	0.91095	0.92592	0.95831	0.82750	0.61775	0.69194

4.2.2 Stability of the Financial Ratios During the Empirical Period

Pre-testing the distributions of the 49 selected ratios, respectively, we find that most of the ratios are non-normally distributed as the previous studies demonstrated, e.g., Deakin (1976). A non-parametric statistical method, the Kruskal-Wallis Test, is employed to test whether the individual ratios are significantly different during the past sixteen years.

Setting the confidence level at 5%, the results (refer to Appendix F) indicated that 36 out of the 49 ratios are not significantly different over the whole time period; that is, the majority of the 49 ratios are stable. However, the following thirteen ratios have significant differences during the empirical period:

R4 ---- LL/FA , R5 ---- LL/TA, R12 ---Inv/CA,
R20 --- OR/QA, R25 --- CF/TL, R27 ---EBT/TL,
R32 --- EBT/TA, R33 --- EBT/OR, R34 ---EBIT/Int,
R43 --- OR2/OR1, R44 --- TA2/TA1, R45 ---FA2/FA1,
R46 --- TL2/TL1.

4.2.3 Analysis of Financial Trends

Examining the mean value (industry average) of the financial ratios could give further insights into the extent of stability of the financial patterns. We could understand the financial trends from the fluctuations of the above thirteen significant ratios in the whole time period. Table 14 listed the mean value of each ratio in the data sample of Set 1, the years '78, '81, '84, '87, '90, and '93.

Table 14 showed that the mean value of R12 (Inv/CA) demonstrated a significant downward shift during the period. This is an indication that the management of inventory became more efficient over time. The mean value of R34 (EBIT/Int) demonstrated an upward shift during the period. This indicated that the firms have improved earnings and/or reduced interest expenses. The mean value of R20 (OR/QA) demonstrated a downward shift over time while the other short-term capital turnover ratios, e.g., R18 (OR/CA) and R29 (OR/WC), were stable in the period. This indicated that the quick assets of the firms played an important role in capital structure and/or increased those proportions of the current assets year by year over the period.

The four ratios of R43 (OR2/OR1), R44 (TA2/TA1), R45 (FA2/FA1), and R46 (TL2/TL1) are grouped under the Growth Rate classification. The Growth Rate indicates whether a firm has the ability to accommodate to the changes in the economy and to the potential development in its production lines. The four ratios with significant differences within the whole period implied that the firms had different abilities to meet the economic changes because of producing different products and facing different environments of markets.

All denominators of the remaining six ratios, R25 (CF/TL), R27 (EBT/TL), R32 (EBT/TA), R33 (EBT/OR), R4 (LL/FA), and R5 (LL/TA), included the components of the above four significant Growth Rate ratios. Therefore, the instability of these six ratios might be caused by the same sources as those of the Growth Rate ratios.

Table 14: The Mean Value of Financial Ratios During the Years '78, '81, '84, '87, '90, '93

Classifications and Ratios	Mean('78)	Mean('81)	Mean('84)	Mean('87)	Mean('90)	Mean('93)	
F1: Return on Investment							
R1(CF/OR)	0.04628	0.07048	0.03482	0.13970	0.11846	0.08195	
R23(CF/TA)	0.02821	0.03031	0.03043	0.08304	0.05929	0.02902	
R24(CF/NW)	0.05640	0.07177	0.04879	0.15003	0.08563	0.00842	
R25(CF/TL)	0.09892	0.06193	0.10551	0.27563	0.33903	0.16805	**[11]
R26(EBT/NW)	-0.02071	0.00852	-0.00740	0.08249	0.04508	-0.06622	
R27(EBT/TL)	0.02724	0.01706	0.04148	0.18360	0.23168	0.05477	**
R32(EBT/TA)	0.00044	0.00667	0.00449	0.05288	0.03620	-0.00264	**
R33(EBT/OR)	-0.02399	0.02466	-0.01825	0.06973	0.06363	0.00495	**
R35(CGS/S)	0.90976	0.90953	0.87968	0.87397	0.91379	0.93978	
R49(OI/OR)	0.03791	0.09983	0.05284	0.05411	0.00382	-0.02272	
F2: Short-Term Liquidity							
R2(CL/FA)	0.8022	1.02867	0.84553	0.67439	0.72430	0.63012	
R3(CL/NW)	1.02083	1.40471	1.09372	1.00967	0.66072	0.99845	
R7(WC/TA)	0.02133	0.03219	0.04759	0.03342	0.11958	0.09040	
R8(CM/TA)	0.03270	0.04406	0.06317	0.10285	0.13450	0.16962	
R9(CM/CL)	0.13442	0.19449	0.38699	0.56945	1.77979	1.94738	
R10(CA/TA)	0.36823	0.41477	0.38993	0.36261	0.41039	0.38286	
R11(CA/CL)	1.25003	1.35133	1.62881	1.47561	3.31444	3.05422	
R12(Inv/CA)	0.56170	0.55362	0.43464	0.37785	0.33826	0.32774	**
R14(QA/TA)	0.11891	0.15474	0.17622	0.19407	0.22330	0.24134	
R15(QA/CL)	0.34871	0.47900	0.73394	0.83398	2.15699	2.27633	
R21(QA/TUC)	1.01478	1.63162	1.50927	3.49824	4.70127	6.49407	
R22(CM/TUC)	0.29612	0.43327	0.66525	1.31906	3.69095	5.53958	
R34(EBIT/Int)	4.030	1.901	2.919	12.185	34.411	178.222	**

[11] ** indicated that the ratio was significantly different during the whole empirical period under the confidence level at 5% by the Kruskal-Wallis Test. The P-Values of ratios were listed in Appendix F.

R37(CL/TA)	0.34690	0.38258	0.34233	0.32919	0.29081	0.29246	
R41(CWC/TUC)	-0.00173	0.10686	0.20560	1.26891	0.60652	0.74239	
F3: L-T Capital Turnover							
R28(OR/NW)	1.36645	1.92358	1.28200	1.21170	0.88006	1.02203	
R30(OR/TA)	0.50302	0.61262	0.52942	0.48302	0.46949	0.44391	
R36(OR/FA)	1.22736	1.56106	1.13731	0.97178	1.04099	0.91665	
F4: Financial Leverage							
R4(LL/FA)	0.41509	0.54859	0.35430	0.27889	0.15731	0.25708	**
R5(LL/TA)	0.22191	0.20315	0.16418	0.13380	0.06898	0.14038	**
R6(TL/NW)	1.76652	2.39482	1.69716	1.52851	0.83185	1.61396	
R38(TL/TA)	0.57506	0.60326	0.51326	0.46398	0.36022	0.43285	
R48(FA/NW)	1.38618	1.27867	1.22870	1.25923	0.87206	1.55970	
F5: Growth Rate							
R39(CUI/FA)	0.14746	0.14418	0.08723	0.09080	0.11465	0.09719	
R40(CUI/TUC)	0.44746	0.44498	0.36976	0.44579	0.53167	0.37713	
R42(NCFI/TSC)	-0.10670	-0.16213	-0.03229	-0.09027	-0.21008	-1.82729	
R43(OR2/OR1)	1.13648	1.22109	1.04452	0.98328	1.00555	0.98839	**
R44(TA2/TA1)	1.13367	1.14919	1.01895	1.00508	1.07036	1.13120	**
R45(FA2/FA1)	1.10759	1.09616	1.02289	1.01989	1.07991	1.20845	**
R46(TL2/TL1)	1.06251	1.19734	0.95556	0.96775	0.95011	1.24185	**
R47(NW2/NW1)	1.26918	1.09401	1.04151	1.05392	1.11941	1.04202	
F6: S-T Capital Turnover							
R13(Inv/WC)	3.97409	9.18707	1.18182	1.97480	-0.91813	0.90884	
R18(OR/CA)	1.37160	1.48482	1.38244	1.34876	1.20311	1.37148	
R19(S/Inv)	2.44557	2.55516	3.07504	3.60838	3.62925	3.49585	
R20(OR/QA)	5.01929	4.64731	3.55243	2.97996	2.69963	2.82636	**
R29(OR/WC)	-1.51237	9.22308	3.33002	-0.86955	-1.41888	1.44456	
R31(CGS/Inv)	2.24019	2.32217	2.66883	3.00341	3.20029	3.20518	

4.2.4 Comparison of the Results of Stability and Those of the Previous Studies

Of the studies reviewed in Table 2, only PMC (1973) in the US and EBM (1987) in the UK addressed the matter of the stability of financial patterns. The results in this study are similar to those reported by PMC (1973). The financial patterns represented by the extracted factors account for a consistently high amount of information contained in the original data matrix between both studies. The underlying structure of the financial patterns and the majority of the classifications are also stable over time in both studies even though the magnitude of many ratios in both samples changed. However, it seemed that the individual classifications extracted by PMC (1973) have higher stability than those in this study because a higher critical value of correlation coefficients (0.866) to determine the stability used in their study rather than 0.61775 in this study. The other reason is that the raw data was used in this study, but the log transformation data was used in their study to reduce outliers and improve the homoscedasticity of the classifications over different time periods.

On the other hand, the financial patterns developed by raw data of the UK manufacturing firms in EBM (1987) had smaller explanatory abilities and were less stable than those of this study. There is no simple answer to this difference. It may be caused by: (1) differences in time periods covered, (2) differences in institutional and economic backgrounds of the firms in the different countries, and / or (3) significant differences in the number of factors extracted.

The three studies do have similarities. All three studies showed that the classifications of Return on Investment (profitability) and Financial Leverage (long-term debt) were the most stable and the classification of Long-Term Capital Turnover (Intensiveness) was the least stable. These similarities demonstrated some important implications. First, Economic theory tells us that in a perfectly competitive industry there are the long-run equilibrium in which each firm earns only normal profits. The stability of the classification of Return on Investment in the three studies revealed that the assumption of long-run equilibrium was feasible in the different countries and different industries, and even in the government-owned firms in Taiwan. Second, although no completely satisfactory finance theory has yet been found to explain the existence of optimal capital structure, i.e., the long-run debt-to-value ratio in a firm, casual empiricism suggests that firms behave as though it does exist. The stability of the classification of Financial Leverage in the three studies might support that each firm had a target capital structure in the long-run even in the different countries and different industries. Third, the classification of Long-Term Capital Turnover focuses on only the operating efficiency of fixed assets and long-term capital. When there were some shocks on the demand side in economy, the operation revenue also changed while the fixed assets and long-term capital remained constant. Therefore, the instability of the classification of Long-Term Capital Turnover in the long-run in the three studies was predictable.

4.2.5 Discussion of the Stability of Major Ratios

It will be recalled that the major ratios of this study are R32 (EBT/TA) of Factor 1, R9 (CM/CL) of Factor 2, R36 (OR/FA) of Factor 3, R48 (FA/NW) of Factor 4, R44 (TA2/TA1) of Factor 5 and R19 (S/Inv) of Factor 6. Among the above major ratios, we found that the R32 (EBT/TA) and R44 (TA2/TA1) were unstable over time in the empirical results. Even though the results of using factor analysis indicated that the major ratios could be used to represented the much larger number of ratios with relatively little loss of information, many of these benefits would be eroded if the major ratios were not stable over time. For predictive purposes of the financial patterns, it is better to choose the other stable ratios which are also highly correlated with the corresponding factors. From Table 8, the R23 (CF/TA) and R39 (CUI/FA) were chosen as the second most significant ratios for Factor 1 and Factor 5; these were applied in the next empirical process. Furthermore, the R23 (CF/TA) and R39 (CUI/FA) chosen to be the major ratios for predictive purposes supported the results shown by Barlev and Livnat (1990), namely that the funds statement ratios possess incremental information content besides the conventional statements.

4.3 Determination and Implication of the Distribution of Major Ratios

4.3.1 Determination of the Distribution of Major Ratios by the Pearson System

To develop a distribution of a financial ratio, the larger the data set, the more accurate the results we obtained. In order to determine the distributions of major ratios during the whole empirical period, we set the 192 observations (see Appendix G) of the twelve companies over a sixteen-year period for each major ratio, R9 (CM/CL), R19 (S/Inv), R23 (CF/TA), R36 (OR/FA), R39 (CUI/FA) and R48 (FA/NW), as the data sample respectively, and then follow the Pearson System to calculate the first four moments to be parameters of each distribution. Using the four parameters, we could compute the k criterion and follow the procedures in Table 4 and Table 5 to determine the distribution type and shape for each ratio. For example, the procedures of computation of R9 (CM/CL) as follows: (1) Using 190 observations[12] of data sample of R9

[12] In the Pearson System, the estimated curve is always graduated and smooth, and has a unimode and sometimes limited range. For the convenience of producing the estimated curve, the following techniques were used in the empirical process.

(CM/CL) listed in Appendix G to calculate the first four moments about mean, $\mu_1 = 0$, $\mu_2 = 1.3059$, $\mu_3 = 4.4689$ and $\mu_4 = 21.9425$. (2) Computing the $k = \beta_1(\beta_2 + 3)^2 / 4(4\beta_2 - 3\beta_1)(2\beta_2 - 3\beta_1 - 6) = -3.2047$, where $\beta_1 = \mu_3^2 / \mu_2^3$ and $\beta_2 = \mu_4 / \mu_2^2$. (3) Because $k = -3.2047$, the distribution type of R9 (CM/CL) is Type 1 and the equation of Type 1 suggested by Elderton & Johnson (1969) is $y = y_0(x)^{m_1}(1 - x/a)^{m_2}$; where $a = a_1 + a_2 = 1/2\sqrt{\mu_2}\sqrt{\beta_1(r+2)^2 + 16(r+1)}$, $r = 6(\beta_2 - \beta_1 - 1)/(6 + 3\beta_1 - 2\beta_2)$, $m_i = 1/2\{r - 2 \pm r(r+2)\sqrt{\beta_1 / \beta_1(r+2)^2 + 16(r+1)}\}$, and $m_1 / a_1 = m_2 / a_2$; when $\mu_3 > 0$, then m_2 is the positive root. (4) Calculating that $a = 8.67503$, $a_1 = -17.2149$, $a_2 = 25.8900$, $m_1 = -0.84596$ and $m_2 = 1.27226$, the distribution shape of R9 (CM/CL) is J-shaped because $m_1 < 0$ and $m_2 > 0$. Table 15 reported the distribution type and shape of each major ratio over time.

Once the type of each ratio is determined, the probability density function suggested by Elderton & Johnson (1969) can be calculated directly as Table 5 stated. For example, the continuous procedure of computation of R9 (CM/CL) as follows: (5) For the equation of $y = y_0(x)^{m_1}(1 - x/a)^{m_2}$, only the parameter of y_0 is unknown now. Because $\int_{0.0001614}^{8.67503} y\,dx = \int_{0.001614}^{8.67503} y_0(x)^{m_1}(1 - x/a)^{m_2}\,dx = N = 190$, then $y_0 = 31.827$; where 0.0001614 is the least amount of R9 (CM/CL) meaning the start of the curve; 8.67503 is the value of a meaning

(1) Pre-detecting the histogram of the R9, we find that there is the other local mode in the right tail. Therefore, we removed the outliers of 9.1442 and 12.4156 in the data sample and estimated the curve from the remaining 190 observations.
(2) All of the amounts of the R23 are less than one. It is better to draw on a rather large scale in order to gain distinctness. We used the 10 times of the amount of R23's as the data sample here to get the estimated curve.
(3) For the R36, the origin of the estimated curve is at mode because the curve is of the Type 3. The range of the curve will be limited from a(-0.28274) below the mode (0.5198). It means the curve starts at the point of 0.23706. Therefore, the four smallest observations will be discarded automatically, and only 188 observations were applied to the estimated process.

the limited range of the curve; N is the number of observations meaning the total number of frequency. Table 16 reported the estimated function of each major ratio.

Based on the hypothesized cumulative distributions calculated from the estimated probability functions and the empirical cumulative distributions computed from the observed ratios, the results of the Kolmogorov-Smirnov Goodness-of-Fit Test are also listed in Table 16. The D-statistics (the test process showed in Appendix H) indicated the estimated functions of R23 (CF/TA), R36 (OR/FA), and R39 (CUI/FA) are fitted with the data samples at 5% level of significance according to Kolmogorov-Smirnov statistics. Even though the estimated function of R9 (CM/CL) is not fitted with the data sample at 5% level of significance, it is fitted at the 2% level[13]. However, the estimated functions of R19 (S/Inv) and R48 (FA/NW) are rejected at both levels of significance. This indicated that the distributions and estimated functions of R19 (S/Inv) and R48 (FA/NW) followed by Pearson System are not fitted with data samples. Therefore, the alternative methods of fitting equations to the data need to be considered again in the cases of R19 (S/Inv) and R48 (FA/NW).

Furthermore, since the Figures 1, 3, 4 and 5 reveal the actual shapes of the estimated functions of R9 (CM/CL), R23 (CF/TA), R36 (OR/FA) and R39 (CUI/FA), this information can give further insight into the distribution of the individual major ratios. For example, in Figure 1, the shape of R9 (CM/CL) looks like a vertical line in the very small area. This information indicated that most of firms maintained the relatively small amount of cash and marketable securities to current liabilities and only a very few firms had the relatively large proportion in a

[13] The Kolmogorov-Smirnov D-Statistic of R9 is 0.10947, and the P-Value is 0.021054. For more details, see Appendix H.

few years during the long run. In Figure 3, the shape of R23 (CF/TA) is almost a bell-shaped because the skewness is 0.2787 even though the kurtosis is 8.7841. This information indicated that most of firms obtained the normal return on investment displayed by CF/TA and only a few firms had loss (negative ratios) or relatively large return on investment in the long run.

Table 15: Distribution Following the Pearson System for Each Major Ratio During 1978-1993

Distribution Characteristics Ratios	μ_1	μ_2 = Variance	μ_3	μ_4	Skewness	Kurtosis	k criterion	Type	Shape *
R9(CM/CL)	0	1.3059	4.4689	21.9425	15.5461	12.8662	-3.2047	1	J
R19(S/Inv)	0	3.1062	5.8484	35.1542	1.4974	3.64347	-0.5285	1	J
R23(CF/TA)	0	0.6567	0.6521	3.78771	0.2787	8.7841	0.2410	4	Skew
R36(OR/FA)	0	0.5969	0.7689	2.4991	0.8890	7.0136	-11.3299	3	Regular
R39(CUI/FA)	0	0.0170	0.0038	0.0017	3.0684	5.8812	-1.2657	1	J
R48(FA/NW)	0	0.6528	2.4608	16.3180	1.8581	38.2963	20.0159	6	J

Note: (1) μ_i indicated the ith moment from curve about mean.

(2) Skewness = $\sqrt{\beta_1}(\beta_2+3)/[2(5\beta_2-6\beta_1-9)]$; Kurtosis = μ_4/μ_2^2. (3) * See the Figure 1 to Figure 6.

Table 16: The Estimated Probability Density Function Following the Pearson System for Each Major Ratio During 1978 - 1993

Ratios	Estimated Probability Density Functions*	Range of x	P-Value[14]
R9	$y = 31.827x^{-0.84596}(1-x/8.67503)^{1.27226}$	$0.0001614 \le x \le 8.67503$	0.021054**
R19	$y = 91.3687x^{-0.13113}(1-x/9.95493)^{2.34923}$	$0.68357 \le x \le 9.95493$	0.000106***
R23	$y = 63.6296(1+x^2/2.1616)^{-3.66848}e^{3.0073\tan^{-1}(x/1.47023)}$	$-1.8133 \le x \le 5.2232$	0.123552
R36	$y = 151.152(1+x/0.28274)^{0.43898}e^{-1.55263x}$	$-0.28274 \le x \le 4.42904$	0.851598
R39	$y = 196.264x^{-0.54951}(1-x/0.83946)^{2.11669}$	$0.0027157 \le x \le 0.83946$	0.322802
R48	$y = 159.285x^{-0.77093}(1+x/28.752)^{-18.8787}$	$0.303 \le x \le 8.58272$	0.000000***

Note: (1)*The variable of x in the functions depends on the different origins of different curves as follows:

For R9, x= R9; for R19, x=R19; for R23, x=R23×10-(-0.32847); for R36, x=R36-0.5198; for R39, x=R39; for R48, x= R48.

(2) ** Significant at the 5% level, but not significant at the 2% level (with number of observations of 190).

(3) *** Significant at the 5% level (with number of observations of 192).

[14] The P-Values are based on the Kolmogorov-Smirnov D-Statistic. For R9, D=0.10947; for R19, D=0.16013; for R23, D=0.085147; for R36, D=0.044445; for R39, D=0.068837; for R48, D=0.29663. For more details, see Appendix H.

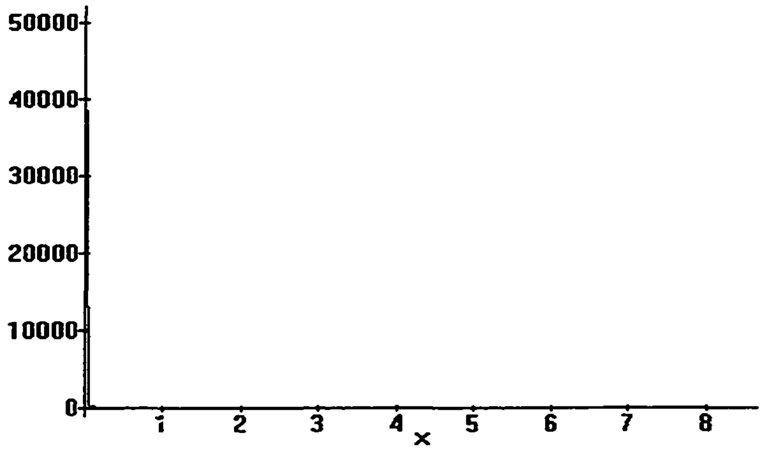


Figure 1: The Distribution Shape of R9(CM/CL) Following the Pearson System During 1978 - 1993

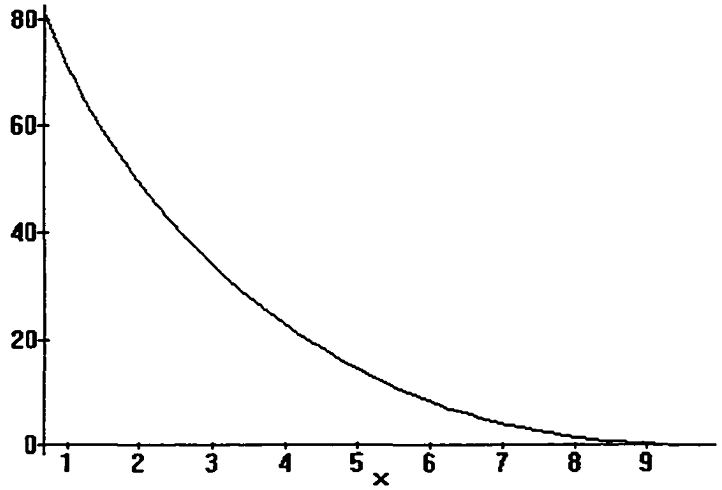


Figure 2: The Distribution Shape of R19(S/Inv) Following the Pearson System During 1978 - 1993

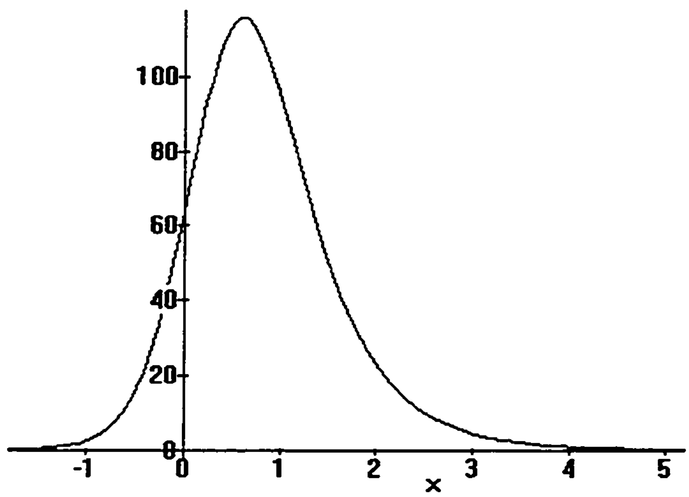


Figure 3: The Distribution Shape of R23(CF/TA) Following the Pearson System During 1978 - 1993

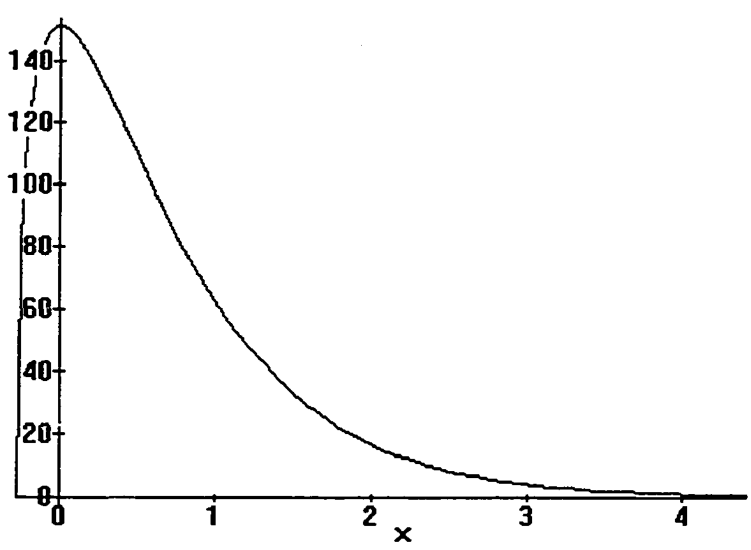


Figure 4: The Distribution Shape of R36(OR/FA) Following the Pearson System During 1978 - 1993

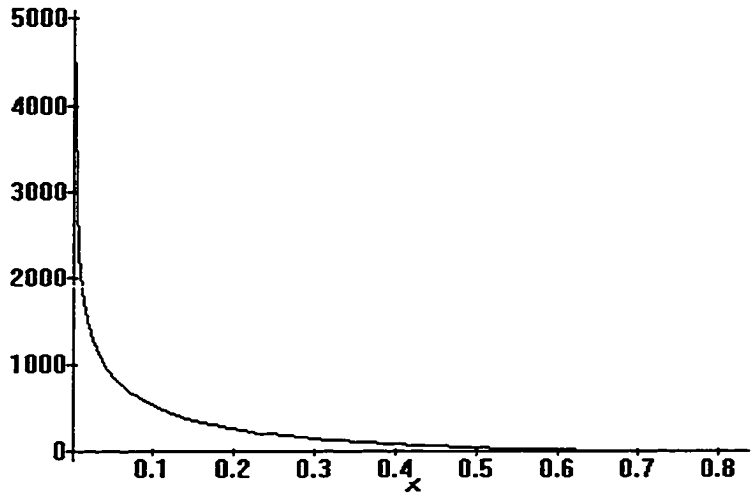


Figure 5: The Distribution Shape of R39(CUI/FA) Following the Pearson System During 1978 - 1993

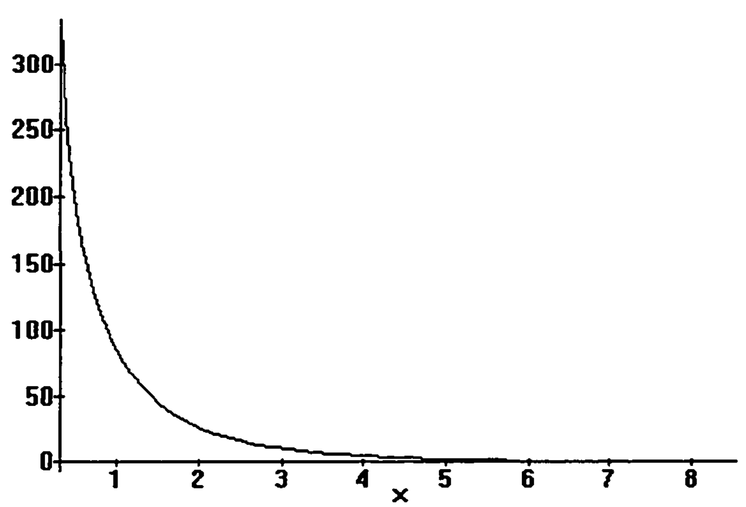


Figure 6: The Distribution Shape of R48(FA/NW) Following the Pearson System During 1978 - 1993

4.3.2 Determination of the Distribution of R19 and R48 by the Polynomials

The Pearson System, with its ease of computation and facility of algebraic manipulation, provides the approximated distribution to as wide a variety of observed distributions as possible. However, it is in general only possible to find the curve from part of a distribution and not a complete distribution because of some restrictions of the model. Reviewed in Table 15, the distribution type of R19 (S/Inv) followed by the Pearson System was Type 1, and that of R48 (FA/NW) was Type 6. The estimated equations suggested by Elderton & Johnson (1969) in Table 5 are: $y = y_0(x)^{m_1}(1-x/a)^{m_2}$ for Type 1, and $y = y_0(x)^{q_1}(1+x/a)^{-q_2}$ for Type 6. We find the both equations can be transformed by the Taylor Series[15] into the linearizable forms represented by polynomials with integer powers of x:

$$y = a_0 + a_1 x + a_2 x^2 + a_3 x^3 + a_4 x^4 + \dots..$$

Actually, the Pearson System is a general model developed from polynomials with the restrictions of unimode and $y \geq 0$. In this study, the value of y means the number of frequency of a particular ratio and the number is never negative. Therefore, relaxing the restriction of unimode and using polynomials with $y \geq 0$ may be the alternative method of fitting equations to the data of R19 (S/Inv) and R48 (FA/NW).

[15] To expand a function y = f(x) around a point x_0 means, in this study, to transform that function into a polynomial form, in which the coefficients of the various terms are expressed in terms of the derivative values $f'(x_0)$, $f''(x_0)$, etc.—all evaluated at the point of expansion x_0. The results of expansion may be referred to as a power series, the Taylor Series, because, being a polynomial, it consistent of a sum of power functions.

The distribution parameters of Pearson System depend on the first four moments of the data sample. In the theory of polynomials, the higher the order of the polynomial, the more precise the data must be. However, for most practical purposes it is sufficient to use only four parameters.

Applying the curve $y = a_0 + a_1x + a_2x^2 + a_3x^3 + a_4x^4$, we can find the values of the five constants, a_0 to a_4, so that each item is exactly reproduced by equating as follows:

$\int_a^b yx^i dx = \mu_i$, where μ_0 = n (the number of observations), i = 0;

μ_i = ith moments from curve about any point, i = 1, 2, 3, 4;

and a, b are the start and the end of the curve.

The graduating curve of polynomials will not necessarily reproduce exactly any of the observations, however, the curve will roughly take into account the observed facts so as to represent their general trend. Therefore, the curve calculated by the polynomials may fall below the x axis and result in some negative value of y (the number of frequency). In the empirical process, it is better to remove the extreme observations corresponding to the negative y value from the data sample, and repeat the polynomial model fitting until all points of the curve fall above the x axis.

Table 17 reported the estimated functions of R19 (S/Inv) and R48 (FA/NW) followed by polynomials and the results of the Kolmogorov-Smirnov Test. The D-Statistic (test process listed in Appendix J) showed that both of the probability density functions of R19 (S/Inv) and R48 (FA/NW) are fitted with the data sample at 5% level of significance.

Figure 7 and Figure 8 revealed the actual shape of R19 (S/Inv) and R48 (FA/NW) following the polynomial model. Both curves with two modes explain why the estimated functions calculated by the Pearson System, which has unimode and sometimes a limited range, could not agree with the data samples. Figure 7 and Figure 8 also give further insight into the distribution of R19 (S/Inv) and R48 (FA/NW). For example, Figure 7 indicated that in addition to most of the firms with relatively low performance on Short-Term Capital Turnover represented by Sale/Inventory and only a few firms with better performance, there were a relatively large number of firms with excellent performance. Examining the R19 (S/Inv) of the government-owned firms in Taiwan, we found that two firms, the China Petroleum Company and the China Petrochemical Company, always had a high amount of R19 (S/Inv) in the empirical period. These phenomena might explain why petroleum and petrochemical products in Taiwan always enjoyed relatively high demand. Furthermore, the inventories of both firms were maintained at lower levels because oil prices changed quickly in past years, e.g., the energy crisis happened during this time period.

Table 17: The Estimated Probability Density Function Following the Polynomial Model for R19(S/Inv) and R48(FA/NW) During 1978 - 1993

Ratios	Estimated Probability Density Functions	Range of x*	P-Value[16]
R19	$y=-46.2821+116.0779x-43.9303x^2+6.0261x^3-0.2804x^4$	$0.68357 \le x \le 8.85484$	0.837903
R48	$y=-418.2674+1695.5606x-1613.2783x^2+578.8035x^3-71.0703x^4$	$0.3558 \le x \le 3.28308$	0.251321

Note: * The range of R19 covered the whole data sample of 192 observations. The range of R48 covered only 187 observations , and five extreme observations of 0.303, 3.28343, 3.53681, 4.15231 and 8.58272 were removed as the outliers.

[16] The P-Values are based on the Kolmogorov-Smirnov D-Statistic. For R19, D=0.044686; for R48, D=0.074435. For more details, see Appendix I.

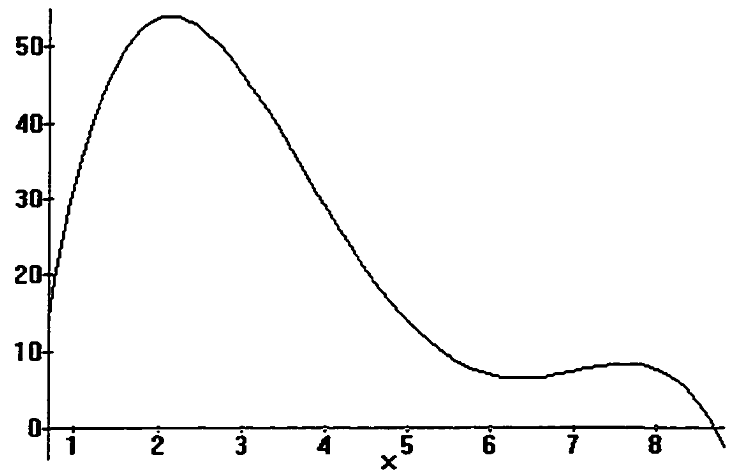


Figure 7: The Distribution Shape of R19(S/Inv) Following the Polynomials During 1978-1993

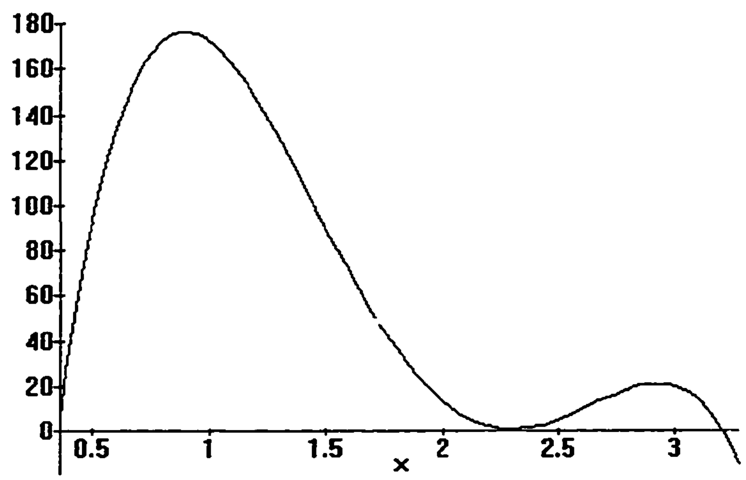


Figure 8: The Distribution Shape of R48(FA/NW) Following the Polynomials During 1978-1993

4.3.3 Implication of the Distribution of Major Ratios

The empirical evidence in this study indicated that all distributions of major ratios are positively skewed. The results supported the conclusions reached in most previous studies. It means that the ratios of most firms are located on the small area to the left side of the distributions, and only a few firms have the ratios departing from the norm in the right side in the industry. The evidence of non-normal distribution of financial ratios may alter the conclusions of some studies that are based on the assumption of a normal distribution and provide some possibilities for future study in the field of financial ratio analysis.

Distribution characteristics of ratios could help to refine the rating process. In the study by Kolari et al.(1989), the authors suggested that the normal distribution could be divided into a 5-point scoring system, and the J-shaped or U-shaped distribution might be suited to a 3-point scale for rating purposes. However, the rating process is still very rough. Following the estimated probability density functions in this study, the locations of the major ratios of a firm among the industry could be easily calculated, and the probabilities may provide a more accurate rating in the industry. The benefit of this study is the increase in the applications of the results. For example, the conclusion of this study is that "the CM/CL ratio in the government-owned manufacturing firms in Taiwan has a J-shaped distribution, and the performance of the ratio of the Tang-Eng Iron Works in 1983 is located at the 24.83% level among the firms in the long run[17]" rather than the

[17] The R9 (CM/CL) of Tang-Eng Iron Works in 1983 was 0.009006 (see the observation 30 of R9 in Appendix G) and P-value of this ratio in the Pearson cumulative density function was 0.24830 (see the observation 30 of R9 in Appendix H).

conclusion of the prior studies that "the CM/CL ratio in the firms has a J-shaped distribution" only.

Financial statements contain important information of the performance of a firm. Using the concepts of mathematics, the performance is a function of the financial information. Therefore, performance = f (financial information); performance = f (factors extracted from financial information); performance = f (major ratios corresponding factors); and performance = f (probabilities of the major ratios in the industry). For management purposes, the probabilities of major ratios could be considered as the rating indices of performance. Moreover, as shown in this study, the government in Taiwan could vary the rating weights on the major ratios to force the government-owned firms to match future policy or economic changes. For example, if the government use the equation of "performance = f (probabilities of the major ratios, R9, R19, R23, R36, R39 and R48, in the industry)" to evaluate the performance of government-owned manufacturing firms and pay bonus based on this rating. When there are negative shocks in economy, the government may follow fiscal policies, e.g., increase on the government investment, to stimulate the recovery of economy. The government can give a heavy weight on R48 (Fixed Assets / Net Worth) and light weights on the other ratios. This will force the government-owned firms to increase the investment on fixed assets and match the fiscal policy. Therefore, the performance of the firms become controllable.

Chapter 5: Conclusions and Recommendations

5.1 Conclusions

Empirically-based financial patterns, the long-term stability of these patterns, and distributional properties of financial ratios have received a considerable amount of attention in recent years for both US and UK firms. However, to the best of our knowledge, no study concerning the financial patterns for government-owned firms in Taiwan exists. Moreover, the prior studies offered no evidence about the probability functions of the actual distributions of financial ratios.

The specific purposes of this study were to (1) develop empirically-based financial ratio patterns of government-owned manufacturing firms in Taiwan; (2) measure the long-term stability or lack of stability in the patterns over the 1978-1993 time period; and (3) determine the probability distributions and their implications for the major ratios during the empirical period.

Forty-nine financial ratios chosen from the financial raw data of the twelve government-owned manufacturing firms in Taiwan during sixteen years were analyzed by Principal Factor Analysis. It was concluded that the financial patterns are (1) Return on Investment, (2) Short-Term Liquidity, (3) Long-Term Capital Turnover, (4) Financial Leverage, (5) Growth Rate, and (6) Short-Term Capital Turnover. The stability of the financial patterns and all financial ratios was examined. The results indicated that financial patterns of the firms were relatively stable, even when thirteen of the forty- nine ratios are unstable over the empirical period. It is worth noting that the transformation data utilized by some prior studies may change the interrelationships among the variables and affect the relative positions of the observations of the group. Using the raw data in this study could capture the actual properties of the ratios.

The six major ratios corresponding to the financial classifications are: Cash Flow / Total Assets, (Cash + Marketable Securities) / Current Liabilities, Operation Revenue / Fixed Assets, Fixed Assets / Net Worth , Cash Used in Investing Activities / Fixed Assets, and Sales / Inventories. The distribution types, shapes, and the probability density functions of the six major ratios were determined. All of the distributions are not normally distributed and they are either J-shaped, regular, or skewed. Following the estimated probability density functions of each distribution, the regulators can easily know the rating locations of the major ratios of the firms among the industry.

Determining the probability density functions of ratios may be the most important contribution of this study to the field of financial ratio analysis. This information increases the applicability of the results. Even though most prior studies showed that the distributions of financial ratios were non-normally distributed, and a few latest studies demonstrated actual distribution types and shapes of the ratios, this information provided little economic interpretation. Knowing the exactly relative performance of the firms among the industry in the long run is important to management and regulators. This information could be applied for evaluation systems and management purposes.

It should be emphasized that this study has developed a generalized empirical model using financial ratios for evaluating the performance of the firms among the industry. The results have five important implications for researchers as well as decision makers. First, there are a number of sufficiently differentiated company financial patterns. Once identified, these can become the focus of both internal and external decision making. The identification of the patterns is also useful for a variety of research purposes. Second, data reduction in the context of financial ratios is feasible. The results showed that it is sufficient to select a few ratios to represent the financial patterns with relatively little loss of information. Third, the reported long-term stability of financial patterns suggested that the extracted patterns are useful for the predictive purposes in Taiwan, but the extension of the results to different countries is not straightforward. Fourth, knowledge of the distribution types and shapes of financial ratios has important implications for decision makers to understand the outlined structure of an industry. The nature of the distributions also provides some avenues for future study for researchers. Finally, for management purposes, the probability functions can help refine the rating process and give more details about the financial information of the firms among the industry.

5.2 Recommendations

(1) The finding of the non-normality of the distribution of ratios in this study implies that one can not invoke the standard assumption that financial ratios are normally distributed as the

sample size increases. In short, an appeal to the normality assumption of financial ratio distribution is of questionable validity.

(2) This study has developed a generalized empirical model using financial ratios for evaluating the performance of the firms among the industry. Of course, similar extensions to other evaluation systems, e.g., rating in the human resources, using quantitative data and/or even qualitative data such as the data coming from questionnaires are possible.

(3) In general, the management of government-owned firms is based on public policy. To evaluate the performance of these firms, one uses not only the “quantitative” data, but also the “qualitative” data. This study has developed the quantitative model in financial management. Therefore, future study in the field of qualitative data is recommended.

(4) Factor Analysis is a highly subjective method in that the choice of factors and type of rotation are crucial decisions. Other approaches should be used to validate the results in this study.

Bibliography

Altman, Edward I., "Financial Ratio, Discriminant Analysis and the Prediction of Corporate Bankruptcy", Journal of Finance (September. 1968), PP 589-609.

Apilado, V.P., D.C. Warner & J.J. Duaten, "Evaluative Techniques in Consumer Finance, Experimental Results and Policy Implications for Financial Institutions", Journal of Financial and Quantitative Analysis (March 1974), pp. 275-283.

Barbeau, E.J., Polynomials: Problem Books in Mathematics, Springer-Verlag New York Inc., 1989.

Barlev, B. & J. Livnat, "The Information Content of Funds Statement Ratios", Journal of Accounting, Auditing and Finance (Summer 1990), pp. 411-438.

Barnes, P., "Methodological Implication of Non-Normally Distributed Financial Ratios", Journal of Business Finance and Accounting (Spring 1982), pp. 51-62.

----------, "The Analysis and Use of Financial Ratios: A review Article", Journal of Business Finance and Accounting (Winter 1987), pp. 449-461.

Beaver, W.H., "Financial Ratios as Predictors of Failure", Empirical Research in Accounting: Selected Studies, Supplement of Journal of Accounting Research (1966), pp. 71-111.

--------------, P. Kettler & M. Scholes, "The Association Between Market - Determinated and Accounting-Determinated Risk Measures", The Accounting Review (October 1970), pp. 654-682.

Bedingfield, J. P., P.M.J. Reckers & A.J. Stagliano, "Distributions of Financial Ratios in the Commercial Banking Industry", Journal of Financial Research (Spring 1985), pp. 77-81.

Belkaoui, A., "Financial ratios as Predictors of Canadian Takeovers", Journal of Business Finance and Accounting (Spring 1978), pp. 93-107.

Benishay, H., "Economic Information in Financial Ratio Analysis: A Note", Accounting and Business Research (Spring 1971), pp. 174-179.

Berenson, Mark L., David M. Levine & Matthew Goldstein, Intermediate Statistical Methods and Applications, Prentice-Hall Inc., New Jersey, 1983.

Bernhard, A., Value Line Methods of Evaluating Common Stocks, 1st ed., Arnold Bernhard and Co. Inc., 1979.

Bernstein, Ira H., Calvin P. Garbin & Gray K. Teng, Applied Multivariate Analysis, Springer-Verlag Inc., 1988.

Bernstein, Leopold A., Financial Statement Analysis----Theory, Application, and Interpretation, 4th ed., Richard D. Irwin, Inc., 1989.

Bird, R.G. & A.J. McHugh, "Financial Ratios --- An Empirical Study", Journal of Business Finance and Accounting (Spring 1977), pp. 29-45.

Bliss, J.H., Financial and Operating Ratios in Management, Ronald Press Co., 1923,. pp. 34-38.

Boughen, P.D. & J.C. Drury, "UK Statistical Distribution of Financial Ratios", Journal of Business Finance and Accounting (Spring 1980), pp. 39-47.

Bowman, R.G., "The Importance of a Market-Value Measurement of Debt in Assessing Leverage", Journal of Accounting Research (Spring 1980), pp. 242-254.

Buijink, W. & M. Jegers, "Cross-Sectional Distributional Properties of Financial Ratios in Belgian Manufacturing Industries: Aggregation Effects and Persistence Over Time", Journal of Business Finance and Accounting (Autumn 1986), pp. 337-363.

Carslaw, C.A. & J.R. Mills, "Developing Ratios for Effective Cash Flow Statement Analysis", Journal of Accounting (November, 1991), pp. 63-70.

Cattell, R. B., "The Scree Test for the Number of Factors", Multivariate Behavioral Research (1966), pp. 245-276.

Chen, C.H. & T.A. Shimerda, "An Empirical Analysis of Useful Financial Ratios", Financial Management (Spring 1981), pp. 51-60.

Coperland, Thomas E. & J. Fred Weston, Financial Theory and Corporate Policy, 3th ed., Addison-Wesley Co., 1992.

Daniel, Cuthbert & Fred s. Wood, Fitting Equations to Data: Computer Analysis of Multifactor Data, 2nd ed., John Wiley & Sons, Inc., 1980.

Deakin, E.B., "Distributions of Financial Accounting Ratios: Some Empirical Evidence", The Accounting Review (January 1976), pp. 90-96.

Dince, R.R. & C. Fortson, "The Use of Discriminant Analysis to Predict the Capital Adequacy of Commercial Banks", Journal of Bank Research (Spring 1972), pp. 54-62.

Dombolena I.G. & S.J. Khoury, "Ratio Stability and Corporate Failure", The Journal Finance (September 1980), pp. 1017-1026.

Eisenbeis, R.A., "Pitfalls in the Application of Discriminant Analysis in Business Finance, and Economics", Journal of Finance (June 1977), pp. 875-899.

Elderton, W.P. & N.L. Johnson, Systems of Frequency Curves, 1st ed., Cambridge University Press, 1969.

Ezzamel, M., C. Mar-Molinero & A. Beecher, "On the Distributional Properties of Financial Ratios", Journal of Business Finance and Accounting (Winter 1987), pp. 463-481.

--------------, J. Brodie & C. Mar-Molinero, "Financial Patterns of UK Manufacturing Companies", Journal of Business Finance and Accounting (Winter 1987), pp. 519-536.

--------------,C. Mar-Moliinero, "The Distributional Properties of Financial Ratios in UK Manufacturing Companies", Journal of Business Finance and Accounting (Spring 1990), pp. 1-29.

Fieldsend, S., N. Longford & S. McLeay, "Industry Effects and Proportionality Assumption in Ratio Analysis : A Variance Component Analysis", Journal of Business and Accounting (Winter 1987), pp. 497-517.

Foster, F., Financial Statement Analysis, 2nd ed., New Jersey: Prentice-Hall, 1986.

Foulke R.A., The Commercial Paper Market, Bankers Publishing Co., 1931, pp. 12-132.

Frecka, T.A. & W.S. Hopwood, "The Effect of Outliers on the cross-section Distributional Properties of Financial Ratios", The Accounting Review (January 1983), pp. 115-128.

Gate, S.W., 101 Business Ratios, 1st ed., Arizona: McLane Publication, 1993.

Giacomino, D.E. & D.E. Mielke, "Using the Statement of Cash Flows to Analyze Corporate Performance", Management Accounting (May 1988), pp. 54-57.

Gibbons, J.D., Nonparametric Methods for Quantitative Analysis, 1st ed., NY: Rinehart & Winston, 1976.

Gombola, M. & E. Ketz, "A Note on Cash flow and Classification Patterns of Financial Ratios", The Accounting Review (1983), pp. 105-114.

Guttman, L., "Some Necessary Conditions for Common Factor Analysis", Psychometrika (1954), pp. 149-161.

Hamada, R.S., "The Effect of the Firm's Capital Structure on the Systematic Risk of Common Stocks", The Journal of Finance (March 1972), pp. 435-452.

Hickman, W. Braddock, "Corporate Bond Quality and Investor Experience" Princeton University Press, 1958, pp. 390-421.

Horrigan, J.O., "Some Empirical Bases of Financial Ratio Analysis", Accounting Review (July 1965), pp. 558-568.

Horrigan, James O., "The Determination of Long-term Credit Standing with Financial Ratios", Journal of Accounting Research (1966), pp. 44-62.

------------------, "A Short History of Financial Ratios Analysis", Accounting Review 43 (April 1968), pp. 284-294.

Hutchinson, P., I. Meric & G. Meric, "The Financial Characteristics of Small Firms Which Achieve Quotation on the UK Unlisted Securities Market", Journal of Business Finance and Accounting (Spring 1988), pp. 9-19.

Johnson, Norman L. & Samuel Kotz, Distributions in Statistics: Continuous Univariate Distribution - 1, Boston: Houghton Mifflin Co., 1970.

--, Distributions in Statistics: Continuous Univariate Distribution - 2, Boston: Houghton Mifflin Co., 1970.

Johnson, R.A. & D.W. Wichern, Applied Multivariate Statistical Analysis, 2nd ed., New Jersey: Prentice Hail, 1988.

Johnson, W.B., "The Cross-Sectional Stability of Financial Patterns", Journal of Business Finance and Accounting (Summer 1978), pp. 207-214.

Ju-Ping, Lai, "Application of Factor Analysis in Financial Ratios", Unpublished Master's Thesis, National Shun Yi-Sien University Press, Taiwan, 1983.

Kaiser, H. F., "The Varimax Criterion for Analytic Rotation in Factor Analysis", Psychometrika (1958), pp. 187-200.

Ketz, J.E., "The Effect of General Price Level Adjustments on the Predictive Ability of Financial Ratios", Supplement to Journal of Accounting Research (1978), pp. 273-284.

Kolari, J., T.H. McInish & E.M. Saniga, "A Note on the Distribution Type of Financial Ratios in the Commercial Banking Industry", Journal of Banking and Finance (July 1989), pp. 463-471.

Kuh, E. & J.R. Meyer, "Correlation and Regression Estimates When the Data are Ratios", Econometrica (October 1955), pp. 401-416.

Laitinen, E., "A Multivariate model of the Financial Relationships in the Firm", The Finnish Journal of Business Economics 4, (1983), pp. 317-333.

Lee, C., "Stochastic Properties of Cross-Sectional Financial Data", Journal of Accounting Research (Spring 1985), pp. 213-227.

Lev, B., Financial Statement Analysis: A New Approach, 1st ed., New Jersey: Pretince-Hall, 1974.

--------, & S. Sunder, "Methodological Issues in the Use of Financial Ratios", Journal of Accounting and Economics (December 1979), pp. 187-210.

Libby, R., "Accounting Ratios and the Prediction of Failure: Some Behavioral Evidence", Journal of Accounting Research, (Spring 1975), pp. 150-161.

Marascuilo, L.A. & J.R. Levin, Multivariate Statistics in Social Science: A Researchers' Guide , Cole Publishing Co., 1983.

Martikainen, T., "Time-Series Distributional Properties of Financial Ratios: Empirical Evidence from Finnish Listed Firms", European Journal of Operational Research (May 1992), pp. 344-355.

McDonald, B. & M.H. Morris, "The Statistical Validity of the Ratio Method in Financial Analysis: An Empirical Examination", Journal of Business Finance and Accounting (Spring 1984), pp. 89-98.

----------------------------------, "The Functional Specification of Financial Ratios: An Empirical Examination", Accounting and Business Research (summer 1985), pp. 223-238.

McLeay, S. & S. Fieldsend, "Sector and Size Effect in Ratio Analysis ----- An Indirect Test of Ratio Proportionality", Accounting and Business Research, Vol. 17, No. 66 (Spring 1987), pp. 133-140.

Mecimore, C.D., "Some Empirical Distributions of Financial Ratios", Management Accounting USA (September 1968), pp. 13-16.

Merwin, C.L., "Financing Small Corporations: In Five Manufacturing Industries, 1926-36", National Bureau of Economic Research, 1942.

Norton, C.L. & R.E. Smith, "A Comparison of General Price Level and Historical Cost Financial Statements in the Prediction of Bankruptcy", The Accounting Review (January 1979), pp. 72-87.

O'Connor, M.C., "On the Usefulness of Financial Ratios to Investors in Common Stock", Accounting Review (April 1973), pp. 339-352.

Osteryoung, J., L. R. Constand & D. Nast , "Financial Ratios in Large Public and Small Private Firms", Journal of Small Business Management (July 1992), pp. 35-46.

Pearson, E.S. & H.O. Hartley, Biometrika Tables for Statisticians, Vol. 2, Biometrika Trust, 1976.

Pettway, R.H. & J. F. Sinkey, "Establishing On-Site Bank Examination Priority: An Early warning System Using Accounting and Market Information", Journal of Finance (March 1980), pp. 137-150.

Pinches, G. E. & K. A. Mingo, "A Multivariate Analysis of Industrial Bond Ratings", Journal of Finance 28 (March 1973), pp. 1-18.

------------------------------- , & J. Kent Caruthers, "The Stability of Financial Patterns in Industrial Organizations", Journal of Finance (1973), pp. 389-396.

Pinches, G.E., Arthur A. Eubank, K.A. Mingo & J. Kent Caruthers, "The Hierarchical Classification of Financial Ratios", Journal of Business Research, (October, 1975), pp. 295-310.

Richardson, F.M. & L.F. Davidson, "On Linear Discrimination with Accounting Ratios", Journal of Business and Accounting (Winter 1984), pp. 511-525.

Ricketts, D. & R. Stover, "An Examination of Commercial Bank Financial Ratios", Journal of Bank Research (Summer 1978), pp. 121-124.

Rege, U.P., "Accounting Ratios to Locate Takeover Targets", Journal of Business Finance and Accounting (Autumn 1984), pp. 291-311.

Short, D.G., "The Impact of Price-level Adjustment on the Meaning of Accounting Ratios", Journal of Business Finance and Accounting (Autumn 1980), pp. 377-391.

Sinkey, J.F., "A Multivariate Statistical Analysis of the Characteristics of Problem Banks", Journal of Finance (March 1975), pp. 21-36.

Smith R.F. & A.H. Winakor, "Changes in the Financial Structure of Unsuccessful Industrial Corporations", Bulletin No. 51: Urbana, Ill.: University of Illinois, Bureau of Business Research, 1935.

So, J.C., "Some Empirical Evidence on the Outliers and the Non-Normal Distributions of Financial Ratios", Journal of Business Finance and Accounting (Winter 1987), pp. 483-495.

Stevens, D. L., "Financial Characteristic of Merged Firm: A Multivariate Analysis", Journal of Financial and Quantitative Analysis (March 1973).

Taffler, R.J., "Forecasting Company Failure in the UK Using Discriminant Analysis and Financial Ratio Data", Journal of the Royal Statistical Society, (1982), part 3, pp. 342-358.

Yli-Olli, P. & I. Virtanen, "On the Long-Term Stability and Cross-Country Invariance of Financial Ratio Patterns", European Journal of Operational Research (March 1989), pp. 40-53.

----------------------------, "On Cross-Sectional Properties and Time-Series Persistence of Finnish Cash-Flow Based Financial Ratio Distributions", Finnish Journal of Business Economics (Winter 1989), pp. 374-404.

Appendices

Appendix A: Financial Items of General Financial Statements

Balance Sheet

Total assets	Liabilities and Net worth
Current assets	Total liabilities
Cash	Current liabilities
Marketable securities	Long-Term debt
Accounts receivable	Other liabilities
Inventories	Net worth
Accounts prepaid	Capital stock
Long-Term investments	Retained earnings
Fixed assets	
Deferred charges	
Other assets	

Income Statement

Operation revenue

- Sales
- Other operation revenue

Operation expense

- Cost of goods sold
- Other operation expenses
- Selling, general & administrative expenses

Operation income

Non-operation revenue & expenses

- Interest income & Interest expense
- Other non-operation revenue & expenses

Earnings before taxes

Income taxes

Earnings after taxes

Statement of Cash Flows

Sources of cash flows

- Cash provided by operations
- Cash provided by investing activities
- Cash provided by financing activities
- Other sources of cash

Uses of cash flows

- Cash used in operations
- Cash used in investing activities
- Cash used in financing activities
- Other uses of cash

Cash and equivalents at end of year

Appendix B: Eigenvalues and Scree Test Obtained by Factor Analysis (Example of Year '93)

Initial Factor Method: Principal Factors

Eigenvalues of the Reduced Correlation Matrix:

Total = 42.5979466 Average = 0.86934585

	1	2	3	4	5	6
Eigenvalue	13.535530	10.872436	6.245820	5.088814	3.497556	3.124327
Difference	2.663095	4.626616	1.157006	1.591257	0.373229	1.238195
Proportion	0.3178	0.2552	0.1466	0.1195	0.0821	0.0733
Cumulative	0.3178	0.5730	0.7196	0.8391	0.9212	0.9945

	7	8	9	10	11	12
Eigenvalue	1.886132	1.522336	0.814401	0.498118	0.092470	-0.002080
Difference	0.363796	0.707935	0.316283	0.405648	0.094550	0.001038
Proportion	0.0443	0.0357	0.0191	0.0117	0.0022	-0.0000
Cumulative	1.0388	1.0745	1.0937	1.1053	1.1075	1.1075

	13	14	15	16	17	18
Eigenvalue	-0.003118	-0.007258	-0.008351	-0.009708	-0.010285	-0.015836
Difference	0.004140	0.001092	0.001357	0.000577	0.005551	0.007629
Proportion	-0.0001	-0.0002	-0.0002	-0.0002	-0.0002	-0.0004
Cumulative	1.1074	1.1072	1.1070	1.1068	1.1066	1.1062

	19	20	21	22	23	24
Eigenvalue	-0.023465	-0.025920	-0.029406	-0.038929	-0.041155	-0.042109
Difference	0.002455	0.003485	0.009523	0.002226	0.000954	0.003144
Proportion	-0.0006	-0.0006	-0.0007	-0.0009	-0.0010	-0.0010
Cumulative	1.1056	1.1050	1.1043	1.1034	1.1025	1.1015

	25	26	27	28	29	30
Eigenvalue	-0.045253	-0.049593	-0.061671	-0.070274	-0.079086	-0.087932
Difference	0.004340	0.012078	0.008603	0.008811	0.008846	0.016446
Proportion	-0.0011	-0.0012	-0.0014	-0.0016	-0.0019	-0.0021
Cumulative	1.1004	1.0992	1.0978	1.0961	1.0943	1.0922

	31	32	33	34	35	36
Eigenvalue	-0.104377	-0.109575	-0.112674	-0.120395	-0.135958	-0.143190
Difference	0.005198	0.003099	0.007721	0.015563	0.007233	0.009239
Proportion	-0.0025	-0.0026	-0.0026	-0.0028	-0.0032	-0.0034
Cumulative	1.0898	1.0872	1.0846	1.0817	1.0785	1.0752

	37	38	39	40	41	42
Eigenvalue	-0.152429	-0.161408	-0.168888	-0.174332	-0.200344	-0.206767
Difference	0.008978	0.007480	0.005444	0.026012	0.006423	0.012638
Proportion	-0.0036	-0.0038	-0.0040	-0.0041	-0.0047	-0.0049
Cumulative	1.0716	1.0678	1.0638	1.0598	1.0550	1.0502

	43	44	45	46	47	48
Eigenvalue	-0.219406	-0.256822	-0.285634	-0.314563	-0.329321	-0.362710
Difference	0.037417	0.028811	0.028929	0.014759	0.033388	0.007061
Proportion	-0.0052	-0.0060	-0.0067	-0.0074	-0.0077	-0.0085
Cumulative	1.0450	1.0390	1.0323	1.0249	1.0172	1.0087

	49
Eigenvalue	-0.369771
Difference	
Proportion	-0.0087
Cumulative	1.0000

Scree Plot of Eigenvalues

```
E    |
i 15 +
g    | 1
e    |    2
n 10 +
v    |
a    |      3
l  5 +        4
u    |         56
e    |            78
s  0 +               901 23 456 78 901 23 456 78 901 23 456 78 901 23 456 78 9
     |
   --+------+------+------+------+------+------+------+------+------+------+-
     0      5     10     15     20     25     30     35     40     45     50
                                     Number
```

Appendix C: The Factor Structure of Oblique Rotation (in the Data Sample of Year '93)

Rotation Method: Promax

Factor Structure (Correlations)

	FACTOR1	FACTOR2	FACTOR3	FACTOR4	FACTOR5	FACTOR6
R21	0.94665	-0.18058	-0.12322	0.02583	-0.24467	-0.37230
R22	0.95370	-0.22051	-0.16756	-0.07529	-0.23038	-0.39087
R9	0.93057	-0.16394	-0.22642	-0.43842	-0.15373	-0.22327
R8	0.89253	0.06617	-0.31148	0.09696	-0.28463	-0.38614
R15	0.92745	-0.11958	-0.23281	-0.44560	-0.16834	-0.18544
R11	0.92141	-0.10622	-0.26700	-0.46022	-0.17365	-0.17040
R14	0.81186	0.00751	-0.21710	0.37621	-0.40844	-0.31900
R7	0.78003	0.18665	-0.60476	-0.18044	-0.24667	-0.10230
R42	-0.81149	0.46563	0.14356	0.28599	0.07737	0.36530
R12	-0.71281	-0.31081	0.10252	0.14148	0.23279	-0.26190
R25	-0.13292	0.95789	-0.13732	-0.13210	-0.00125	0.13568
R27	-0.23077	0.94508	-0.08450	-0.05775	-0.01934	0.19511
R1	0.06480	0.97774	-0.43463	-0.08585	-0.03724	0.04346
R34	0.12964	0.84180	-0.05964	-0.26042	-0.11914	0.03910
R33	0.06563	0.96394	-0.47309	-0.02198	-0.05075	0.05954
R32	0.11218	0.90264	-0.57224	0.08125	0.06818	0.06120
R23	0.01095	0.88423	-0.56502	0.06821	0.21875	0.01020
R49	-0.37821	0.81520	-0.33241	0.26737	0.14114	0.30277
R35	0.09043	-0.85232	0.39695	-0.06098	-0.11009	-0.00905
R6	-0.26620	-0.25252	0.95860	0.22656	0.06567	0.31277
R48	-0.29949	-0.24134	0.95232	-0.06755	0.13069	0.34583
R3	-0.26092	-0.24434	0.91505	0.42065	0.00250	0.17786
R43	-0.34815	0.31091	0.52627	0.43321	0.10082	0.10817
R38	-0.59559	-0.32819	0.70247	0.55730	0.09752	0.23617
R17	-0.47857	-0.31633	0.62374	-0.00482	0.04457	0.20446
R40	-0.08924	0.33937	-0.48567	0.24349	0.36327	-0.06313
R39	-0.41801	-0.08456	-0.33667	0.30641	0.19140	0.12338
R47	0.03725	0.36619	-0.60519	-0.03768	-0.14402	0.24215
R24	0.17194	0.55068	-0.87721	0.29039	0.08463	-0.20102
R26	0.24101	0.50707	-0.92949	0.19595	-0.01750	-0.20217
R2	-0.11567	-0.06462	0.19486	0.89601	-0.16410	-0.15714
R36	-0.16120	-0.15075	-0.20999	0.86036	0.11518	-0.05456
R41	-0.03691	0.52412	-0.00059	0.75363	-0.12571	0.06160
R28	-0.41885	-0.23596	0.60866	0.72491	0.25998	0.19381
R10	0.54319	-0.09378	-0.29110	0.55096	-0.49451	-0.45586
R37	-0.48442	-0.28836	0.47615	0.63279	-0.09590	-0.23452
R30	-0.57616	-0.16803	-0.23039	0.53284	0.58737	-0.03361
R19	-0.11042	0.31112	-0.06258	-0.24342	0.84957	0.29847
R31	-0.10672	0.06084	0.06098	-0.25984	0.85652	0.36253
R18	-0.56198	-0.05366	0.03347	0.11342	0.94081	0.09180
R20	-0.56951	-0.11829	-0.02081	0.11369	0.86256	-0.04588
R16	0.01646	0.09151	-0.40922	-0.16266	0.44073	-0.23203
R13	-0.00049	0.15054	-0.15885	0.49948	-0.51142	-0.14335
R29	0.01042	0.08640	-0.16293	-0.15394	-0.60761	-0.00394
R45	-0.19031	-0.11603	0.05995	-0.23589	0.06933	0.90290
R44	-0.18686	0.18960	0.29242	-0.04228	0.06704	0.94963
R46	-0.33200	0.32520	0.15447	-0.11577	0.10370	0.90912
R4	-0.29704	-0.11541	0.34759	0.48613	0.17517	0.67173
R5	-0.37141	-0.17360	0.57748	0.08016	0.31946	0.77582

Appendix D: Correlation Matrix of the Pool Sample of Year '78, '81, '84, '87, '90, '93

Pearson Correlation Coefficients / N = 72

	R1	R2	R3	R4	R5	R6	R7
R1	1.00000	-0.30945	-0.42203	-0.27409	-0.27511	-0.41214	0.48141
R2	-0.30945	1.00000	0.75856	0.29929	0.00458	0.51330	-0.38771
R3	-0.42203	0.75856	1.00000	0.57064	0.38988	0.91897	-0.56674
R4	-0.27409	0.29929	0.57064	1.00000	0.87616	0.77294	-0.31138
R5	-0.27511	0.00458	0.38988	0.87616	1.00000	0.66239	-0.38671
R6	-0.41214	0.51330	0.91897	0.77294	0.66239	1.00000	-0.51274
R7	0.48141	-0.38771	-0.56674	-0.31138	-0.38671	-0.51274	1.00000
R8	0.28351	-0.18214	-0.32217	-0.33435	-0.40334	-0.34564	0.72430
R9	0.15403	-0.35919	-0.33487	-0.27317	-0.27854	-0.30022	0.64767
R10	0.00445	0.66678	0.28739	-0.13215	-0.44399	0.03551	0.30879
R11	0.22189	-0.40333	-0.38506	-0.28981	-0.29967	-0.34308	0.67561
R12	-0.23506	0.07774	0.11747	0.11542	0.13693	0.13590	-0.39192
R13	0.00145	0.20505	0.25496	0.42205	0.26982	0.31444	0.00619
R14	0.12118	0.32691	0.08587	-0.10997	-0.31919	-0.05646	0.48385
R15	0.17498	-0.34637	-0.32481	-0.25342	-0.26616	-0.29102	0.64824
R16	0.32028	-0.43421	-0.48499	-0.39678	-0.32770	-0.45523	0.31702
R17	-0.17787	0.10350	0.16555	0.06903	0.08824	0.13536	-0.36889
R18	0.05650	-0.11445	-0.11069	-0.10323	-0.01950	-0.10150	-0.21120
R19	0.30640	-0.29841	-0.32674	-0.29272	-0.23397	-0.31364	0.25755
R20	-0.02702	-0.04785	-0.09191	-0.09105	-0.03161	-0.09848	-0.19521
R21	0.11177	-0.07127	-0.15242	-0.26370	-0.32548	-0.19749	0.54260
R22	0.09806	-0.17182	-0.21339	-0.24108	-0.28538	-0.22154	0.63050
R23	0.83411	-0.21020	-0.35761	-0.27591	-0.29677	-0.36859	0.43345
R24	0.73669	-0.03410	-0.31596	-0.17375	-0.26095	-0.37731	0.34445
R25	0.80281	-0.31479	-0.35103	-0.29589	-0.30593	-0.33282	0.45811
R26	0.73432	-0.07196	-0.41397	-0.24217	-0.34655	-0.48728	0.42337
R27	0.79417	-0.22401	-0.26003	-0.21518	-0.23364	-0.24881	0.35506
R28	-0.21391	0.67591	0.73814	0.45592	0.22907	0.64870	-0.38223
R29	0.12613	-0.11550	-0.19567	-0.17671	-0.18000	-0.22180	0.14594
R30	0.03742	0.28015	0.04442	-0.20140	-0.31014	-0.10103	-0.01263
R31	0.11502	-0.22296	-0.24349	-0.24679	-0.18981	-0.23717	0.19559
R32	0.84529	-0.16646	-0.32061	-0.23884	-0.28835	-0.33599	0.45109
R33	0.97877	-0.20685	-0.36719	-0.26009	-0.32092	-0.38898	0.48545
R34	0.52718	-0.14833	-0.12908	-0.10651	-0.11150	-0.11579	0.18573
R35	-0.68784	0.32171	0.32706	0.16590	0.11139	0.28399	-0.26575
R36	-0.04518	0.52975	0.23865	-0.03560	-0.25195	0.06493	0.02009
R37	-0.43199	0.87677	0.73942	0.17743	-0.00044	0.49186	-0.66102
R38	-0.50125	0.67364	0.81633	0.70344	0.64591	0.80298	-0.75080
R39	-0.05781	0.00560	-0.02166	0.08334	0.08296	-0.01937	-0.11708
R40	0.24677	-0.28422	-0.36981	-0.31386	-0.30129	-0.37072	0.26704
R41	0.28301	0.10028	-0.01470	-0.10264	-0.16858	-0.06976	0.10496
R42	0.20931	0.13104	0.10331	0.08716	0.09995	0.09068	-0.33292
R43	-0.14133	0.17786	0.28781	0.34140	0.33812	0.35639	-0.27935
R44	-0.00175	0.13718	0.25276	0.34570	0.36930	0.32268	-0.11716
R45	-0.11635	-0.11392	0.04718	0.16859	0.28217	0.11888	-0.12248
R46	-0.07505	0.17672	0.28239	0.36234	0.41631	0.33327	-0.31251
R47	0.10823	0.08444	0.06125	0.20130	0.15703	0.09080	-0.01413
R48	-0.36809	0.06221	0.62806	0.45065	0.63010	0.77871	-0.54136
R49	0.51411	-0.14352	-0.19077	0.01512	0.04781	-0.14924	0.10958

(Continued Appendix D)

	R8	R9	R10	R11	R12	R13	R14
R1	0.28351	0.15403	0.00445	0.22189	-0.23506	0.00145	0.12118
R2	-0.18214	-0.35919	0.66678	-0.40333	0.07774	0.20505	0.32691
R3	-0.32217	-0.33487	0.28739	-0.38506	0.11747	0.25496	0.08587
R4	-0.33435	-0.27317	-0.13215	-0.28981	0.11542	0.42205	-0.10997
R5	-0.40334	-0.27854	-0.44399	-0.29967	0.13693	0.26982	-0.31919
R6	-0.34564	-0.30022	0.03551	-0.34308	0.13590	0.31444	-0.05646
R7	0.72430	0.64767	0.30879	0.67561	-0.39192	0.00619	0.48385
R8	1.00000	0.66380	0.36240	0.57075	-0.63244	-0.16200	0.75052
R9	0.66380	1.00000	0.08069	0.96809	-0.47193	-0.11272	0.43166
R10	0.36240	0.08069	1.00000	0.01929	-0.14582	0.17807	0.70069
R11	0.57075	0.96809	0.01929	1.00000	-0.39905	-0.09570	0.32747
R12	-0.63244	-0.47193	-0.14582	-0.39905	1.00000	0.18718	-0.69524
R13	-0.16200	-0.11272	0.17807	-0.09570	0.18718	1.00000	-0.02569
R14	0.75052	0.43166	0.70069	0.32747	-0.69524	-0.02569	1.00000
R15	0.64214	0.99605	0.08557	0.97223	-0.49580	-0.10062	0.44894
R16	0.28272	0.19823	-0.19640	0.22570	-0.03456	-0.25509	-0.15185
R17	-0.36728	-0.20036	-0.10040	-0.21029	0.31265	0.12530	-0.22892
R18	-0.24547	-0.26958	-0.23837	-0.24473	0.23575	-0.16000	-0.34128
R19	0.40004	0.18994	-0.12365	0.16804	-0.48269	-0.26867	0.22021
R20	-0.39917	-0.31912	-0.16230	-0.25907	0.56331	-0.06308	-0.51554
R21	0.68959	0.78732	0.36151	0.70233	-0.36920	-0.06488	0.59717
R22	0.78321	0.88352	0.31111	0.79515	-0.42675	-0.08623	0.60838
R23	0.29919	0.05735	0.13494	0.08978	-0.19389	-0.04405	0.16087
R24	0.20354	0.00248	0.24212	0.02738	-0.12685	0.06628	0.19049
R25	0.32206	0.24982	-0.00703	0.32218	-0.24390	-0.10900	0.13920
R26	0.23309	0.07428	0.25481	0.11204	-0.13280	0.06882	0.19492
R27	0.22731	0.12821	0.01219	0.20017	-0.20412	-0.07461	0.10707
R28	-0.29189	-0.35450	0.40554	-0.38483	0.21795	0.32487	0.05003
R29	0.10199	0.00718	0.06021	0.01423	0.06693	0.18079	-0.01683
R30	-0.04377	-0.23880	0.41507	-0.24655	0.16316	0.02764	0.06439
R31	0.39165	0.16528	-0.07425	0.12048	-0.47593	-0.24704	0.26648
R32	0.28674	0.08137	0.17577	0.12251	-0.19993	-0.00944	0.17815
R33	0.26097	0.12836	0.11962	0.20208	-0.20680	0.03851	0.15559
R34	0.13969	0.18900	-0.04894	0.20671	-0.20533	-0.04252	0.08784
R35	-0.08755	-0.11383	0.20747	-0.19852	0.08823	0.04449	0.12461
R36	-0.01794	-0.20709	0.60095	-0.20659	0.14684	0.17462	0.21410
R37	-0.36931	-0.52224	0.50959	-0.59596	0.23950	0.13488	0.11509
R38	-0.55043	-0.58386	0.10456	-0.64982	0.28646	0.28368	-0.12418
R39	-0.17397	-0.22841	-0.02334	-0.23908	0.16778	0.20748	-0.14266
R40	0.16102	0.05990	-0.03601	0.08955	0.04296	0.04923	-0.06045
R41	0.17980	0.05228	0.13787	0.07004	-0.03125	-0.06675	0.19174
R42	-0.41152	-0.67036	-0.14325	-0.56117	0.21420	0.01068	-0.31474
R43	-0.30302	-0.26980	-0.07010	-0.23915	0.33743	0.15253	-0.25975
R44	-0.13305	-0.10364	-0.02141	-0.11511	0.01185	0.27815	-0.03207
R45	-0.16983	-0.05154	-0.21597	-0.06494	-0.00762	0.15627	-0.17609
R46	-0.24989	-0.28210	-0.12970	-0.32044	0.02119	0.20083	-0.13638
R47	-0.08450	-0.07594	0.07244	-0.06897	0.07761	0.17351	0.01086
R48	-0.34745	-0.23916	-0.33811	-0.28175	0.09527	0.08172	-0.26620
R49	-0.00997	-0.16043	-0.13117	-0.11342	0.05803	0.02661	-0.14035

(Continued Appendix D)

	R15	R16	R17	R18	R19	R20	R21
R1	0.17498	0.32028	-0.17787	0.05650	0.30640	-0.02702	0.11177
R2	-0.34637	-0.43421	0.10350	-0.11445	-0.29841	-0.04785	-0.07127
R3	-0.32481	-0.48499	0.16555	-0.11069	-0.32674	-0.09191	-0.15242
R4	-0.25342	-0.39678	0.06903	-0.10323	-0.29272	-0.09105	-0.26370
R5	-0.26616	-0.32770	0.08824	-0.01950	-0.23397	-0.03161	-0.32548
R6	-0.29102	-0.45523	0.13536	-0.10150	-0.31364	-0.09848	-0.19749
R7	0.64824	0.31702	-0.36889	-0.21120	0.25755	-0.19521	0.54260
R8	0.64214	0.28272	-0.36728	-0.24547	0.40004	-0.39917	0.68959
R9	0.99605	0.19823	-0.20036	-0.26958	0.18994	-0.31912	0.78732
R10	0.08557	-0.19640	-0.10040	-0.23837	-0.12365	-0.16230	0.36151
R11	0.97223	0.22570	-0.21029	-0.24473	0.16804	-0.25907	0.70233
R12	-0.49580	-0.03456	0.31265	0.23575	-0.48269	0.56331	-0.36920
R13	-0.10062	-0.25509	0.12530	-0.16000	-0.26867	-0.06308	-0.06488
R14	0.44894	-0.15185	-0.22892	-0.34128	0.22021	-0.51554	0.59717
R15	1.00000	0.15455	-0.19466	-0.28123	0.18659	-0.34203	0.77880
R16	0.15455	1.00000	-0.28163	0.46460	0.52319	0.42340	0.01236
R17	-0.19466	-0.28163	1.00000	0.03891	-0.21819	0.11272	-0.03326
R18	-0.28123	0.46460	0.03891	1.00000	0.55427	0.79477	-0.30295
R19	0.18659	0.52319	-0.21819	0.55427	1.00000	0.16802	0.00806
R20	-0.34203	0.42340	0.11272	0.79477	0.16802	1.00000	-0.30953
R21	0.77880	0.01236	-0.03326	-0.30295	0.00806	-0.30953	1.00000
R22	0.86847	0.11845	-0.18333	-0.29693	0.07611	-0.31534	0.92949
R23	0.06040	0.45229	-0.18977	0.32105	0.45785	0.16635	0.06105
R24	0.00784	0.33407	-0.11357	0.28577	0.31996	0.18989	0.05053
R25	0.27668	0.25734	-0.18484	0.09271	0.35648	-0.01172	0.18235
R26	0.08001	0.34156	-0.11375	0.17623	0.24687	0.13570	0.10286
R27	0.16024	0.18720	-0.14923	0.07083	0.28587	-0.02041	0.10456
R28	-0.34793	-0.19231	0.11744	0.34048	-0.04392	0.29973	-0.20497
R29	-0.00297	0.31576	-0.08294	0.24614	0.24591	0.19370	-0.04395
R30	-0.24593	0.28236	-0.01228	0.69944	0.37964	0.58407	-0.13903
R31	0.15966	0.41570	-0.17448	0.51748	0.95681	0.13807	0.01776
R32	0.08837	0.40804	-0.17668	0.22153	0.36856	0.10676	0.09286
R33	0.15206	0.29612	-0.15117	0.06241	0.27047	0.00252	0.11829
R34	0.22598	-0.06336	-0.06831	-0.09848	0.12546	-0.12447	0.11737
R35	-0.12258	-0.38274	0.17866	-0.21132	-0.28815	-0.12780	0.01975
R36	-0.20666	0.08781	-0.01762	0.48765	0.20039	0.45494	-0.05597
R37	-0.51890	-0.44173	0.25450	0.00300	-0.33054	0.04855	-0.20564
R38	-0.57312	-0.54724	0.24487	-0.01235	-0.41033	0.02236	-0.37392
R39	-0.22921	0.09135	0.06349	0.28091	0.06433	0.22386	-0.29090
R40	0.04404	0.36125	-0.04521	0.16566	0.23782	0.14537	0.04921
R41	0.06855	-0.09938	0.14175	-0.05036	-0.04660	-0.04036	0.46529
R42	-0.64017	-0.11895	0.06659	0.15046	0.01067	0.13886	-0.58427
R43	-0.27096	-0.10056	-0.09909	0.14513	-0.18334	0.22070	-0.32398
R44	-0.08962	-0.16078	0.01141	0.02130	-0.02353	-0.04356	-0.14069
R45	-0.04547	-0.00989	0.07548	0.06071	0.05369	-0.01890	-0.18951
R46	-0.26886	-0.17502	0.00878	0.06616	-0.00393	-0.02521	-0.31293
R47	-0.06414	-0.11401	0.03351	-0.00739	-0.03786	-0.00590	-0.09969
R48	-0.23951	-0.28194	0.15251	0.01859	-0.15106	-0.04728	-0.22332
R49	-0.15888	0.22971	-0.16935	0.18596	0.16711	0.11406	-0.19018

(Continued Appendix D)

	R22	R23	R24	R25	R26	R27	R28
R1	0.09806	0.83411	0.73669	0.80281	0.73432	0.79417	-0.21391
R2	-0.17182	-0.21020	-0.03410	-0.31479	-0.07196	-0.22401	0.67591
R3	-0.21339	-0.35761	-0.31596	-0.35103	-0.41397	-0.26003	0.73814
R4	-0.24108	-0.27591	-0.17375	-0.29589	-0.24217	-0.21518	0.45592
R5	-0.28538	-0.29677	-0.26095	-0.30593	-0.34655	-0.23364	0.22907
R6	-0.22154	-0.36859	-0.37731	-0.33282	-0.48728	-0.24881	0.64870
R7	0.63050	0.43345	0.34445	0.45811	0.42337	0.35506	-0.38223
R8	0.78321	0.29919	0.20354	0.32206	0.23309	0.22731	-0.29189
R9	0.88352	0.05735	0.00248	0.24982	0.07428	0.12821	-0.35450
R10	0.31111	0.13494	0.24212	-0.00703	0.25481	0.01219	0.40554
R11	0.79515	0.08978	0.02738	0.32218	0.11204	0.20017	-0.38483
R12	-0.42675	-0.19389	-0.12685	-0.24390	-0.13280	-0.20412	0.21795
R13	-0.08623	-0.04405	0.06628	-0.10900	0.06882	-0.07461	0.32487
R14	0.60838	0.16087	0.19049	0.13920	0.19492	0.10707	0.05003
R15	0.86847	0.06040	0.00784	0.27668	0.08001	0.16024	-0.34793
R16	0.11845	0.45229	0.33407	0.25734	0.34156	0.18720	-0.19231
R17	-0.18333	-0.18977	-0.11357	-0.18484	-0.11375	-0.14923	0.11744
R18	-0.29693	0.32105	0.28577	0.09271	0.17623	0.07083	0.34048
R19	0.07611	0.45785	0.31996	0.35648	0.24687	0.28587	-0.04392
R20	-0.31534	0.16635	0.18989	-0.01172	0.13570	-0.02041	0.29973
R21	0.92949	0.06105	0.05053	0.18235	0.10286	0.10456	-0.20497
R22	1.00000	0.05512	0.03114	0.19445	0.08421	0.09668	-0.24584
R23	0.05512	1.00000	0.86965	0.70350	0.82109	0.68818	-0.01147
R24	0.03114	0.86965	1.00000	0.47474	0.96917	0.47604	0.12682
R25	0.19445	0.70350	0.47474	1.00000	0.48256	0.98121	-0.21114
R26	0.08421	0.82109	0.96917	0.48256	1.00000	0.48074	0.00452
R27	0.09668	0.68818	0.47604	0.98121	0.48074	1.00000	-0.13613
R28	-0.24584	-0.01147	0.12682	-0.21114	0.00452	-0.13613	1.00000
R29	-0.00116	0.18040	0.16390	0.08785	0.18065	0.07107	0.11509
R30	-0.16076	0.38609	0.41675	0.07764	0.34020	0.08437	0.61725
R31	0.08226	0.27662	0.16140	0.18442	0.07698	0.11083	-0.00716
R32	0.07845	0.98170	0.87249	0.71333	0.85350	0.71398	-0.00562
R33	0.09131	0.83732	0.77211	0.79606	0.78764	0.80273	-0.11612
R34	0.11592	0.23246	0.10369	0.65710	0.12953	0.67430	-0.14691
R35	0.00722	-0.62035	-0.58299	-0.56989	-0.59908	-0.56592	0.09772
R36	-0.08926	0.25083	0.33987	0.01233	0.28504	0.02344	0.72184
R37	-0.32492	-0.28566	-0.12059	-0.41997	-0.18196	-0.31158	0.66571
R38	-0.43823	-0.40778	-0.25685	-0.52049	-0.35920	-0.38992	0.65823
R39	-0.22762	0.06686	0.11608	-0.05056	0.12022	-0.02905	0.26778
R40	0.01823	0.28311	0.23989	0.23986	0.31063	0.19461	-0.12837
R41	0.21030	0.18805	0.17247	0.37459	0.17661	0.40027	-0.04426
R42	-0.67027	0.14191	0.07759	0.32368	0.03731	0.42950	0.10267
R43	-0.26033	-0.17147	-0.09791	-0.17494	-0.17400	-0.13353	0.38341
R44	-0.11968	-0.00520	-0.04108	-0.00915	-0.10000	0.03533	0.24972
R45	-0.14444	-0.09964	-0.11937	-0.11474	-0.10827	-0.08538	0.10869
R46	-0.30418	-0.10989	-0.13886	-0.09015	-0.18600	-0.02023	0.21812
R47	-0.08397	0.10675	0.19603	0.02932	0.13742	0.05904	0.21922
R48	-0.22973	-0.34306	-0.50543	-0.26230	-0.63047	-0.20726	0.29986
R49	-0.18265	0.50484	0.49073	0.35606	0.49002	0.39348	-0.01495

(Continued Appendix D)

	R29	R30	R31	R32	R33	R34	R35
R1	0.12613	0.03742	0.11502	0.84529	0.97877	0.52718	-0.68784
R2	-0.11550	0.28015	-0.22296	-0.16646	-0.20685	-0.14833	0.32171
R3	-0.19567	0.04442	-0.24349	-0.32061	-0.36719	-0.12908	0.32706
R4	-0.17671	-0.20140	-0.24679	-0.23884	-0.26009	-0.10651	0.16590
R5	-0.18000	-0.31014	-0.18981	-0.28835	-0.32092	-0.11150	0.11139
R6	-0.22180	-0.10103	-0.23717	-0.33599	-0.38898	-0.11579	0.28399
R7	0.14594	-0.01263	0.19559	0.45109	0.48545	0.18573	-0.26575
R8	0.10199	-0.04377	0.39165	0.28674	0.26097	0.13969	-0.08755
R9	0.00718	-0.23880	0.16528	0.08137	0.12836	0.18900	-0.11383
R10	0.06021	0.41507	-0.07425	0.17577	0.11962	-0.04894	0.20747
R11	0.01423	-0.24655	0.12048	0.12251	0.20208	0.20671	-0.19852
R12	0.06693	0.16316	-0.47593	-0.19993	-0.20680	-0.20533	0.08823
R13	0.18079	0.02764	-0.24704	-0.00944	0.03851	-0.04252	0.04449
R14	-0.01683	0.06439	0.26648	0.17815	0.15559	0.08784	0.12461
R15	-0.00297	-0.24593	0.15966	0.08837	0.15206	0.22598	-0.12258
R16	0.31576	0.28236	0.41570	0.40804	0.29612	-0.06336	-0.38274
R17	-0.08294	-0.01228	-0.17448	-0.17668	-0.15117	-0.06831	0.17866
R18	0.24614	0.69944	0.51748	0.22153	0.06241	-0.09848	-0.21132
R19	0.24591	0.37964	0.95681	0.36856	0.27047	0.12546	-0.28815
R20	0.19370	0.58407	0.13807	0.10676	0.00252	-0.12447	-0.12780
R21	-0.04395	-0.13903	0.01776	0.09286	0.11829	0.11737	0.01975
R22	-0.00116	-0.16076	0.08226	0.07845	0.09131	0.11592	0.00722
R23	0.18040	0.38609	0.27662	0.98170	0.83732	0.23246	-0.62035
R24	0.16390	0.41675	0.16140	0.87249	0.77211	0.10369	-0.58299
R25	0.08785	0.07764	0.18442	0.71333	0.79606	0.65710	-0.56989
R26	0.18065	0.34020	0.07698	0.85350	0.78764	0.12953	-0.59908
R27	0.07107	0.08437	0.11083	0.71398	0.80273	0.67430	-0.56592
R28	0.11509	0.61725	-0.00716	-0.00562	-0.11612	-0.14691	0.09772
R29	1.00000	0.40976	0.21033	0.15231	0.14855	-0.00415	-0.20552
R30	0.40976	1.00000	0.37116	0.33227	0.12527	-0.12132	-0.08034
R31	0.21033	0.37116	1.00000	0.17345	0.07606	0.02375	-0.02136
R32	0.15231	0.33227	0.17345	1.00000	0.87250	0.26474	-0.64651
R33	0.14855	0.12527	0.07606	0.87250	1.00000	0.52265	-0.68550
R34	-0.00415	-0.12132	0.02375	0.26474	0.52265	1.00000	-0.29173
R35	-0.20552	-0.08034	-0.02136	-0.64651	-0.68550	-0.29173	1.00000
R36	0.35590	0.91207	0.22052	0.23324	0.06777	-0.12407	0.02074
R37	-0.08452	0.33888	-0.23551	-0.26939	-0.34478	-0.20663	0.40409
R38	-0.17340	0.05838	-0.31085	-0.38962	-0.46417	-0.23236	0.37452
R39	0.21793	0.36181	0.02212	0.06499	-0.01024	-0.10439	-0.13183
R40	0.27194	0.19221	0.15274	0.29218	0.27832	-0.01830	-0.32284
R41	-0.07494	-0.02461	-0.09122	0.21009	0.29943	0.24387	-0.16708
R42	-0.01934	0.09347	-0.02393	0.13336	0.21785	0.13965	-0.13205
R43	-0.17286	0.10662	-0.17655	-0.17672	-0.13195	-0.04377	0.02866
R44	-0.22266	0.03214	-0.02162	0.00683	-0.00037	0.04738	-0.01073
R45	0.11210	0.04061	0.07062	-0.07950	-0.10004	-0.07275	-0.00275
R46	-0.11007	0.00437	0.01212	-0.10768	-0.08044	0.13112	0.06141
R47	-0.37321	0.07960	-0.05780	0.11242	0.11817	0.01871	-0.06784
R48	-0.15226	-0.20191	-0.08284	-0.35356	-0.41799	-0.08063	0.20360
R49	0.15918	0.10378	-0.00771	0.53144	0.52981	0.12664	-0.68681

(Continued Appendix D)

	R36	R37	R38	R39	R40	R41	R42
R1	-0.04518	-0.43199	-0.50125	-0.05781	0.24677	0.28301	0.20931
R2	0.52975	0.87677	0.67364	0.00560	-0.28422	0.10028	0.13104
R3	0.23865	0.73942	0.81633	-0.02166	-0.36981	-0.01470	0.10331
R4	-0.03560	0.17743	0.70344	0.08334	-0.31386	-0.10264	0.08716
R5	-0.25195	-0.00044	0.64591	0.08296	-0.30129	-0.16858	0.09995
R6	0.06493	0.49186	0.80298	-0.01937	-0.37072	-0.06976	0.09068
R7	0.02009	-0.66102	-0.75080	-0.11708	0.26704	0.10496	-0.33292
R8	-0.01794	-0.36931	-0.55043	-0.17397	0.16102	0.17980	-0.41152
R9	-0.20709	-0.52224	-0.58386	-0.22841	0.05990	0.05228	-0.67036
R10	0.60095	0.50959	0.10456	-0.02334	-0.03601	0.13787	-0.14325
R11	-0.20659	-0.59596	-0.64982	-0.23908	0.08955	0.07004	-0.56117
R12	0.14684	0.23950	0.28646	0.16778	0.04296	-0.03125	0.21420
R13	0.17462	0.13488	0.28368	0.20748	0.04923	-0.06675	0.01068
R14	0.21410	0.11509	-0.12418	-0.14266	-0.06045	0.19174	-0.31474
R15	-0.20666	-0.51890	-0.57312	-0.22921	0.04404	0.06855	-0.64017
R16	0.08781	-0.44173	-0.54724	0.09135	0.36125	-0.09938	-0.11895
R17	-0.01762	0.25450	0.24487	0.06349	-0.04521	0.14175	0.06659
R18	0.48765	0.00300	-0.01235	0.28091	0.16566	-0.05036	0.15046
R19	0.20039	-0.33054	-0.41033	0.06433	0.23782	-0.04660	0.01067
R20	0.45494	0.04855	0.02236	0.22386	0.14537	-0.04036	0.13886
R21	-0.05597	-0.20564	-0.37392	-0.29090	0.04921	0.46529	-0.58427
R22	-0.08926	-0.32492	-0.43823	-0.22762	0.01823	0.21030	-0.67027
R23	0.25083	-0.28566	-0.40778	0.06686	0.28311	0.18805	0.14191
R24	0.33987	-0.12059	-0.25685	0.11608	0.23989	0.17247	0.07759
R25	0.01233	-0.41997	-0.52049	-0.05056	0.23986	0.37459	0.32368
R26	0.28504	-0.18196	-0.35920	0.12022	0.31063	0.17661	0.03731
R27	0.02344	-0.31158	-0.38992	-0.02905	0.19461	0.40027	0.42950
R28	0.72184	0.66571	0.65823	0.26778	-0.12837	-0.04426	0.10267
R29	0.35590	-0.08452	-0.17340	0.21793	0.27194	-0.07494	-0.01934
R30	0.91207	0.33888	0.05838	0.36181	0.19221	-0.02461	0.09347
R31	0.22052	-0.23551	-0.31085	0.02212	0.15274	-0.09122	-0.02393
R32	0.23324	-0.26939	-0.38962	0.06499	0.29218	0.21009	0.13336
R33	0.06777	-0.34478	-0.46417	-0.01024	0.27832	0.29943	0.21785
R34	-0.12407	-0.20663	-0.23236	-0.10439	-0.01830	0.24387	0.13965
R35	0.02074	0.40409	0.37452	-0.13183	-0.32284	-0.16708	-0.13205
R36	1.00000	0.45593	0.18599	0.31039	0.12188	0.01073	0.05183
R37	0.45593	1.00000	0.76168	0.08750	-0.26998	0.01381	0.18816
R38	0.18599	0.76168	1.00000	0.11933	-0.40186	-0.10012	0.21066
R39	0.31039	0.08750	0.11933	1.00000	0.52206	-0.20944	-0.01408
R40	0.12188	-0.26998	-0.40186	0.52206	1.00000	0.10325	0.02767
R41	0.01073	0.01381	-0.10012	-0.20944	0.10325	1.00000	0.26192
R42	0.05183	0.18816	0.21066	-0.01408	0.02767	0.26192	1.00000
R43	0.13025	0.19740	0.37779	0.24833	-0.08817	-0.20476	0.13426
R44	0.06569	0.08910	0.30666	0.47122	0.01035	-0.01760	0.05822
R45	0.00889	-0.05958	0.13271	0.62535	0.26649	-0.18380	-0.03917
R46	0.01539	0.18038	0.40527	0.33857	-0.09229	-0.08070	0.18909
R47	0.07297	0.06993	0.15796	0.43314	0.05970	0.01797	0.03967
R48	-0.20910	0.22298	0.57330	-0.03199	-0.27437	-0.13556	0.09120
R49	0.03444	-0.20261	-0.11716	0.09584	0.23498	0.09419	0.27369

(Continued Appendix D)

	R43	R44	R45	R46	R47	R48	R49
R1	-0.14133	-0.00175	-0.11635	-0.07505	0.10823	-0.36809	0.51411
R2	0.17786	0.13718	-0.11392	0.17672	0.08444	0.06221	-0.14352
R3	0.28781	0.25276	0.04718	0.28239	0.06125	0.62806	-0.19077
R4	0.34140	0.34570	0.16859	0.36234	0.20130	0.45065	0.01512
R5	0.33812	0.36930	0.28217	0.41631	0.15703	0.63010	0.04781
R6	0.35639	0.32268	0.11888	0.33327	0.09080	0.77871	-0.14924
R7	-0.27935	-0.11716	-0.12248	-0.31251	-0.01413	-0.54136	0.10958
R8	-0.30302	-0.13305	-0.16983	-0.24989	-0.08450	-0.34745	-0.00997
R9	-0.26980	-0.10364	-0.05154	-0.28210	-0.07594	-0.23916	-0.16043
R10	-0.07010	-0.02141	-0.21597	-0.12970	0.07244	-0.33811	-0.13117
R11	-0.23915	-0.11511	-0.06494	-0.32044	-0.06897	-0.28175	-0.11342
R12	0.33743	0.01185	-0.00762	0.02119	0.07761	0.09527	0.05803
R13	0.15253	0.27815	0.15627	0.20083	0.17351	0.08172	0.02661
R14	-0.25975	-0.03207	-0.17609	-0.13638	0.01086	-0.26620	-0.14035
R15	-0.27096	-0.08962	-0.04547	-0.26886	-0.06414	-0.23951	-0.15888
R16	-0.10056	-0.16078	-0.00989	-0.17502	-0.11401	-0.28194	0.22971
R17	-0.09909	0.01141	0.07548	0.00878	0.03351	0.15251	-0.16935
R18	0.14513	0.02130	0.06071	0.06616	-0.00739	0.01859	0.18596
R19	-0.18334	-0.02353	0.05369	-0.00393	-0.03786	-0.15106	0.16711
R20	0.22070	-0.04356	-0.01890	-0.02521	-0.00590	-0.04728	0.11406
R21	-0.32398	-0.14069	-0.18951	-0.31293	-0.09969	-0.22332	-0.19018
R22	-0.26033	-0.11968	-0.14444	-0.30418	-0.08397	-0.22973	-0.18265
R23	-0.17147	-0.00520	-0.09964	-0.10989	0.10675	-0.34306	0.50484
R24	-0.09791	-0.04108	-0.11937	-0.13886	0.19603	-0.50543	0.49073
R25	-0.17494	-0.00915	-0.11474	-0.09015	0.02932	-0.26230	0.35606
R26	-0.17400	-0.10000	-0.10827	-0.18600	0.13742	-0.63047	0.49002
R27	-0.13353	0.03533	-0.08538	-0.02023	0.05904	-0.20726	0.39348
R28	0.38341	0.24972	0.10869	0.21812	0.21922	0.29986	-0.01495
R29	-0.17286	-0.22266	0.11210	-0.11007	-0.37321	-0.15226	0.15918
R30	0.10662	0.03214	0.04061	0.00437	0.07960	-0.20191	0.10378
R31	-0.17655	-0.02162	0.07062	0.01212	-0.05780	-0.08284	-0.00771
R32	-0.17672	0.00683	-0.07950	-0.10768	0.11242	-0.35356	0.53144
R33	-0.13195	-0.00037	-0.10004	-0.08044	0.11817	-0.41799	0.52981
R34	-0.04377	0.04738	-0.07275	0.13112	0.01871	-0.08063	0.12664
R35	0.02866	-0.01073	-0.00275	0.06141	-0.06784	0.20360	-0.68681
R36	0.13025	0.06569	0.00889	0.01539	0.07297	-0.20910	0.03444
R37	0.19740	0.08910	-0.05958	0.18038	0.06993	0.22298	-0.20261
R38	0.37779	0.30666	0.13271	0.40527	0.15796	0.57330	-0.11716
R39	0.24833	0.47122	0.62535	0.33857	0.43314	-0.03199	0.09584
R40	-0.08817	0.01035	0.26649	-0.09229	0.05970	-0.27437	0.23498
R41	-0.20476	-0.01760	-0.18380	-0.08070	0.01797	-0.13556	0.09419
R42	0.13426	0.05822	-0.03917	0.18909	0.03967	0.09120	0.27369
R43	1.00000	0.48220	0.07916	0.33672	0.51527	0.26831	0.06410
R44	0.48220	1.00000	0.63304	0.83095	0.75809	0.28451	0.09164
R45	0.07916	0.63304	1.00000	0.65066	0.37118	0.24009	0.01835
R46	0.33672	0.83095	0.65066	1.00000	0.42626	0.31977	0.10476
R47	0.51527	0.75809	0.37118	0.42626	1.00000	-0.03172	0.07986
R48	0.26831	0.28451	0.24009	0.31977	-0.03172	1.00000	-0.13689
R49	0.06410	0.09164	0.01835	0.10476	0.07986	-0.13689	1.00000

Appendix E: ANOVA for Stability of Financial Patterns Between Three Pool Samples

Test for Normality of Explanation Ability by the Set 1

------------------------------ Set 1 ------------------------------

UNIVARIATE PROCEDURE

Variable=EXP

Moments

N	6	Sum Wgts	6
Mean	0.144882	Sum	0.86929
Std Dev	0.049525	Variance	0.002453
Skewness	0.569434	Kurtosis	-1.82218
USS	0.138208	CSS	0.012264
CV	34.18316	Std Mean	0.020219
T:Mean=0	7.165778	Prob>|T|	0.0008
Sgn Rank	10.5	Prob>|S|	0.0313
Num ^= 0	6		
W:Normal	0.855117	Prob<W	0.1651

Test for Normality of Explanation Ability by the Set 2

------------------------------ Set 2 ------------------------------

UNIVARIATE PROCEDURE

Variable=EXP

Moments

N	6	Sum Wgts	6
Mean	0.149298	Sum	0.89579
Std Dev	0.049452	Variance	0.002446
Skewness	1.364891	Kurtosis	1.228395
USS	0.145967	CSS	0.012228
CV	33.12298	Std Mean	0.020189
T:Mean=0	7.395136	Prob>|T|	0.0007
Sgn Rank	10.5	Prob>|S|	0.0313
Num ^= 0	6		
W:Normal	0.844393	Prob<W	0.1328

Test for Normality of Explanation Ability by the Set 3

------------------------------ Set 3 ------------------------------

UNIVARIATE PROCEDURE

Variable=EXP

Moments

N	6	Sum Wgts	6
Mean	0.145418	Sum	0.87251
Std Dev	0.065041	Variance	0.00423
Skewness	0.693724	Kurtosis	-1.79942
USS	0.14803	CSS	0.021152
CV	44.72668	Std Mean	0.026553
T:Mean=0	5.476574	Prob>|T|	0.0028
Sgn Rank	10.5	Prob>|S|	0.0313
Num ^= 0	6		
W:Normal	0.833023	Prob<W	0.1054

Again, we also used Fmax (Hartley 1950) to test the homoscedasticity between three samples.

$$Fmax = 1.7247268474 < Fmax(0.95)_{3,5} = 10.8$$

Therefore, we accept HO: $\sigma_1 = \sigma_2 = \sigma_3$.

(Continued Appendix E)

One-Way ANOVA for 3 Sets of Pool Samples
General Linear Models Procedure

Class Level Information

Class	Levels	Values
SET	3	1 2 3

Number of observations in data set = 18

Dependent Variable: EXP

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	0.00006970	0.00003485	0.01	0.9886
Error	15	0.04564275	0.00304285		
Corrected Total	17	0.04571245			

R-Square	C.V.	Root MSE	EXP Mean
0.001525	37.64484	0.055162	0.14653278

Dependent Variable: EXP

Source	DF	Type I SS	Mean Square	F Value	Pr > F
SET	2	0.00006970	0.00003485	0.01	0.9886

Source	DF	Type III SS	Mean Square	F Value	Pr > F
SET	2	0.00006970	0.00003485	0.01	0.9886

(Continued Appendix E)

One-Way ANOVA for 3 Sets of Pool Samples

General Linear Models Procedure

Tukey's Studentized Range (HSD) Test for variable: EXP

NOTE: This test controls the type I experimentwise error rate, but generally has a higher type II error rate than REGWQ.

Alpha= 0.05 df= 15 MSE= 0.003043
Critical Value of Studentized Range= 3.673
Minimum Significant Difference= 0.0827

Means with the same letter are not significantly different.

Tukey Grouping	Mean	N	SET
A	0.1493	6	2
A	0.1454	6	3
A	0.1449	6	1

Appendix F: Kruskal-Wallis Test for Stability of Financial Ratios Over the Empirical Period

Nparlway of R1 over Year 78--93

N P A R 1 W A Y P R O C E D U R E
Wilcoxon Scores (Rank Sums) for Variable R1
Classified by Variable NO

NO	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
1	12	835.0	1158.0	186.386695	69.583333
2	12	1171.0	1158.0	186.386695	97.583333
3	12	1018.0	1158.0	186.386695	84.833333
4	12	1014.0	1158.0	186.386695	84.500000
5	12	807.0	1158.0	186.386695	67.250000
6	12	974.0	1158.0	186.386695	81.166667
7	12	1032.0	1158.0	186.386695	86.000000
8	12	1007.0	1158.0	186.386695	83.916667
9	12	1198.0	1158.0	186.386695	99.833333
10	12	1475.0	1158.0	186.386695	122.916667
11	12	1578.0	1158.0	186.386695	131.500000
12	12	1635.0	1158.0	186.386695	136.250000
13	12	1323.0	1158.0	186.386695	110.250000
14	12	1254.0	1158.0	186.386695	104.500000
15	12	1187.0	1158.0	186.386695	98.916667
16	12	1020.0	1158.0	186.386695	85.000000

Kruskal-Wallis Test (Chi-Square Approximation)
CHISQ= 24.366 DF= 15 Prob > CHISQ= 0.0591

Nparlway of R2 over Year 78--93

N P A R 1 W A Y P R O C E D U R E
Wilcoxon Scores (Rank Sums) for Variable R2
Classified by Variable NO

NO	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
1	12	1179.0	1158.0	186.386695	98.250000
2	12	1227.0	1158.0	186.386695	102.250000
3	12	1413.0	1158.0	186.386695	117.750000
4	12	1529.0	1158.0	186.386695	127.416667
5	12	1417.0	1158.0	186.386695	118.083333
6	12	1304.0	1158.0	186.386695	108.666667
7	12	1180.0	1158.0	186.386695	98.333333
8	12	1251.0	1158.0	186.386695	104.250000
9	12	1098.0	1158.0	186.386695	91.500000
10	12	1098.0	1158.0	186.386695	91.500000
11	12	969.0	1158.0	186.386695	80.750000
12	12	1061.0	1158.0	186.386695	88.416667
13	12	981.0	1158.0	186.386695	81.750000
14	12	983.0	1158.0	186.386695	81.916667
15	12	965.0	1158.0	186.386695	80.416667
16	12	873.0	1158.0	186.386695	72.750000

Kruskal-Wallis Test (Chi-Square Approximation)
CHISQ= 14.523 DF= 15 Prob > CHISQ= 0.4863

Nparlway of R3 over Year 78--93

N P A R 1 W A Y   P R O C E D U R E
Wilcoxon Scores (Rank Sums) for Variable R3
Classified by Variable NO

NO	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
1	12	1331.0	1158.0	186.386695	110.916667
2	12	1267.0	1158.0	186.386695	105.583333
3	12	1391.0	1158.0	186.386695	115.916667
4	12	1438.0	1158.0	186.386695	119.833333
5	12	1372.0	1158.0	186.386695	114.333333
6	12	1267.0	1158.0	186.386695	105.583333
7	12	1207.0	1158.0	186.386695	100.583333
8	12	1258.0	1158.0	186.386695	104.833333
9	12	1154.0	1158.0	186.386695	96.166667
10	12	1134.0	1158.0	186.386695	94.500000
11	12	988.0	1158.0	186.386695	82.333333
12	12	952.0	1158.0	186.386695	79.333333
13	12	906.0	1158.0	186.386695	75.500000
14	12	927.0	1158.0	186.386695	77.250000
15	12	972.0	1158.0	186.386695	81.000000
16	12	964.0	1158.0	186.386695	80.333333

Kruskal-Wallis Test (Chi-Square Approximation)
CHISQ= 13.644   DF= 15   Prob > CHISQ=   0.5527

==

Nparlway of R4 over Year 78--93

N P A R 1 W A Y   P R O C E D U R E
Wilcoxon Scores (Rank Sums) for Variable R4
Classified by Variable NO

NO	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
1	12	1404.0	1158.0	186.386695	117.000000
2	12	1419.0	1158.0	186.386695	118.250000
3	12	1435.0	1158.0	186.386695	119.583333
4	12	1467.0	1158.0	186.386695	122.250000
5	12	1490.0	1158.0	186.386695	124.166667
6	12	1523.0	1158.0	186.386695	126.916667
7	12	1232.0	1158.0	186.386695	102.666667
8	12	1145.0	1158.0	186.386695	95.416667
9	12	1122.0	1158.0	186.386695	93.500000
10	12	953.0	1158.0	186.386695	79.416667
11	12	933.0	1158.0	186.386695	77.750000
12	12	804.0	1158.0	186.386695	67.000000
13	12	754.0	1158.0	186.386695	62.833333
14	12	884.0	1158.0	186.386695	73.666667
15	12	907.0	1158.0	186.386695	75.583333
16	12	1056.0	1158.0	186.386695	88.000000

Kruskal-Wallis Test (Chi-Square Approximation)
CHISQ= 29.169   DF= 15   Prob > CHISQ=   0.0153

(Continued Appendix F)

Nparlway of R5 over Year 78--93

N P A R 1 W A Y   P R O C E D U R E
Wilcoxon Scores (Rank Sums) for Variable R5
Classified by Variable NO

NO	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
1	12	1419.0	1158.0	186.386695	118.250000
2	12	1428.0	1158.0	186.386695	119.000000
3	12	1397.0	1158.0	186.386695	116.416667
4	12	1420.0	1158.0	186.386695	118.333333
5	12	1463.0	1158.0	186.386695	121.916667
6	12	1518.0	1158.0	186.386695	126.500000
7	12	1260.0	1158.0	186.386695	105.000000
8	12	1138.0	1158.0	186.386695	94.833333
9	12	1158.0	1158.0	186.386695	96.500000
10	12	984.0	1158.0	186.386695	82.000000
11	12	965.0	1158.0	186.386695	80.416667
12	12	773.0	1158.0	186.386695	64.416667
13	12	712.0	1158.0	186.386695	59.333333
14	12	867.0	1158.0	186.386695	72.250000
15	12	931.0	1158.0	186.386695	77.583333
16	12	1095.0	1158.0	186.386695	91.250000

Kruskal-Wallis Test (Chi-Square Approximation)
CHISQ= 28.472 DF= 15 Prob > CHISQ= 0.0188

Nparlway of R6 over Year 78--93

N P A R 1 W A Y   P R O C E D U R E
Wilcoxon Scores (Rank Sums) for Variable R6
Classified by Variable NO

NO	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
1	12	1437.0	1158.0	186.386695	119.750000
2	12	1392.0	1158.0	186.386695	116.000000
3	12	1424.0	1158.0	186.386695	118.666667
4	12	1495.0	1158.0	186.386695	124.583333
5	12	1436.0	1158.0	186.386695	119.666667
6	12	1335.0	1158.0	186.386695	111.250000
7	12	1219.0	1158.0	186.386695	101.583333
8	12	1243.0	1158.0	186.386695	103.583333
9	12	1146.0	1158.0	186.386695	95.500000
10	12	1085.0	1158.0	186.386695	90.416667
11	12	968.0	1158.0	186.386695	80.666667
12	12	869.0	1158.0	186.386695	72.416667
13	12	814.0	1158.0	186.386695	67.833333
14	12	816.0	1158.0	186.386695	68.000000
15	12	884.0	1158.0	186.386695	73.666667
16	12	965.0	1158.0	186.386695	80.416667

Kruskal-Wallis Test (Chi-Square Approximation)
CHISQ= 24.536 DF= 15 Prob > CHISQ= 0.0565

(Continued Appendix F)

Nparlway of R7 over Year 78--93

N P A R 1 W A Y   P R O C E D U R E

Wilcoxon Scores (Rank Sums) for Variable R7

Classified by Variable NO

NO	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
1	12	1011.0	1158.0	186.386695	84.250000
2	12	998.0	1158.0	186.386695	83.166667
3	12	1029.0	1158.0	186.386695	85.750000
4	12	1073.0	1158.0	186.386695	89.416667
5	12	1031.0	1158.0	186.386695	85.916667
6	12	1011.0	1158.0	186.386695	84.250000
7	12	1187.0	1158.0	186.386695	98.916667
8	12	1143.0	1158.0	186.386695	95.250000
9	12	1133.0	1158.0	186.386695	94.416667
10	12	1128.0	1158.0	186.386695	94.000000
11	12	1150.0	1158.0	186.386695	95.833333
12	12	1426.0	1158.0	186.386695	118.833333
13	12	1340.0	1158.0	186.386695	111.666667
14	12	1280.0	1158.0	186.386695	106.666667
15	12	1227.0	1158.0	186.386695	102.250000
16	12	1361.0	1158.0	186.386695	113.416667

Kruskal-Wallis Test (Chi-Square Approximation)

CHISQ= 7.4825 DF= 15 Prob > CHISQ= 0.9429

==

Nparlway of R8 over Year 78--93

N P A R 1 W A Y   P R O C E D U R E

Wilcoxon Scores (Rank Sums) for Variable R8

Classified by Variable NO

NO	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
1	12	901.0	1158.0	186.386695	75.083333
2	12	1014.0	1158.0	186.386695	84.500000
3	12	991.0	1158.0	186.386695	82.583333
4	12	1022.0	1158.0	186.386695	85.166667
5	12	887.0	1158.0	186.386695	73.916667
6	12	1041.0	1158.0	186.386695	86.750000
7	12	1169.0	1158.0	186.386695	97.416667
8	12	1078.0	1158.0	186.386695	89.833333
9	12	1136.0	1158.0	186.386695	94.666667
10	12	1250.0	1158.0	186.386695	104.166667
11	12	1031.0	1158.0	186.386695	85.916667
12	12	1381.0	1158.0	186.386695	115.083333
13	12	1387.0	1158.0	186.386695	115.583333
14	12	1210.0	1158.0	186.386695	100.833333
15	12	1485.0	1158.0	186.386695	123.750000
16	12	1545.0	1158.0	186.386695	128.750000

Kruskal-Wallis Test (Chi-Square Approximation)

CHISQ= 16.555 DF= 15 Prob > CHISQ= 0.3461

(Continued Appendix F)

Nparlway of R9 over Year 78--93

N P A R 1 W A Y   P R O C E D U R E

Wilcoxon Scores (Rank Sums) for Variable R9

Classified by Variable NO

NO	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
1	12	968.0	1158.0	186.386695	80.666667
2	12	1092.0	1158.0	186.386695	91.000000
3	12	992.0	1158.0	186.386695	82.666667
4	12	1031.0	1158.0	186.386695	85.916667
5	12	907.0	1158.0	186.386695	75.583333
6	12	1057.0	1158.0	186.386695	88.083333
7	12	1185.0	1158.0	186.386695	98.750000
8	12	1049.0	1158.0	186.386695	87.416667
9	12	1137.0	1158.0	186.386695	94.750000
10	12	1202.0	1158.0	186.386695	100.166667
11	12	1042.0	1158.0	186.386695	86.833333
12	12	1354.0	1158.0	186.386695	112.833333
13	12	1391.0	1158.0	186.386695	115.916667
14	12	1188.0	1158.0	186.386695	99.000000
15	12	1432.0	1158.0	186.386695	119.333333
16	12	1501.0	1158.0	186.386695	125.083333

Kruskal-Wallis Test (Chi-Square Approximation)

CHISQ= 12.741   DF= 15   Prob > CHISQ=   0.6223

==

Nparlway of R10 over Year 78--93

N P A R 1 W A Y   P R O C E D U R E

Wilcoxon Scores (Rank Sums) for Variable R10

Classified by Variable NO

NO	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
1	12	1093.0	1158.0	186.386695	91.083333
2	12	1030.0	1158.0	186.386695	85.833333
3	12	1237.0	1158.0	186.386695	103.083333
4	12	1348.0	1158.0	186.386695	112.333333
5	12	1129.0	1158.0	186.386695	94.083333
6	12	1029.0	1158.0	186.386695	85.750000
7	12	1153.0	1158.0	186.386695	96.083333
8	12	1195.0	1158.0	186.386695	99.583333
9	12	1043.0	1158.0	186.386695	86.916667
10	12	1052.0	1158.0	186.386695	87.666667
11	12	989.0	1158.0	186.386695	82.416667
12	12	1380.0	1158.0	186.386695	115.000000
13	12	1315.0	1158.0	186.386695	109.583333
14	12	1288.0	1158.0	186.386695	107.333333
15	12	1128.0	1158.0	186.386695	94.000000
16	12	1119.0	1158.0	186.386695	93.250000

Kruskal-Wallis Test (Chi-Square Approximation)

CHISQ= 6.1556   DF= 15   Prob > CHISQ=   0.9770

(Continued Appendix F)

Nparlway of R11 over Year 78--93

N P A R 1 W A Y   P R O C E D U R E

Wilcoxon Scores (Rank Sums) for Variable R11

Classified by Variable NO

NO	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
1	12	1025.0	1158.0	186.386695	85.416667
2	12	1095.0	1158.0	186.386695	91.250000
3	12	1038.0	1158.0	186.386695	86.500000
4	12	1079.0	1158.0	186.386695	89.916667
5	12	1064.0	1158.0	186.386695	88.666667
6	12	1071.0	1158.0	186.386695	89.250000
7	12	1200.0	1158.0	186.386695	100.000000
8	12	1084.0	1158.0	186.386695	90.333333
9	12	1075.0	1158.0	186.386695	89.583333
10	12	1097.0	1158.0	186.386695	91.416667
11	12	1158.0	1158.0	186.386695	96.500000
12	12	1399.0	1158.0	186.386695	116.583333
13	12	1332.0	1158.0	186.386695	111.000000
14	12	1287.0	1158.0	186.386695	107.250000
15	12	1205.0	1158.0	186.386695	100.416667
16	12	1319.0	1158.0	186.386695	109.916667

Kruskal-Wallis Test (Chi-Square Approximation)

CHISQ= 5.6585   DF= 15   Prob > CHISQ=   0.9849

==

Nparlway of R12 over Year 78--93

N P A R 1 W A Y   P R O C E D U R E

Wilcoxon Scores (Rank Sums) for Variable R12

Classified by Variable NO

NO	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
1	12	1638.0	1158.0	186.386695	136.500000
2	12	1607.0	1158.0	186.386695	133.916667
3	12	1613.0	1158.0	186.386695	134.416667
4	12	1645.0	1158.0	186.386695	137.083333
5	12	1482.0	1158.0	186.386695	123.500000
6	12	1301.0	1158.0	186.386695	108.416667
7	12	1164.0	1158.0	186.386695	97.000000
8	12	976.0	1158.0	186.386695	81.333333
9	12	912.0	1158.0	186.386695	76.000000
10	12	908.0	1158.0	186.386695	75.666667
11	12	1013.0	1158.0	186.386695	84.416667
12	12	794.0	1158.0	186.386695	66.166667
13	12	785.0	1158.0	186.386695	65.416667
14	12	958.0	1158.0	186.386695	79.833333
15	12	1012.0	1158.0	186.386695	84.333333
16	12	720.0	1158.0	186.386695	60.000000

Kruskal-Wallis Test (Chi-Square Approximation)

CHISQ= 45.974   DF= 15   Prob > CHISQ=   0.0001

(Continued Appendix F)

Nparlway of R13 over Year 78--93

N P A R 1 W A Y   P R O C E D U R E

Wilcoxon Scores (Rank Sums) for Variable R13

Classified by Variable NO

NO	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
1	12	1311.0	1158.0	186.386695	109.250000
2	12	1031.0	1158.0	186.386695	85.916667
3	12	1457.0	1158.0	186.386695	121.416667
4	12	1630.0	1158.0	186.386695	135.833333
5	12	1444.0	1158.0	186.386695	120.333333
6	12	1251.0	1158.0	186.386695	104.250000
7	12	1249.0	1158.0	186.386695	104.083333
8	12	1018.0	1158.0	186.386695	84.833333
9	12	829.0	1158.0	186.386695	69.083333
10	12	980.0	1158.0	186.386695	81.666667
11	12	1119.0	1158.0	186.386695	93.250000
12	12	897.0	1158.0	186.386695	74.750000
13	12	939.0	1158.0	186.386695	78.250000
14	12	1202.0	1158.0	186.386695	100.166667
15	12	1073.0	1158.0	186.386695	89.416667
16	12	1098.0	1158.0	186.386695	91.500000

Kruskal-Wallis Test (Chi-Square Approximation)

CHISQ= 19.979 DF= 15 Prob > CHISQ= 0.1727

Nparlway of R14 over Year 78--93

N P A R 1 W A Y   P R O C E D U R E

Wilcoxon Scores (Rank Sums) for Variable R14

Classified by Variable NO

NO	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
1	12	777.0	1158.0	186.386695	64.750000
2	12	748.0	1158.0	186.386695	62.333333
3	12	944.0	1158.0	186.386695	78.666667
4	12	1037.0	1158.0	186.386695	86.416667
5	12	1006.0	1158.0	186.386695	83.833333
6	12	1015.0	1158.0	186.386695	84.583333
7	12	1106.0	1158.0	186.386695	92.166667
8	12	1182.0	1158.0	186.386695	98.500000
9	12	1204.0	1158.0	186.386695	100.333333
10	12	1348.0	1158.0	186.386695	112.333333
11	12	1140.0	1158.0	186.386695	95.000000
12	12	1391.0	1158.0	186.386695	115.916667
13	12	1391.0	1158.0	186.386695	115.916667
14	12	1365.0	1158.0	186.386695	113.750000
15	12	1378.0	1158.0	186.386695	114.833333
16	12	1496.0	1158.0	186.386695	124.666667

Kruskal-Wallis Test (Chi-Square Approximation)

CHISQ= 20.864 DF= 15 Prob > CHISQ= 0.1412

(Continued Appendix F)

Nparlway of R15 over Year 78--93

N P A R 1 W A Y P R O C E D U R E
Wilcoxon Scores (Rank Sums) for Variable R15
Classified by Variable NO

NO	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
1	12	785.0	1158.0	186.386695	65.416667
2	12	884.0	1158.0	186.386695	73.666667
3	12	908.0	1158.0	186.386695	75.666667
4	12	988.0	1158.0	186.386695	82.333333
5	12	1013.0	1158.0	186.386695	84.416667
6	12	1055.0	1158.0	186.386695	87.916667
7	12	1206.0	1158.0	186.386695	100.500000
8	12	1137.0	1158.0	186.386695	94.750000
9	12	1170.0	1158.0	186.386695	97.500000
10	12	1273.0	1158.0	186.386695	106.083333
11	12	1216.0	1158.0	186.386695	101.333333
12	12	1380.0	1158.0	186.386695	115.000000
13	12	1429.0	1158.0	186.386695	119.083333
14	12	1321.0	1158.0	186.386695	110.083333
15	12	1303.0	1158.0	186.386695	108.583333
16	12	1460.0	1158.0	186.386695	121.666667

Kruskal-Wallis Test (Chi-Square Approximation)
CHISQ= 16.684 DF= 15 Prob > CHISQ= 0.3381

==

Nparlway of R16 over Year 78--93

N P A R 1 W A Y P R O C E D U R E
Wilcoxon Scores (Rank Sums) for Variable R16
Classified by Variable NO

NO	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
1	12	1200.0	1158.0	186.386695	100.000000
2	12	1358.0	1158.0	186.386695	113.166667
3	12	1250.0	1158.0	186.386695	104.166667
4	12	1104.0	1158.0	186.386695	92.000000
5	12	948.0	1158.0	186.386695	79.000000
6	12	957.0	1158.0	186.386695	79.750000
7	12	979.0	1158.0	186.386695	81.583333
8	12	987.0	1158.0	186.386695	82.250000
9	12	1070.0	1158.0	186.386695	89.166667
10	12	1171.0	1158.0	186.386695	97.583333
11	12	1187.0	1158.0	186.386695	98.916667
12	12	1207.0	1158.0	186.386695	100.583333
13	12	1167.0	1158.0	186.386695	97.250000
14	12	1286.0	1158.0	186.386695	107.166667
15	12	1341.0	1158.0	186.386695	111.750000
16	12	1316.0	1158.0	186.386695	109.666667

Kruskal-Wallis Test (Chi-Square Approximation)
CHISQ= 7.6911 DF= 15 Prob > CHISQ= 0.9356

(Continued Appendix F)

Nparlway of R17 over Year 78--93

N P A R 1 W A Y P R O C E D U R E

Wilcoxon Scores (Rank Sums) for Variable R17

Classified by Variable NO

NO	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
1	12	1383.0	1158.0	186.386695	115.250000
2	12	1339.0	1158.0	186.386695	111.583333
3	12	1329.0	1158.0	186.386695	110.750000
4	12	1348.0	1158.0	186.386695	112.333333
5	12	1330.0	1158.0	186.386695	110.833333
6	12	1344.0	1158.0	186.386695	112.000000
7	12	1204.0	1158.0	186.386695	100.333333
8	12	1137.0	1158.0	186.386695	94.750000
9	12	1253.0	1158.0	186.386695	104.416667
10	12	1121.0	1158.0	186.386695	93.416667
11	12	1166.0	1158.0	186.386695	97.166667
12	12	1010.0	1158.0	186.386695	84.166667
13	12	916.0	1158.0	186.386695	76.333333
14	12	1007.0	1158.0	186.386695	83.916667
15	12	900.0	1158.0	186.386695	75.000000
16	12	741.0	1158.0	186.386695	61.750000

Kruskal-Wallis Test (Chi-Square Approximation)

CHISQ= 15.373 DF= 15 Prob > CHISQ= 0.4249

Nparlway of R18 over Year 78--93

N P A R 1 W A Y P R O C E D U R E

Wilcoxon Scores (Rank Sums) for Variable R18

Classified by Variable NO

NO	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
1	12	1099.0	1158.0	186.386695	91.583333
2	12	1460.0	1158.0	186.386695	121.666667
3	12	1403.0	1158.0	186.386695	116.916667
4	12	1277.0	1158.0	186.386695	106.416667
5	12	1039.0	1158.0	186.386695	86.583333
6	12	1157.0	1158.0	186.386695	96.416667
7	12	1088.0	1158.0	186.386695	90.666667
8	12	1008.0	1158.0	186.386695	84.000000
9	12	1164.0	1158.0	186.386695	97.000000
10	12	1174.0	1158.0	186.386695	97.833333
11	12	1297.0	1158.0	186.386695	108.083333
12	12	1178.0	1158.0	186.386695	98.166667
13	12	948.0	1158.0	186.386695	79.000000
14	12	1164.0	1158.0	186.386695	97.000000
15	12	1084.0	1158.0	186.386695	90.333333
16	12	988.0	1158.0	186.386695	82.333333

Kruskal-Wallis Test (Chi-Square Approximation)

CHISQ= 8.3376 DF= 15 Prob > CHISQ= 0.9095

(Continued Appendix F)

Nparlway of R19 over Year 78--93

N P A R 1 W A Y   P R O C E D U R E

Wilcoxon Scores (Rank Sums) for Variable R19

Classified by Variable NO

NO	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
1	12	850.0	1158.0	186.386695	70.833333
2	12	1013.0	1158.0	186.386695	84.416667
3	12	964.0	1158.0	186.386695	80.333333
4	12	871.0	1158.0	186.386695	72.583333
5	12	799.0	1158.0	186.386695	66.583333
6	12	994.0	1158.0	186.386695	82.833333
7	12	1149.0	1158.0	186.386695	95.750000
8	12	1207.0	1158.0	186.386695	100.583333
9	12	1398.0	1158.0	186.386695	116.500000
10	12	1349.0	1158.0	186.386695	112.416667
11	12	1387.0	1158.0	186.386695	115.583333
12	12	1444.0	1158.0	186.386695	120.333333
13	12	1327.0	1158.0	186.386695	110.583333
14	12	1351.0	1158.0	186.386695	112.583333
15	12	1160.0	1158.0	186.386695	96.666667
16	12	1265.0	1158.0	186.386695	105.416667

Kruskal-Wallis Test (Chi-Square Approximation)

CHISQ= 18.883 DF= 15 Prob > CHISQ= 0.2191

Nparlway of R20 over Year 78--93

N P A R 1 W A Y   P R O C E D U R E

Wilcoxon Scores (Rank Sums) for Variable R20

Classified by Variable NO

NO	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
1	12	1436.0	1158.0	186.386695	119.666667
2	12	1647.0	1158.0	186.386695	137.250000
3	12	1581.0	1158.0	186.386695	131.750000
4	12	1463.0	1158.0	186.386695	121.916667
5	12	1267.0	1158.0	186.386695	105.583333
6	12	1197.0	1158.0	186.386695	99.750000
7	12	1141.0	1158.0	186.386695	95.083333
8	12	1088.0	1158.0	186.386695	90.666667
9	12	1095.0	1158.0	186.386695	91.250000
10	12	1006.0	1158.0	186.386695	83.833333
11	12	1063.0	1158.0	186.386695	88.583333
12	12	1017.0	1158.0	186.386695	84.750000
13	12	907.0	1158.0	186.386695	75.583333
14	12	955.0	1158.0	186.386695	79.583333
15	12	907.0	1158.0	186.386695	75.583333
16	12	758.0	1158.0	186.386695	63.166667

Kruskal-Wallis Test (Chi-Square Approximation)

CHISQ= 26.720 DF= 15 Prob > CHISQ= 0.0311

(Continued Appendix F)

Nparlway of R21 over Year 78--93

N P A R 1 W A Y   P R O C E D U R E

Wilcoxon Scores (Rank Sums) for Variable R21

Classified by Variable NO

NO	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
1	12	866.0	1158.0	186.386695	72.166667
2	12	802.0	1158.0	186.386695	66.833333
3	12	1038.0	1158.0	186.386695	86.500000
4	12	1072.0	1158.0	186.386695	89.333333
5	12	753.0	1158.0	186.386695	62.750000
6	12	965.0	1158.0	186.386695	80.416667
7	12	1083.0	1158.0	186.386695	90.250000
8	12	1211.0	1158.0	186.386695	100.916667
9	12	1183.0	1158.0	186.386695	98.583333
10	12	1338.0	1158.0	186.386695	111.500000
11	12	1250.0	1158.0	186.386695	104.166667
12	12	1531.0	1158.0	186.386695	127.583333
13	12	1430.0	1158.0	186.386695	119.166667
14	12	1251.0	1158.0	186.386695	104.250000
15	12	1340.0	1158.0	186.386695	111.666667
16	12	1415.0	1158.0	186.386695	117.916667

Kruskal-Wallis Test (Chi-Square Approximation)

CHISQ= 21.749   DF= 15   Prob > CHISQ= 0.1146

Nparlway of R22 over Year 78--93

N P A R 1 W A Y   P R O C E D U R E

Wilcoxon Scores (Rank Sums) for Variable R22

Classified by Variable NO

NO	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
1	12	993.0	1158.0	186.386695	82.750000
2	12	985.0	1158.0	186.386695	82.083333
3	12	1064.0	1158.0	186.386695	88.666667
4	12	1078.0	1158.0	186.386695	89.833333
5	12	803.0	1158.0	186.386695	66.916667
6	12	966.0	1158.0	186.386695	80.500000
7	12	1152.0	1158.0	186.386695	96.000000
8	12	1116.0	1158.0	186.386695	93.000000
9	12	1126.0	1158.0	186.386695	93.833333
10	12	1272.0	1158.0	186.386695	106.000000
11	12	1035.0	1158.0	186.386695	86.250000
12	12	1448.0	1158.0	186.386695	120.666667
13	12	1398.0	1158.0	186.386695	116.500000
14	12	1170.0	1158.0	186.386695	97.500000
15	12	1417.0	1158.0	186.386695	118.083333
16	12	1505.0	1158.0	186.386695	125.416667

Kruskal-Wallis Test (Chi-Square Approximation)

CHISQ= 16.072   DF= 15   Prob > CHISQ= 0.3773

(Continued Appendix F)

Nparlway of R23 over Year 78--93

N P A R 1 W A Y   P R O C E D U R E

Wilcoxon Scores (Rank Sums) for Variable R23

Classified by Variable NO

NO	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
1	12	897.0	1158.0	186.386695	74.750000
2	12	1243.0	1158.0	186.386695	103.583333
3	12	1059.0	1158.0	186.386695	88.250000
4	12	1030.0	1158.0	186.386695	85.833333
5	12	743.0	1158.0	186.386695	61.916667
6	12	953.0	1158.0	186.386695	79.416667
7	12	1078.0	1158.0	186.386695	89.833333
8	12	1000.0	1158.0	186.386695	83.333333
9	12	1188.0	1158.0	186.386695	99.000000
10	12	1435.0	1158.0	186.386695	119.583333
11	12	1516.0	1158.0	186.386695	126.333333
12	12	1616.0	1158.0	186.386695	134.666667
13	12	1315.0	1158.0	186.386695	109.583333
14	12	1276.0	1158.0	186.386695	106.333333
15	12	1170.0	1158.0	186.386695	97.500000
16	12	1009.0	1158.0	186.386695	84.083333

Kruskal-Wallis Test (Chi-Square Approximation)

CHISQ= 22.226   DF= 15   Prob > CHISQ= 0.1020

===

Nparlway of R24 over Year 78--93

N P A R 1 W A Y   P R O C E D U R E

Wilcoxon Scores (Rank Sums) for Variable R24

Classified by Variable NO

NO	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
1	12	944.0	1158.0	186.386695	78.666667
2	12	1371.0	1158.0	186.386695	114.250000
3	12	1198.0	1158.0	186.386695	99.833333
4	12	1161.0	1158.0	186.386695	96.750000
5	12	794.0	1158.0	186.386695	66.166667
6	12	1051.0	1158.0	186.386695	87.583333
7	12	1088.0	1158.0	186.386695	90.666667
8	12	954.0	1158.0	186.386695	79.500000
9	12	1139.0	1158.0	186.386695	94.916667
10	12	1441.0	1158.0	186.386695	120.083333
11	12	1480.0	1158.0	186.386695	123.333333
12	12	1551.0	1158.0	186.386695	129.250000
13	12	1187.0	1158.0	186.386695	98.916667
14	12	1114.0	1158.0	186.386695	92.833333
15	12	1100.0	1158.0	186.386695	91.666667
16	12	955.0	1158.0	186.386695	79.583333

Kruskal-Wallis Test (Chi-Square Approximation)

CHISQ= 18.058   DF= 15   Prob > CHISQ= 0.2596

Nparlway of R25 over Year 78--93

N P A R 1 W A Y   P R O C E D U R E
Wilcoxon Scores (Rank Sums) for Variable R25
Classified by Variable NO

NO	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
1	12	895.0	1158.0	186.386695	74.583333
2	12	1129.0	1158.0	186.386695	94.083333
3	12	931.0	1158.0	186.386695	77.583333
4	12	921.0	1158.0	186.386695	76.750000
5	12	728.0	1158.0	186.386695	60.666667
6	12	917.0	1158.0	186.386695	76.416667
7	12	1036.0	1158.0	186.386695	86.333333
8	12	1024.0	1158.0	186.386695	85.333333
9	12	1218.0	1158.0	186.386695	101.500000
10	12	1407.0	1158.0	186.386695	117.250000
11	12	1497.0	1158.0	186.386695	124.750000
12	12	1601.0	1158.0	186.386695	133.416667
13	12	1409.0	1158.0	186.386695	117.416667
14	12	1459.0	1158.0	186.386695	121.583333
15	12	1356.0	1158.0	186.386695	113.000000
16	12	1000.0	1158.0	186.386695	83.333333

Kruskal-Wallis Test (Chi-Square Approximation)
CHISQ= 28.283 DF= 15 Prob > CHISQ= 0.0199

==

Nparlway of R26 over Year 78--93

N P A R 1 W A Y   P R O C E D U R E
Wilcoxon Scores (Rank Sums) for Variable R26
Classified by Variable NO

NO	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
1	12	848.0	1158.0	186.386695	70.666667
2	12	1318.0	1158.0	186.386695	109.833333
3	12	1098.0	1158.0	186.386695	91.500000
4	12	1130.0	1158.0	186.386695	94.166667
5	12	779.0	1158.0	186.386695	64.916667
6	12	972.0	1158.0	186.386695	81.000000
7	12	1100.0	1158.0	186.386695	91.666667
8	12	962.0	1158.0	186.386695	80.166667
9	12	1149.0	1158.0	186.386695	95.750000
10	12	1485.0	1158.0	186.386695	123.750000
11	12	1510.0	1158.0	186.386695	125.833333
12	12	1607.0	1158.0	186.386695	133.916667
13	12	1245.0	1158.0	186.386695	103.750000
14	12	1209.0	1158.0	186.386695	100.750000
15	12	1153.0	1158.0	186.386695	96.083333
16	12	963.0	1158.0	186.386695	80.250000

Kruskal-Wallis Test (Chi-Square Approximation)
CHISQ= 22.313 DF= 15 Prob > CHISQ= 0.0999

(Continued Appendix F)

Nparlway of R27 over Year 78--93

N P A R 1 W A Y   P R O C E D U R E

Wilcoxon Scores (Rank Sums) for Variable R27

Classified by Variable NO

NO	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
1	12	866.0	1158.0	186.386695	72.166667
2	12	1170.0	1158.0	186.386695	97.500000
3	12	940.0	1158.0	186.386695	78.333333
4	12	995.0	1158.0	186.386695	82.916667
5	12	728.0	1158.0	186.386695	60.666667
6	12	895.0	1158.0	186.386695	74.583333
7	12	1082.0	1158.0	186.386695	90.166667
8	12	1023.0	1158.0	186.386695	85.250000
9	12	1240.0	1158.0	186.386695	103.333333
10	12	1449.0	1158.0	186.386695	120.750000
11	12	1524.0	1158.0	186.386695	127.000000
12	12	1649.0	1158.0	186.386695	137.416667
13	12	1369.0	1158.0	186.386695	114.083333
14	12	1452.0	1158.0	186.386695	121.000000
15	12	1233.0	1158.0	186.386695	102.750000
16	12	913.0	1158.0	186.386695	76.083333

Kruskal-Wallis Test (Chi-Square Approximation)

CHISQ= 29.702   DF= 15   Prob > CHISQ=   0.0130

==

Nparlway of R28 over Year 78--93

N P A R 1 W A Y   P R O C E D U R E

Wilcoxon Scores (Rank Sums) for Variable R28

Classified by Variable NO

NO	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
1	12	1260.0	1158.0	186.386695	105.000000
2	12	1405.0	1158.0	186.386695	117.083333
3	12	1440.0	1158.0	186.386695	120.000000
4	12	1476.0	1158.0	186.386695	123.000000
5	12	1326.0	1158.0	186.386695	110.500000
6	12	1234.0	1158.0	186.386695	102.833333
7	12	1199.0	1158.0	186.386695	99.916667
8	12	1139.0	1158.0	186.386695	94.916667
9	12	1184.0	1158.0	186.386695	98.666667
10	.12	1088.0	1158.0	186.386695	90.666667
11	12	1073.0	1158.0	186.386695	89.416667
12	12	1002.0	1158.0	186.386695	83.500000
13	12	873.0	1158.0	186.386695	72.750000
14	12	976.0	1158.0	186.386695	81.333333
15	12	929.0	1158.0	186.386695	77.416667
16	12	924.0	1158.0	186.386695	77.000000

Kruskal-Wallis Test (Chi-Square Approximation)

CHISQ= 14.756   DF= 15   Prob > CHISQ=   0.4692

(Continued Appendix F)

Nparlway of R29 over Year 78--93

N P A R 1 W A Y   P R O C E D U R E

Wilcoxon Scores (Rank Sums) for Variable R29

Classified by Variable NO

NO	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
1	12	1132.0	1158.0	186.386695	94.333333
2	12	1012.0	1158.0	186.386695	84.333333
3	12	1214.0	1158.0	186.386695	101.166667
4	12	1499.0	1158.0	186.386695	124.916667
5	12	1464.0	1158.0	186.386695	122.000000
6	12	1349.0	1158.0	186.386695	112.416667
7	12	1310.0	1158.0	186.386695	109.166667
8	12	1085.0	1158.0	186.386695	90.416667
9	12	965.0	1158.0	186.386695	80.416667
10	12	942.0	1158.0	186.386695	78.500000
11	12	1086.0	1158.0	186.386695	90.500000
12	12	1119.0	1158.0	186.386695	93.250000
13	12	1027.0	1158.0	186.386695	85.583333
14	12	1093.0	1158.0	186.386695	91.083333
15	12	1140.0	1158.0	186.386695	95.000000
16	12	1091.0	1158.0	186.386695	90.916667

Kruskal-Wallis Test (Chi-Square Approximation)

CHISQ= 11.247   DF= 15   Prob > CHISQ= 0.7349

===

Nparlway of R30 over Year 78--93

N P A R 1 W A Y   P R O C E D U R E

Wilcoxon Scores (Rank Sums) for Variable R30

Classified by Variable NO

NO	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
1	12	1098.0	1086.0	174.378898	91.500000
2	12	1187.0	1086.0	174.378898	98.916667
3	12	1199.0	1086.0	174.378898	99.916667
4	12	1219.0	1086.0	174.378898	101.583333
5	12	1034.0	1086.0	174.378898	86.166667
6	12	1017.0	1086.0	174.378898	84.750000
7	12	1039.0	1086.0	174.378898	86.583333
8	12	960.0	1086.0	174.378898	80.000000
10	12	1022.0	1086.0	174.378898	85.166667
11	12	1095.0	1086.0	174.378898	91.250000
12	12	1199.0	1086.0	174.378898	99.916667
13	12	1035.0	1086.0	174.378898	86.250000
14	12	1203.0	1086.0	174.378898	100.250000
15	12	1068.0	1086.0	174.378898	89.000000
16	12	915.0	1086.0	174.378898	76.250000

Kruskal-Wallis Test (Chi-Square Approximation)

CHISQ= 3.9642   DF= 14   Prob > CHISQ= 0.9957

(Continued Appendix F)

Nparlway of R31 over Year 78--93

N P A R 1 W A Y   P R O C E D U R E

Wilcoxon Scores (Rank Sums) for Variable R31

Classified by Variable NO

NO	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
1	12	851.0	1158.0	186.386695	70.916667
2	12	950.0	1158.0	186.386695	79.166667
3	12	939.0	1158.0	186.386695	78.250000
4	12	889.0	1158.0	186.386695	74.083333
5	12	827.0	1158.0	186.386695	68.916667
6	12	1013.0	1158.0	186.386695	84.416667
7	12	1102.0	1158.0	186.386695	91.833333
8	12	1214.0	1158.0	186.386695	101.166667
9	12	1418.0	1158.0	186.386695	118.166667
10	12	1316.0	1158.0	186.386695	109.666667
11	12	1343.0	1158.0	186.386695	111.916667
12	12	1434.0	1158.0	186.386695	119.500000
13	12	1338.0	1158.0	186.386695	111.500000
14	12	1341.0	1158.0	186.386695	111.750000
15	12	1218.0	1158.0	186.386695	101.500000
16	12	1335.0	1158.0	186.386695	111.250000

Kruskal-Wallis Test (Chi-Square Approximation)

CHISQ= 18.849 DF= 15 Prob > CHISQ= 0.2206

==

Nparlway of R32 over Year 78--93

N P A R 1 W A Y   P R O C E D U R E

Wilcoxon Scores (Rank Sums) for Variable R32

Classified by Variable NO

NO	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
1	12	848.0	1158.0	186.386695	70.666667
2	12	1259.0	1158.0	186.386695	104.916667
3	12	1033.0	1158.0	186.386695	86.083333
4	12	1045.0	1158.0	186.386695	87.083333
5	12	747.0	1158.0	186.386695	62.250000
6	12	927.0	1158.0	186.386695	77.250000
7	12	1095.0	1158.0	186.386695	91.250000
8	12	997.0	1158.0	186.386695	83.083333
9	12	1207.0	1158.0	186.386695	100.583333
10	12	1467.0	1158.0	186.386695	122.250000
11	12	1541.0	1158.0	186.386695	128.416667
12	12	1638.0	1158.0	186.386695	136.500000
13	12	1308.0	1158.0	186.386695	109.000000
14	12	1318.0	1158.0	186.386695	109.833333
15	12	1166.0	1158.0	186.386695	97.166667
16	12	932.0	1158.0	186.386695	77.666667

Kruskal-Wallis Test (Chi-Square Approximation)

CHISQ= 25.936 DF= 15 Prob > CHISQ= 0.0387

(Continued Appendix F)

Nparlway of R33 over Year 78--93

N P A R 1 W A Y   P R O C E D U R E

Wilcoxon Scores (Rank Sums) for Variable R33

Classified by Variable NO

NO	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
1	12	811.0	1158.0	186.386695	67.583333
2	12	1210.0	1158.0	186.386695	100.833333
3	12	1068.0	1158.0	186.386695	89.000000
4	12	1080.0	1158.0	186.386695	90.000000
5	12	780.0	1158.0	186.386695	65.000000
6	12	916.0	1158.0	186.386695	76.333333
7	12	1057.0	1158.0	186.386695	88.083333
8	12	982.0	1158.0	186.386695	81.833333
9	12	1192.0	1158.0	186.386695	99.333333
10	12	1482.0	1158.0	186.386695	123.500000
11	12	1586.0	1158.0	186.386695	132.166667
12	12	1649.0	1158.0	186.386695	137.416667
13	12	1314.0	1158.0	186.386695	109.500000
14	12	1297.0	1158.0	186.386695	108.083333
15	12	1173.0	1158.0	186.386695	97.750000
16	12	931.0	1158.0	186.386695	77.583333

Kruskal-Wallis Test (Chi-Square Approximation)

CHISQ= 27.141   DF= 15   Prob > CHISQ= 0.0276

==

Nparlway of R34 over Year 78--93

N P A R 1 W A Y   P R O C E D U R E

Wilcoxon Scores (Rank Sums) for Variable R34

Classified by Variable NO

NO	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
1	12	905.0	1158.0	186.386695	75.416667
2	12	1171.0	1158.0	186.386695	97.583333
3	12	918.0	1158.0	186.386695	76.500000
4	12	975.0	1158.0	186.386695	81.250000
5	12	755.0	1158.0	186.386695	62.916667
6	12	824.0	1158.0	186.386695	68.666667
7	12	1015.0	1158.0	186.386695	84.583333
8	12	1012.0	1158.0	186.386695	84.333333
9	12	1169.0	1158.0	186.386695	97.416667
10	12	1384.0	1158.0	186.386695	115.333333
11	12	1540.0	1158.0	186.386695	128.333333
12	12	1683.0	1158.0	186.386695	140.250000
13	12	1473.0	1158.0	186.386695	122.750000
14	12	1454.0	1158.0	186.386695	121.166667
15	12	1307.0	1158.0	186.386695	108.916667
16	12	943.0	1158.0	186.386695	78.583333

Kruskal-Wallis Test (Chi-Square Approximation)

CHISQ= 32.357   DF= 15   Prob > CHISQ= 0.0058

(Continued Appendix F)

Nparlway of R35 over Year 78--93

N P A R 1 W A Y   P R O C E D U R E

Wilcoxon Scores (Rank Sums) for Variable R35

Classified by Variable NO

NO	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
1	12	1217.0	1158.0	186.386695	101.416667
2	12	1053.0	1158.0	186.386695	87.750000
3	12	1160.0	1158.0	186.386695	96.666667
4	12	1241.0	1158.0	186.386695	103.416667
5	12	1339.0	1158.0	186.386695	111.583333
6	12	1272.0	1158.0	186.386695	106.000000
7	12	1053.0	1158.0	186.386695	87.750000
8	12	1206.0	1158.0	186.386695	100.500000
9	12	1034.0	1158.0	186.386695	86.166667
10	12	885.0	1158.0	186.386695	73.750000
11	12	837.0	1158.0	186.386695	69.750000
12	12	994.0	1158.0	186.386695	82.833333
13	12	1259.0	1158.0	186.386695	104.916667
14	12	1188.0	1158.0	186.386695	99.000000
15	12	1372.0	1158.0	186.386695	114.333333
16	12	1418.0	1158.0	186.386695	118.166667

Kruskal-Wallis Test (Chi-Square Approximation)

CHISQ= 11.464 DF= 15 Prob > CHISQ= 0.7190

Nparlway of R36 over Year 78--93

N P A R 1 W A Y   P R O C E D U R E

Wilcoxon Scores (Rank Sums) for Variable R36

Classified by Variable NO

NO	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
1	12	1183.0	1158.0	186.386695	98.583333
2	12	1233.0	1158.0	186.386695	102.750000
3	12	1310.0	1158.0	186.386695	109.166667
4	12	1421.0	1158.0	186.386695	118.416667
5	12	1261.0	1158.0	186.386695	105.083333
6	12	1143.0	1158.0	186.386695	95.250000
7	12	1096.0	1158.0	186.386695	91.333333
8	12	1040.0	1158.0	186.386695	86.666667
9	12	1094.0	1158.0	186.386695	91.166667
10	12	1022.0	1158.0	186.386695	85.166667
11	12	1059.0	1158.0	186.386695	88.250000
12	12	1207.0	1158.0	186.386695	100.583333
13	12	1133.0	1158.0	186.386695	94.416667
14	12	1268.0	1158.0	186.386695	105.666667
15	12	1114.0	1158.0	186.386695	92.833333
16	12	944.0	1158.0	186.386695	78.666667

Kruskal-Wallis Test (Chi-Square Approximation)

CHISQ= 6.0011 DF= 15 Prob > CHISQ= 0.9797

(Continued Appendix F)

Nparlway of R37 over Year 78--93

N P A R 1 W A Y   P R O C E D U R E
Wilcoxon Scores (Rank Sums) for Variable R37
Classified by Variable NO

NO	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
1	12	1202.0	1158.0	186.386695	100.166667
2	12	1163.0	1158.0	186.386695	96.916667
3	12	1385.0	1158.0	186.386695	115.416667
4	12	1404.0	1158.0	186.386695	117.000000
5	12	1316.0	1158.0	186.386695	109.666667
6	12	1232.0	1158.0	186.386695	102.666667
7	12	1196.0	1158.0	186.386695	99.666667
8	12	1269.0	1158.0	186.386695	105.750000
9	12	1120.0	1158.0	186.386695	93.333333
10	12	1130.0	1158.0	186.386695	94.166667
11	12	1021.0	1158.0	186.386695	85.083333
12	12	1025.0	1158.0	186.386695	85.416667
13	12	1002.0	1158.0	186.386695	83.500000
14	12	1038.0	1158.0	186.386695	86.500000
15	12	1047.0	1158.0	186.386695	87.250000
16	12	978.0	1158.0	186.386695	81.500000

Kruskal-Wallis Test (Chi-Square Approximation)
CHISQ= 7.5657   DF= 15   Prob > CHISQ=   0.9400

===

Nparlway of R38 over Year 78--93

N P A R 1 W A Y   P R O C E D U R E
Wilcoxon Scores (Rank Sums) for Variable R38
Classified by Variable NO

NO	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
1	12	1436.0	1158.0	186.386695	119.666667
2	12	1388.0	1158.0	186.386695	115.666667
3	12	1421.0	1158.0	186.386695	118.416667
4	12	1491.0	1158.0	186.386695	124.250000
5	12	1432.0	1158.0	186.386695	119.333333
6	12	1333.0	1158.0	186.386695	111.083333
7	12	1218.0	1158.0	186.386695	101.500000
8	12	1241.0	1158.0	186.386695	103.416667
9	12	1145.0	1158.0	186.386695	95.416667
10	12	1085.0	1158.0	186.386695	90.416667
11	12	967.0	1158.0	186.386695	80.583333
12	12	866.0	1158.0	186.386695	72.166667
13	12	812.0	1158.0	186.386695	67.666667
14	12	814.0	1158.0	186.386695	67.833333
15	12	883.0	1158.0	186.386695	73.583333
16	12	996.0	1158.0	186.386695	83.000000

Kruskal-Wallis Test (Chi-Square Approximation)
CHISQ= 24.115   DF= 15   Prob > CHISQ=   0.0632

(Continued Appendix F)

Nparlway of R39 over Year 78--93

N P A R 1 W A Y   P R O C E D U R E

Wilcoxon Scores (Rank Sums) for Variable R39

Classified by Variable NO

NO	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
1	12	1395.0	1158.0	186.386695	116.250000
2	12	1461.0	1158.0	186.386695	121.750000
3	12	1354.0	1158.0	186.386695	112.833333
4	12	1342.0	1158.0	186.386695	111.833333
5	12	1688.0	1158.0	186.386695	140.666667
6	12	1243.0	1158.0	186.386695	103.583333
7	12	1063.0	1158.0	186.386695	88.583333
8	12	908.0	1158.0	186.386695	75.666667
9	12	1090.0	1158.0	186.386695	90.833333
10	12	1002.0	1158.0	186.386695	83.500000
11	12	907.0	1158.0	186.386695	75.583333
12	12	843.0	1158.0	186.386695	70.250000
13	12	1122.0	1158.0	186.386695	93.500000
14	12	1144.0	1158.0	186.386695	95.333333
15	12	975.0	1158.0	186.386695	81.250000
16	12	991.0	1158.0	186.386695	82.583333

Kruskal-Wallis Test (Chi-Square Approximation)

CHISQ= 22.505   DF= 15   Prob > CHISQ= 0.0952

Nparlway of R40 over Year 78--93

N P A R 1 W A Y   P R O C E D U R E

Wilcoxon Scores (Rank Sums) for Variable R40

Classified by Variable NO

NO	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
1	12	1204.0	1158.0	186.386695	100.333333
2	12	1376.0	1158.0	186.386695	114.666667
3	12	1229.0	1158.0	186.386695	102.416667
4	12	1175.0	1158.0	186.386695	97.916667
5	12	1228.0	1158.0	186.386695	102.333333
6	12	1020.0	1158.0	186.386695	85.000000
7	12	995.0	1158.0	186.386695	82.916667
8	12	955.0	1158.0	186.386695	79.583333
9	12	1188.0	1158.0	186.386695	99.000000
10	12	1181.0	1158.0	186.386695	98.416667
11	12	1124.0	1158.0	186.386695	93.666667
12	12	1260.0	1158.0	186.386695	105.000000
13	12	1370.0	1158.0	186.386695	114.166667
14	12	1179.0	1158.0	186.386695	98.250000
15	12	1010.0	1158.0	186.386695	84.166667
16	12	1034.0	1158.0	186.386695	86.166667

Kruskal-Wallis Test (Chi-Square Approximation)

CHISQ= 6.5400   DF= 15   Prob > CHISQ= 0.9692

(Continued Appendix F)

Nparlway of R41 over Year 78--93

N P A R 1 W A Y P R O C E D U R E

Wilcoxon Scores (Rank Sums) for Variable R41

Classified by Variable NO

NO	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
1	12	1236.0	1158.0	186.386695	103.000000
2	12	1181.0	1158.0	186.386695	98.416667
3	12	1155.0	1158.0	186.386695	96.250000
4	12	1186.0	1158.0	186.386695	98.833333
5	12	862.0	1158.0	186.386695	71.833333
6	12	1060.0	1158.0	186.386695	88.333333
7	12	1243.0	1158.0	186.386695	103.583333
8	12	1196.0	1158.0	186.386695	99.666667
9	12	1129.0	1158.0	186.386695	94.083333
10	12	1238.0	1158.0	186.386695	103.166667
11	12	1365.0	1158.0	186.386695	113.750000
12	12	1649.0	1158.0	186.386695	137.416667
13	12	1046.0	1158.0	186.386695	87.166667
14	12	1012.0	1158.0	186.386695	84.333333
15	12	938.0	1158.0	186.386695	78.166667
16	12	1032.0	1158.0	186.386695	86.000000

Kruskal-Wallis Test (Chi-Square Approximation)

CHISQ= 13.563 DF= 15 Prob > CHISQ= 0.5589

===

Nparlway of R42 over Year 78--93

N P A R 1 W A Y P R O C E D U R E

Wilcoxon Scores (Rank Sums) for Variable R42

Classified by Variable NO

NO	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
1	12	1208.0	1158.0	186.386695	100.666667
2	12	954.0	1158.0	186.386695	79.500000
3	12	1079.0	1158.0	186.386695	89.916667
4	12	1167.0	1158.0	186.386695	97.250000
5	12	730.0	1158.0	186.386695	60.833333
6	12	1006.0	1158.0	186.386695	83.833333
7	12	1341.0	1158.0	186.386695	111.750000
8	12	1529.0	1158.0	186.386695	127.416667
9	12	1172.0	1158.0	186.386695	97.666667
10	12	1343.0	1158.0	186.386695	111.916667
11	12	1495.0	1158.0	186.386695	124.583333
12	12	1514.0	1158.0	186.386695	126.166667
13	12	1147.0	1158.0	186.386695	95.583333
14	12	834.0	1158.0	186.386695	69.500000
15	12	1094.0	1158.0	186.386695	91.166667
16	12	915.0	1158.0	186.386695	76.250000

Kruskal-Wallis Test (Chi-Square Approximation)

CHISQ= 23.500 DF= 15 Prob > CHISQ= 0.0741

(Continued Appendix F)

Nparlway of R43 over Year 78--93

N P A R 1 W A Y   P R O C E D U R E

Wilcoxon Scores (Rank Sums) for Variable R43

Classified by Variable NO

NO	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
1	12	1288.0	1158.0	186.386616	107.333333
2	12	1717.0	1158.0	186.386616	143.083333
3	12	1718.0	1158.0	186.386616	143.166667
4	12	1702.0	1158.0	186.386616	141.833333
5	12	1169.0	1158.0	186.386616	97.416667
6	12	1013.0	1158.0	186.386616	84.416667
7	12	1061.0	1158.0	186.386616	88.416667
8	12	721.0	1158.0	186.386616	60.083333
9	12	1129.0	1158.0	186.386616	94.083333
10	12	795.0	1158.0	186.386616	66.250000
11	12	1114.0	1158.0	186.386616	92.833333
12	12	1293.0	1158.0	186.386616	107.750000
13	12	846.0	1158.0	186.386616	70.500000
14	12	1451.0	1158.0	186.386616	120.916667
15	12	701.0	1158.0	186.386616	58.416667
16	12	810.0	1158.0	186.386616	67.500000

Kruskal-Wallis Test (Chi-Square Approximation)

CHISQ= 49.286 DF= 15 Prob > CHISQ= 0.0001

==

Nparlway of R44 over Year 78--93

N P A R 1 W A Y   P R O C E D U R E

Wilcoxon Scores (Rank Sums) for Variable R44

Classified by Variable NO

NO	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
1	12	1052.0	1158.0	186.386695	87.666667
2	12	1557.0	1158.0	186.386695	129.750000
3	12	1718.0	1158.0	186.386695	143.166667
4	12	1442.0	1158.0	186.386695	120.166667
5	12	1445.0	1158.0	186.386695	120.416667
6	12	1166.0	1158.0	186.386695	97.166667
7	12	967.0	1158.0	186.386695	80.583333
8	12	894.0	1158.0	186.386695	74.500000
9	12	755.0	1158.0	186.386695	62.916667
10	12	843.0	1158.0	186.386695	70.250000
11	12	747.0	1158.0	186.386695	62.250000
12	12	1360.0	1158.0	186.386695	113.333333
13	12	1135.0	1158.0	186.386695	94.583333
14	12	960.0	1158.0	186.386695	80.000000
15	12	1108.0	1158.0	186.386695	92.333333
16	12	1379.0	1158.0	186.386695	114.916667

Kruskal-Wallis Test (Chi-Square Approximation)

CHISQ= 35.507 DF= 15 Prob > CHISQ= 0.0021

Nparlway of R45 over Year 78--93

N P A R 1 W A Y   P R O C E D U R E

Wilcoxon Scores (Rank Sums) for Variable R45

Classified by Variable NO

NO	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
1	12	1285.0	1158.0	186.386695	107.083333
2	12	1338.0	1158.0	186.386695	111.500000
3	12	1323.0	1158.0	186.386695	110.250000
4	12	1095.0	1158.0	186.386695	91.250000
5	12	1687.0	1158.0	186.386695	140.583333
6	12	1299.0	1158.0	186.386695	108.250000
7	12	969.0	1158.0	186.386695	80.750000
8	12	836.0	1158.0	186.386695	69.666667
9	12	1063.0	1158.0	186.386695	88.583333
10	12	905.0	1158.0	186.386695	75.416667
11	12	843.0	1158.0	186.386695	70.250000
12	12	768.0	1158.0	186.386695	64.000000
13	12	1095.0	1158.0	186.386695	91.250000
14	12	1298.0	1158.0	186.386695	108.166667
15	12	1424.0	1158.0	186.386695	118.666667
16	12	1300.0	1158.0	186.386695	108.333333

Kruskal-Wallis Test (Chi-Square Approximation)

CHISQ= 25.845   DF= 15   Prob > CHISQ= 0.0397

Nparlway of R46 over Year 78--93

N P A R 1 W A Y   P R O C E D U R E

Wilcoxon Scores (Rank Sums) for Variable R46

Classified by Variable NO

NO	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
1	12	1029.0	1158.0	186.386695	85.750000
2	12	1457.0	1158.0	186.386695	121.416667
3	12	1600.0	1158.0	186.386695	133.333333
4	12	1493.0	1158.0	186.386695	124.416667
5	12	1344.0	1158.0	186.386695	112.000000
6	12	989.0	1158.0	186.386695	82.416667
7	12	927.0	1158.0	186.386695	77.250000
8	12	1044.0	1158.0	186.386695	87.000000
9	12	738.0	1158.0	186.386695	61.500000
10	12	905.0	1158.0	186.386695	75.416667
11	12	711.0	1158.0	186.386695	59.250000
12	12	1037.0	1158.0	186.386695	86.416667
13	12	934.0	1158.0	186.386695	77.833333
14	12	1309.0	1158.0	186.386695	109.083333
15	12	1463.0	1158.0	186.386695	121.916667
16	12	1548.0	1158.0	186.386695	129.000000

Kruskal-Wallis Test (Chi-Square Approximation)

CHISQ= 35.517   DF= 15   Prob > CHISQ= 0.0021

Nparlway of R47 over Year 78--93

N P A R 1 W A Y   P R O C E D U R E
Wilcoxon Scores (Rank Sums) for Variable R47
Classified by Variable NO

NO	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
1	12	1218.0	1158.0	186.386695	101.500000
2	12	1474.0	1158.0	186.386695	122.833333
3	12	1295.0	1158.0	186.386695	107.916667
4	12	1261.0	1158.0	186.386695	105.083333
5	12	1501.0	1158.0	186.386695	125.083333
6	12	1299.0	1158.0	186.386695	108.250000
7	12	1092.0	1158.0	186.386695	91.000000
8	12	836.0	1158.0	186.386695	69.666667
9	12	980.0	1158.0	186.386695	81.666667
10	12	1143.0	1158.0	186.386695	95.250000
11	12	1206.0	1158.0	186.386695	100.500000
12	12	1426.0	1158.0	186.386695	118.833333
13	12	1156.0	1158.0	186.386695	96.333333
14	12	798.0	1158.0	186.386695	66.500000
15	12	860.0	1158.0	186.386695	71.666667
16	12	983.0	1158.0	186.386695	81.916667

Kruskal-Wallis Test (Chi-Square Approximation)
CHISQ= 19.794 DF= 15 Prob > CHISQ= 0.1800

===

Nparlway of R48 over Year 78--93

N P A R 1 W A Y   P R O C E D U R E
Wilcoxon Scores (Rank Sums) for Variable R48
Classified by Variable NO

NO	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
1	12	1430.0	1158.0	186.386695	119.166667
2	12	1385.0	1158.0	186.386695	115.416667
3	12	1346.0	1158.0	186.386695	112.166667
4	12	1279.0	1158.0	186.386695	106.583333
5	12	1406.0	1158.0	186.386695	117.166667
6	12	1325.0	1158.0	186.386695	110.416667
7	12	1286.0	1158.0	186.386695	107.166667
8	12	1250.0	1158.0	186.386695	104.166667
9	12	1191.0	1158.0	186.386695	99.250000
10	12	1176.0	1158.0	186.386695	98.000000
11	12	1107.0	1158.0	186.386695	92.250000
12	12	833.0	1158.0	186.386695	69.416667
13	12	759.0	1158.0	186.386695	63.250000
14	12	824.0	1158.0	186.386695	68.666667
15	12	898.0	1158.0	186.386695	74.833333
16	12	1033.0	1158.0	186.386695	86.083333

Kruskal-Wallis Test (Chi-Square Approximation)
CHISQ= 20.330 DF= 15 Prob > CHISQ= 0.1596

(Continued Appendix F)

Nparlway of R49 over Year 78--93

N P A R 1 W A Y P R O C E D U R E

Wilcoxon Scores (Rank Sums) for Variable R49

Classified by Variable NO

NO	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
1	12	1177.0	1158.0	186.386695	98.083333
2	12	1400.0	1158.0	186.386695	116.666667
3	12	1232.0	1158.0	186.386695	102.666667
4	12	1247.0	1158.0	186.386695	103.916667
5	12	1009.0	1158.0	186.386695	84.083333
6	12	1040.0	1158.0	186.386695	86.666667
7	12	1264.0	1158.0	186.386695	105.333333
8	12	1092.0	1158.0	186.386695	91.000000
9	12	1270.0	1158.0	186.386695	105.833333
10	12	1402.0	1158.0	186.386695	116.833333
11	12	1381.0	1158.0	186.386695	115.083333
12	12	1164.0	1158.0	186.386695	97.000000
13	12	936.0	1158.0	186.386695	78.000000
14	12	1096.0	1158.0	186.386695	91.333333
15	12	889.0	1158.0	186.386695	74.083333
16	12	929.0	1158.0	186.386695	77.416667

Kruskal-Wallis Test (Chi-Square Approximation)

CHISQ= 11.437 DF= 15 Prob > CHISQ= 0.7210

Appendix G: The Data Samples of Each Major Ratios During 1978-1993

OBS	R9	R19	R23	R36	R39	R48
1	.0001614	0.68357	-0.21416	0.12007	.0027157	0.30300
2	.0004434	0.74894	-0.13236	0.21730	.0035074	0.35580
3	.0006775	0.99845	-0.10439	0.22796	.0042553	0.36200
4	.0012250	1.03226	-0.10048	0.23161	.0046278	0.37257
5	.0014675	1.05763	-0.08689	0.24657	.0049251	0.40689
6	.0016854	1.06843	-0.08614	0.26651	.0051974	0.42153
7	.0020078	1.07834	-0.08568	0.27889	.0058651	0.46799
8	.0021234	1.11858	-0.08493	0.28420	.0064816	0.47336
9	.0022088	1.15787	-0.07966	0.29866	.0065030	0.49225
10	.0028017	1.18919	-0.07864	0.31941	.0065968	0.51789
11	.0029491	1.22124	-0.06409	0.32378	.0067904	0.52108
12	.0029848	1.22940	-0.06362	0.33858	.0074707	0.52982
13	.0033825	1.24760	-0.05886	0.34074	.0081448	0.53690
14	.0037381	1.25369	-0.05851	0.34364	.0083615	0.55077
15	.0041109	1.26288	-0.05717	0.35397	.0084253	0.57095
16	.0042035	1.28308	-0.05459	0.36004	.0091010	0.58275
17	.0042934	1.33159	-0.04782	0.36306	.0098091	0.59726
18	0.004416	1.33333	-0.045500	0.37448	0.010186	0.62942
19	0.004620	1.35989	-0.045424	0.38031	0.010249	0.63034
20	0.005528	1.36026	-0.043401	0.38638	0.010871	0.63355
21	0.005571	1.37708	-0.043170	0.41755	0.011042	0.64582
22	0.005656	1.38401	-0.038170	0.43877	0.011445	0.65445
23	0.005834	1.40683	-0.029759	0.44716	0.012135	0.65863
24	0.006632	1.40806	-0.028565	0.46016	0.012333	0.67447
25	0.006723	1.41263	-0.028465	0.46501	0.012450	0.69287
26	0.007201	1.44330	-0.027834	0.46613	0.013268	0.70007
27	0.007519	1.48214	-0.025547	0.47495	0.014995	0.70178
28	0.007898	1.48517	-0.019342	0.48008	0.016795	0.70376
29	0.008179	1.52698	-0.018384	0.48012	0.018745	0.70797
30	0.009006	1.53013	-0.017954	0.49156	0.018745	0.71321
31	0.009612	1.55881	-0.014080	0.49913	0.018951	0.71603
32	0.011017	1.59033	-0.012676	0.50132	0.018959	0.71891
33	0.011763	1.59225	-0.007529	0.50815	0.019220	0.73594
34	0.012249	1.59753	-0.006114	0.51067	0.019463	0.73776
35	0.012744	1.60726	-0.005112	0.51163	0.019910	0.74516
36	0.012857	1.63078	-0.000141	0.51833	0.021776	0.74701
37	0.012990	1.63258	0.002083	0.53737	0.022944	0.74795
38	0.013035	1.63976	0.002611	0.54001	0.023393	0.75544
39	0.014209	1.63992	0.003402	0.54876	0.023405	0.75996
40	0.015116	1.65385	0.003655	0.55616	0.023476	0.76233
41	0.015205	1.65487	0.005323	0.56037	0.023592	0.76698
42	0.015423	1.65520	0.005942	0.56757	0.023918	0.77537
43	0.015568	1.66129	0.007372	0.56836	0.024023	0.78018
44	0.015852	1.67255	0.008066	0.57722	0.024084	0.78033
45	0.015931	1.73395	0.008230	0.58283	0.024975	0.78286
46	0.016352	1.73481	0.008411	0.59262	0.025529	0.78751
47	0.017134	1.75544	0.008849	0.60357	0.025844	0.79906

(Continued Appendix G)

48	0.017194	1.77148	0.009156	0.61728	0.027149	0.81029
49	0.017498	1.77729	0.009378	0.62637	0.027217	0.81481
50	0.019483	1.78297	0.011064	0.62907	0.027899	0.81512
51	0.022040	1.80978	0.014778	0.62925	0.028932	0.81658
52	0.022323	1.81215	0.014803	0.63373	0.032445	0.82286
53	0.022576	1.81379	0.014903	0.64122	0.034421	0.82413
54	0.023781	1.84212	0.017227	0.64879	0.034547	0.82429
55	0.028609	1.85535	0.018322	0.67532	0.034585	0.83171
56	0.030072	1.94066	0.018883	0.68333	0.035105	0.83204
57	0.032702	1.96564	0.019578	0.68485	0.036135	0.83658
58	0.033737	2.04321	0.019787	0.68522	0.036407	0.84733
59	0.034585	2.06809	0.020717	0.68857	0.037387	0.84988
60	0.037936	2.07353	0.021310	0.69561	0.037530	0.85829
61	0.038012	2.09216	0.022463	0.69887	0.038844	0.86049
62	0.043391	2.10909	0.022528	0.70357	0.038857	0.86063
63	0.043560	2.10937	0.023060	0.71396	0.039405	0.86374
64	0.044640	2.13587	0.024781	0.73539	0.039616	0.86487
65	0.047405	2.17733	0.024858	0.73999	0.039736	0.87864
66	0.051915	2.21107	0.026553	0.74057	0.040310	0.87953
67	0.055718	2.22311	0.028555	0.76589	0.041009	0.87985
68	0.057615	2.22442	0.028837	0.76599	0.041162	0.88324
69	0.05780	2.22770	0.028945	0.76816	0.043237	0.88863
70	0.05806	2.23865	0.029348	0.77581	0.043241	0.89038
71	0.05900	2.23948	0.030252	0.77845	0.043551	0.89590
72	0.06117	2.29084	0.032294	0.78682	0.043750	0.90719
73	0.06225	2.29731	0.032542	0.78704	0.044202	0.91287
74	0.06263	2.32323	0.032658	0.78884	0.044894	0.91461
75	0.06853	2.34171	0.032780	0.79844	0.046080	0.91597
76	0.06926	2.35525	0.033115	0.79951	0.048327	0.92899
77	0.07153	2.38314	0.033342	0.80047	0.051001	0.92975
78	0.07227	2.43931	0.033625	0.80081	0.051011	0.93932
79	0.08752	2.45450	0.033636	0.80332	0.052026	0.95058
80	0.08808	2.46734	0.034301	0.80956	0.054459	0.95125
81	0.09528	2.48313	0.034435	0.81066	0.056135	0.95361
82	0.09684	2.50141	0.035904	0.81087	0.057572	0.95361
83	0.09738	2.58333	0.037028	0.81849	0.058145	0.95470
84	0.10413	2.60809	0.038731	0.83308	0.059070	0.95671
85	0.10546	2.61905	0.039192	0.83476	0.060728	0.96182
86	0.10621	2.62544	0.039224	0.83751	0.060960	0.96263
87	0.10977	2.62920	0.039779	0.84084	0.061248	0.96799
88	0.12160	2.63084	0.040493	0.84215	0.061671	0.97691
89	0.13284	2.63241	0.041327	0.86300	0.062663	0.97694
90	0.13332	2.63354	0.041991	0.86308	0.064544	0.97828
91	0.13706	2.70814	0.042483	0.87887	0.064875	0.97949
92	0.14078	2.71856	0.042734	0.88773	0.066482	0.99094
93	0.14533	2.72109	0.042991	0.90210	0.066705	0.99498
94	0.15322	2.72368	0.044155	0.91843	0.068170	0.99682
95	0.15460	2.77091	0.044193	0.93262	0.068618	1.00294
96	0.15871	2.79769	0.044680	0.94212	0.070082	1.00384
97	0.16066	2.80760	0.044769	0.95013	0.071558	1.00753

(Continued Appendix G)

98	0.17073	2.81294	0.045910	0.95245	0.072821	1.01033
99	0.17969	2.82806	0.046284	0.95410	0.077740	1.02026
100	0.18352	2.83593	0.046372	0.97464	0.077921	1.02034
101	0.18942	2.86624	0.046907	0.98045	0.078530	1.02054
102	0.19469	2.87764	0.046964	1.00102	0.082000	1.02460
103	0.19835	2.92951	0.047357	1.01431	0.08520	1.02577
104	0.20224	2.95656	0.047484	1.02967	0.08697	1.02580
105	0.20356	2.95703	0.047505	1.04302	0.08720	1.03117
106	0.20507	2.98643	0.048274	1.04784	0.08762	1.03352
107	0.20908	3.01395	0.048776	1.06656	0.08915	1.04688
108	0.21721	3.05318	0.048916	1.07924	0.08976	1.05175
109	0.21808	3.10101	0.049786	1.10393	0.09115	1.05736
110	0.22114	3.10204	0.049890	1.12922	0.09130	1.06319
111	0.22827	3.10399	0.050450	1.15005	0.09251	1.07143
112	0.23874	3.13337	0.052478	1.17366	0.09252	1.07331
113	0.23904	3.14315	0.052575	1.18971	0.09449	1.07417
114	0.24286	3.16287	0.054864	1.19831	0.09812	1.08515
115	0.24467	3.18502	0.055593	1.21092	0.09840	1.09060
116	0.24980	3.22072	0.055892	1.21798	0.10194	1.09987
117	0.25771	3.31939	0.057082	1.22938	0.10474	1.10210
118	0.27119	3.32439	0.057600	1.23329	0.10572	1.11975
119	0.27270	3.32615	0.058150	1.23405	0.10614	1.11998
120	0.27534	3.33768	0.058836	1.23510	0.10662	1.12281
121	0.28504	3.35968	0.059897	1.24171	0.10701	1.13918
122	0.29748	3.36627	0.060690	1.24584	0.11018	1.15624
123	0.30226	3.37327	0.060775	1.25008	0.11048	1.16243
124	0.30460	3.39725	0.061291	1.27578	0.11319	1.16768
125	0.30483	3.49428	0.061653	1.28455	0.11332	1.16887
126	0.30691	3.50832	0.061669	1.29351	0.11340	1.18962
127	0.31019	3.53400	0.064293	1.30472	0.11459	1.20939
128	0.31141	3.56093	0.065223	1.32364	0.11537	1.22259
129	0.31915	3.60165	0.065392	1.37177	0.11605	1.23583
130	0.32708	3.61202	0.068303	1.37321	0.11816	1.24095
131	0.32869	3.62492	0.069102	1.37940	0.12040	1.24110
132	0.34132	3.64237	0.069772	1.39033	0.12083	1.26201
133	0.34382	3.65500	0.069841	1.39431	0.12226	1.26624
134	0.34965	3.65542	0.070764	1.40480	0.12450	1.27592
135	0.35541	3.70943	0.071973	1.41406	0.13028	1.27673
136	0.36323	3.73274	0.072281	1.41461	0.13490	1.29544
137	0.38190	3.76190	0.073409	1.42692	0.13816	1.30409
138	0.39283	3.77160	0.073992	1.42832	0.14223	1.31183
139	0.39409	3.77710	0.077443	1.43704	0.14927	1.35144
140	0.49348	3.78123	0.077669	1.46286	0.15188	1.37348
141	0.51576	3.84953	0.078962	1.46458	0.16074	1.38299
142	0.51918	3.90442	0.079828	1.46787	0.16600	1.38931
143	0.53051	3.90485	0.080876	1.47974	0.16622	1.39642
144	0.53914	3.91326	0.080891	1.53545	0.17085	1.39961
145	0.57137	3.95854	0.081893	1.54463	0.17172	1.42768
146	0.58839	4.06903	0.082349	1.54780	0.17331	1.45379
147	0.61481	4.14417	0.085475	1.55205	0.17560	1.45709

(Continued Appendix G)

148	0.71314	4.22054	0.086451	1.55345	0.17663	1.45814
149	0.73686	4.34803	0.08779	1.61173	0.17689	1.50035
150	0.74990	4.39147	0.08801	1.61605	0.18086	1.50267
151	0.77862	4.46261	0.08847	1.62591	0.19161	1.52365
152	0.82425	4.49354	0.09004	1.64404	0.19239	1.52381
153	0.83347	4.52294	0.09453	1.64494	0.19299	1.53222
154	0.86640	4.58614	0.09579	1.65734	0.19332	1.53585
155	0.89130	4.61075	0.09635	1.69922	0.19838	1.55382
156	0.92208	4.61837	0.09889	1.71883	0.20017	1.55879
157	0.96825	4.65534	0.10024	1.72227	0.20215	1.57713
158	0.97619	4.76596	0.10229	1.73305	0.20339	1.58064
159	1.07837	4.84947	0.10231	1.74591	0.20377	1.58488
160	1.09135	4.90085	0.10865	1.78410	0.22355	1.59375
161	1.11267	4.93465	0.11001	1.78638	0.22400	1.59522
162	1.11983	4.93946	0.11430	1.78842	0.24359	1.61693
163	1.29074	5.05709	0.11697	1.82231	0.26080	1.62083
164	1.43475	5.07160	0.11767	1.85720	0.26250	1.63297
165	1.52322	5.15082	0.11870	1.90009	0.26517	1.67873
166	1.53138	5.34644	0.12046	1.91506	0.26906	1.77322
167	1.53224	5.34752	0.12504	1.92833	0.27635	1.79145
168	1.74894	5.43064	0.12509	1.94226	0.28513	1.82018
169	1.92989	5.44314	0.12560	1.99035	0.28528	1.83737
170	1.96656	5.57946	0.12792	2.02763	0.28676	1.86390
171	2.16977	5.62093	0.13103	2.06265	0.29734	1.90834
172	2.20611	5.64046	0.13529	2.06952	0.30072	1.95635
173	2.26354	5.65323	0.13693	2.09720	0.32791	1.97751
174	2.30259	5.72708	0.14495	2.12132	0.33357	1.98481
175	2.31429	5.79227	0.14520	2.13250	0.34644	2.02579
176	2.48780	5.94254	0.14669	2.23822	0.35489	2.05204
177	2.52333	6.05245	0.15104	2.25102	0.36496	2.13102
178	2.55274	6.22907	0.15149	2.30925	0.36505	2.17600
179	2.60704	6.59324	0.15445	2.37629	0.37733	2.17857
180	2.76015	6.71718	0.15961	2.40045	0.38168	2.21755
181	2.84961	6.72266	0.16361	2.44407	0.38321	2.34221
182	3.09689	6.77329	0.16408	2.47445	0.38629	2.43218
183	3.27410	6.98759	0.16678	2.70549	0.40138	2.51666
184	3.65421	7.08926	0.17099	2.71814	0.40176	2.60411
185	4.09691	7.23234	0.17924	2.79470	0.40481	2.66607
186	4.23529	7.56479	0.18191	2.89599	0.43842	2.83045
187	4.90476	7.82791	0.20420	3.03815	0.45326	3.04519
188	5.8982	7.87020	0.24416	3.29492	0.46768	3.28308
189	6.4745	8.00301	0.29479	3.37851	0.51840	3.28343
190	6.4995	8.15004	0.33261	4.09871	0.55044	3.53681
191	9.1442	8.39281	0.36811	4.11018	0.62459	4.15231
192	12.4156	8.85484	0.48948	4.94884	0.67884	8.58272

Appendix H: The Results of Kolmogorov-Smirnov Test for the Distribution Estimated by Pearson System of Each Major Ratios During 1978-1993

Kolmogorov-Smirnov Goodness-of-Fit Test of R9

Max D=0.10947 > $D_{0.05,190}$=0.0986650

Max D=0.10947 < $D_{0.02,190}$=0.11027239

Reject H0: F2 (the Pearson cumulative density function) is fitted with F1 (the empirical distribution function) at 5% level.

Accept H0: F2 (the Pearson cumulative density function) is fitted with F1 (the empirical distribution function) at 2% level.

OBS	F1	F2	D	
1	0.005263	0.03828	0.03302	
2	0.010526	0.07006	0.05953	
3	0.015789	0.10381	0.08802	
4	0.021053	0.11473	0.09368	
5	0.026316	0.12331	0.09699	
6	0.031579	0.13442	0.10284	
7	0.036842	0.13804	0.10119	
8	0.042105	0.14060	0.09850	
9	0.047368	0.15641	0.10904	
10	0.052632	0.15990	0.10727	
11	0.057895	0.16072	0.10283	
12	0.063158	0.16935	0.10620	
13	0.068421	0.17638	0.10795	
14	0.073684	0.18315	0.10947 ***	(The Max D-Statistic) ; Prob (D > 0.10947) = 0.021054 .
15	0.078947	0.18476	0.10581	
16	0.084211	0.18628	0.10207	
17	0.089474	0.18832	0.09885	
18	0.09474	0.19161	0.09688	
19	0.10000	0.20492	0.10492	
20	0.10526	0.20550	0.10023	
21	0.11053	0.20664	0.09611	
22	0.11579	0.20898	0.09319	
23	0.12105	0.21879	0.09774	
24	0.12632	0.21985	0.09353	
25	0.13158	0.22519	0.09361	
26	0.13684	0.22859	0.09174	
27	0.14211	0.23248	0.09037	
28	0.14737	0.23526	0.08789	
29	0.15263	0.24300	0.09037	
30	0.15789	0.24830	0.09041	
31	0.16316	0.25958	0.09642	
32	0.16842	0.26507	0.09665	
33	0.17368	0.26850	0.09482	
34	0.17895	0.27187	0.09293	
35	0.18421	0.27263	0.088416	
36	0.18947	0.27351	0.084034	
37	0.19474	0.27380	0.079067	
38	0.20000	0.28124	0.081241	
39	0.20526	0.28664	0.081375	
40	0.21053	0.28715	0.076626	

Kolmogorov-Smirnov Goodness-of-Fit Test of R9 (Continued Appendix H)

41	0.21579	0.28840	0.072613
42	0.22105	0.28923	0.068173
43	0.22632	0.29082	0.064503
44	0.23158	0.29126	0.059679
45	0.23684	0.29357	0.056724
46	0.24211	0.29772	0.055618
47	0.24737	0.29804	0.050667
48	0.25263	0.29960	0.046972
49	0.25789	0.30931	0.051415
50	0.26316	0.32064	0.057487
51	0.26842	0.32183	0.053408
52	0.27368	0.32288	0.049194
53	0.27895	0.32774	0.048791
54	0.28421	0.34533	0.061117
55	0.28947	0.35016	0.060683
56	0.29474	0.35836	0.063622
57	0.30000	0.36143	0.061433
58	0.30526	0.36389	0.058629
59	0.31053	0.37313	0.062609
60	0.31579	0.37334	0.057547
61	0.32105	0.38679	0.065738
62	0.32632	0.38719	0.060874
63	0.33158	0.38971	0.058131
64	0.33684	0.39593	0.059090
65	0.34211	0.40545	0.063342
66	0.34737	0.41294	0.065569
67	0.35263	0.41651	0.063880
68	0.35789	0.41685	0.058960
69	0.36316	0.41733	0.054177
70	0.36842	0.41906	0.050636
71	0.37368	0.42295	0.049262
72	0.37895	0.42484	0.045891
73	0.38421	0.42550	0.041286
74	0.38947	0.43531	0.045838
75	0.39474	0.43648	0.041739
76	0.40000	0.44003	0.040028
77	0.40526	0.44117	0.035902
78	0.41053	0.46263	0.052101
79	0.41579	0.46335	0.047563
80	0.42105	0.47234	0.051286
81	0.42632	0.47421	0.047892
82	0.43158	0.47485	0.043270
83	0.43684	0.48262	0.045773
84	0.44211	0.48409	0.041989
85	0.44737	0.48492	0.037553
86	0.45263	0.48878	0.036147
87	0.45789	0.50087	0.042971
88	0.46316	0.51144	0.048286
89	0.46842	0.51188	0.043457
90	0.47368	0.51522	0.041531

Kolmogorov-Smirnov Goodness-of-Fit Test of R9 (Continued Appendix H)

91	0.47895	0.51846	0.039511
92	0.48421	0.52232	0.038114
93	0.48947	0.52879	0.039313
94	0.49474	0.52989	0.035150
95	0.50000	0.53311	0.033115
96	0.50526	0.53462	0.029357
97	0.51053	0.54215	0.031627
98	0.51579	0.54854	0.032748
99	0.52105	0.55118	0.030129
100	0.52632	0.55516	0.028846
101	0.53158	0.55863	0.027048
102	0.53684	0.56099	0.024143
103	0.54211	0.56345	0.021345
104	0.54737	0.56428	0.016909
105	0.55263	0.56522	0.012587
106	0.55789	0.56769	0.009792
107	0.56316	0.57257	0.009408
108	0.56842	0.57308	0.004657
109	0.57368	0.57487	0.001183
110	0.57895	0.57895	0.000004
111	0.58421	0.58475	0.000540
112	0.58947	0.58491	0.004560
113	0.59474	0.58697	0.007765
114	0.60000	0.58794	0.012063
115	0.60526	0.59064	0.014625
116	0.61053	0.59471	0.015817
117	0.61579	0.60140	0.014391
118	0.62105	0.60213	0.018924
119	0.62632	0.60340	0.022918
120	0.63158	0.60797	0.023608
121	0.63684	0.61364	0.023206
122	0.64211	0.61576	0.026348
123	0.64737	0.61678	0.030584
124	0.65263	0.61689	0.035747
125	0.65789	0.61779	0.040103
126	0.66316	0.61921	0.043947
127	0.66842	0.61973	0.048686
128	0.67368	0.62302	0.050665
129	0.67895	0.62631	0.052637
130	0.68421	0.62697	0.057240
131	0.68947	0.63205	0.057427
132	0.69474	0.63303	0.061706
133	0.70000	0.63530	0.064697
134	0.70526	0.63751	0.067750
135	0.71053	0.64046	0.070062
136	0.71579	0.64728	0.068506
137	0.72105	0.65114	0.069915
138	0.72632	0.65158	0.074740
139	0.73158	0.68265	0.048931
140	0.73684	0.68882	0.048025

Kolmogorov-Smirnov Goodness-of-Fit Test of R9 (Continued Appendix H)

141	0.74211	0.68974	0.052363
142	0.74737	0.69277	0.054602
143	0.75263	0.69503	0.057602
144	0.75789	0.70320	0.054699
145	0.76316	0.70734	0.055822
146	0.76842	0.71355	0.054876
147	0.77368	0.73463	0.039059
148	0.77895	0.73929	0.039654
149	0.78421	0.74180	0.042412
150	0.78947	0.74717	0.042304
151	0.79474	0.75532	0.039417
152	0.80000	0.75691	0.043087
153	0.80526	0.76246	0.042799
154	0.81053	0.76653	0.044000
155	0.81579	0.77139	0.044395
156	0.82105	0.77840	0.042653
157	0.82632	0.77957	0.046745
158	0.83158	0.79383	0.037745
159	0.83684	0.79555	0.041296
160	0.84211	0.79831	0.043792
161	0.84737	0.79923	0.048138
162	0.85263	0.81947	0.033159
163	0.85789	0.83443	0.023470
164	0.86316	0.84282	0.020340
165	0.86842	0.84356	0.024856
166	0.87368	0.84364	0.030041
167	0.87895	0.86196	0.016988
168	0.88421	0.87534	0.008872
169	0.88947	0.87787	0.011607
170	0.89474	0.89090	0.003841
171	0.90000	0.89306	0.006935
172	0.90526	0.89640	0.008863
173	0.91053	0.89861	0.011920
174	0.91579	0.89926	0.016532
175	0.92105	0.90844	0.012617
176	0.92632	0.91021	0.016106
177	0.93158	0.91165	0.019927
178	0.93684	0.91426	0.022586
179	0.94211	0.92121	0.020899
180	0.94737	0.92502	0.022351
181	0.95263	0.93469	0.017946
182	0.95789	0.94091	0.016983
183	0.96316	0.95257	0.010591
184	0.96842	0.96369	0.004732
185	0.97368	0.96671	0.006979
186	0.97895	0.97872	0.000225
187	0.98421	0.99038	0.006172
188	0.98947	0.99462	.0051417
189	0.99474	0.99476	.0000278
190	1.00000	1.00000	.0000000

Kolmogorov-Smirnov Goodness-of-Fit Test of R19 (Continued Appendix H)

Max D=0.16013 > $D_{0.05,192}$=0.098150

Reject H0: F2 (the Pearson cumulative density function) is fitted with F1 (the empirical distribution function) at 5% level.

OBS	F1	F2	D	
1	0.005208	0.02727	0.02206	
2	0.010417	0.12475	0.11433	
3	0.015625	0.13722	0.12160	
4	0.020833	0.14647	0.12564	
5	0.026042	0.15038	0.12434	
6	0.031250	0.15396	0.12271	
7	0.036458	0.16833	0.13187	
8	0.041667	0.18215	0.14048	
9	0.046875	0.19302	0.14615	
10	0.052083	0.20401	0.15193	
11	0.057292	0.20679	0.14950	
12	0.062500	0.21295	0.15045	
13	0.067708	0.21501	0.14730	
14	0.072917	0.21809	0.14518	
15	0.078125	0.22485	0.14672	
16	0.083333	0.24086	0.15753	
17	0.088542	0.24143	0.15289	
18	0.09375	0.25007	0.15632	
19	0.09896	0.25019	0.15123	
20	0.10417	0.25561	0.15145	
21	0.10938	0.25784	0.14847	
22	0.11458	0.26513	0.15055	
23	0.11979	0.26552	0.14573	
24	0.12500	0.26697	0.14197	
25	0.13021	0.27666	0.14645	
26	0.13542	0.28876	0.15335	
27	0.14063	0.28970	0.14907	
28	0.14583	0.30253	0.15669	
29	0.15104	0.30348	0.15244	
30	0.15625	0.31216	0.15591	
31	0.16146	0.32159	0.16013	*** (The Max D-Statistic) ; Prob (D > 0.16013) = 0.000106 .
32	0.16667	0.32216	0.15550	
33	0.17188	0.32373	0.15186	
34	0.17708	0.32661	0.14953	
35	0.18229	0.33354	0.15125	
36	0.18750	0.33406	0.14656	
37	0.19271	0.33617	0.14346	
38	0.19792	0.33621	0.13830	
39	0.20313	0.34027	0.13715	
40	0.20833	0.34057	0.13224	
41	0.21354	0.34066	0.12712	
42	0.21875	0.34243	0.12368	
43	0.22396	0.34569	0.12173	
44	0.22917	0.36322	0.13406	

Kolmogorov-Smirnov Goodness-of-Fit Test of R19 (Continued Appendix H)

45	0.23438	0.36347	0.12909
46	0.23958	0.36927	0.12969
47	0.24479	0.37375	0.12896
48	0.25000	0.37537	0.12537
49	0.25521	0.37695	0.12174
50	0.26042	0.38435	0.12393
51	0.26562	0.38500	0.11938
52	0.27083	0.38545	0.11462
53	0.27604	0.39319	0.11714
54	0.28125	0.39677	0.11552
55	0.28646	0.41948	0.13302
56	0.29167	0.42600	0.13433
57	0.29687	0.44587	0.14899
58	0.30208	0.45212	0.15004
59	0.30729	0.45349	0.14619
60	0.31250	0.45812	0.14562
61	0.31771	0.46231	0.14460
62	0.32292	0.46238	0.13947
63	0.32812	0.46889	0.14076
64	0.33333	0.47894	0.14561
65	0.33854	0.48701	0.14847
66	0.34375	0.48986	0.14611
67	0.34896	0.49017	0.14122
68	0.35417	0.49095	0.13678
69	0.35937	0.49353	0.13416
70	0.36458	0.49373	0.12914
71	0.36979	0.50570	0.13591
72	0.37500	0.50719	0.13219
73	0.38021	0.51313	0.13293
74	0.38542	0.51734	0.13192
75	0.39062	0.52040	0.12977
76	0.39583	0.52666	0.13083
77	0.40104	0.53907	0.13803
78	0.40625	0.54239	0.13614
79	0.41146	0.54517	0.13371
80	0.41667	0.54858	0.13191
81	0.42187	0.55250	0.13063
82	0.42708	0.56976	0.14267
83	0.43229	0.57487	0.14258
84	0.43750	0.57712	0.13962
85	0.44271	0.57843	0.13572
86	0.44792	0.57919	0.13128
87	0.45312	0.57953	0.12640
88	0.45833	0.57985	0.12151
89	0.46354	0.58008	0.11654
90	0.46875	0.59506	0.12631
91	0.47396	0.59712	0.12316
92	0.47917	0.59762	0.11845
93	0.48437	0.59813	0.11375
94	0.48958	0.60735	0.11777

Kolmogorov-Smirnov Goodness-of-Fit Test of R19 (Continued Appendix H)

95	0.49479	0.61250	0.11771
96	0.50000	0.61440	0.11440
97	0.50521	0.61542	0.11021
98	0.51042	0.61829	0.10787
99	0.51563	0.61978	0.10415
100	0.52083	0.62547	0.10463
101	0.52604	0.62759	0.10155
102	0.53125	0.63714	0.10589
103	0.53646	0.64204	0.10559
104	0.54167	0.64213	0.10046
105	0.54688	0.64740	0.10053
106	0.55208	0.65228	0.10020
107	0.55729	0.65916	0.10186
108	0.56250	0.66740	0.10490
109	0.56771	0.66757	0.09986
110	0.57292	0.66791	0.09499
111	0.57813	0.67289	0.09476
112	0.58333	0.67453	0.09120
113	0.58854	0.67783	0.08929
114	0.59375	0.68151	0.08776
115	0.59896	0.68737	0.08841
116	0.60417	0.70314	0.09897
117	0.60938	0.70392	0.09455
118	0.61458	0.70420	0.08961
119	0.61979	0.70600	0.08621
120	0.62500	0.70941	0.084407
121	0.63021	0.71042	0.080214
122	0.63542	0.71150	0.076082
123	0.64063	0.71516	0.074537
124	0.64583	0.72963	0.083800
125	0.65104	0.73168	0.080639
126	0.65625	0.73540	0.079147
127	0.66146	0.73925	0.077794
128	0.66667	0.74500	0.078337
129	0.67188	0.74645	0.074578
130	0.67708	0.74825	0.071164
131	0.68229	0.75066	0.068368
132	0.68750	0.75240	0.064895
133	0.69271	0.75245	0.059744
134	0.69792	0.75977	0.061856
135	0.70313	0.76288	0.059757
136	0.70833	0.76673	0.058396
137	0.71354	0.76800	0.054457
138	0.71875	0.76872	0.049966
139	0.72396	0.76925	0.045296
140	0.72917	0.77802	0.048849
141	0.73438	0.78488	0.050502
142	0.73958	0.78493	0.045347
143	0.74479	0.78597	0.041176
144	0.75000	0.79149	0.041489

Kolmogorov-Smirnov Goodness-of-Fit Test of R19 (Continued Appendix H)

145	0.75521	0.80452	0.049315
146	0.76042	0.81304	0.052623
147	0.76563	0.82141	0.055789
148	0.77083	0.83478	0.063946
149	0.77604	0.83916	0.063120
150	0.78125	0.84616	0.064906
151	0.78646	0.84913	0.062668
152	0.79167	0.85191	0.060245
153	0.79688	0.85777	0.060896
154	0.80208	0.86001	0.057924
155	0.80729	0.86069	0.053403
156	0.81250	0.86399	0.051493
157	0.81771	0.87352	0.055817
158	0.82292	0.88039	0.057477
159	0.82813	0.88448	0.056358
160	0.83333	0.88712	0.053784
161	0.83854	0.88749	0.048947
162	0.84375	0.89630	0.052548
163	0.84896	0.89735	0.048391
164	0.85417	0.90295	0.048786
165	0.85938	0.91584	0.056468
166	0.86458	0.91591	0.051327
167	0.86979	0.92099	0.051201
168	0.87500	0.92174	0.046737
169	0.88021	0.92954	0.049327
170	0.88542	0.93179	0.046376
171	0.89063	0.93284	0.042212
172	0.89583	0.93351	0.037681
173	0.90104	0.93733	0.036292
174	0.90625	0.94057	0.034322
175	0.91146	0.94758	0.036121
176	0.91667	0.95232	0.035649
177	0.92188	0.95927	0.037399
178	0.92708	0.97129	0.044210
179	0.93229	0.97473	0.042439
180	0.93750	0.97488	0.037376
181	0.94271	0.97619	0.033478
182	0.94792	0.98120	0.033285
183	0.95313	0.98330	0.030171
184	0.95833	0.98596	0.027622
185	0.96354	0.99096	0.027417
186	0.96875	0.99390	0.025153
187	0.97396	0.99430	0.020344
188	0.97917	0.99544	0.016270
189	0.98438	0.99650	0.012121
190	0.98958	0.99785	0.008263
191	0.99479	0.99934	0.004546
192	1.00000	1.00000	0.000000

Kolmogorov-Smirnov Goodness-of-Fit Test of R23 (Continued Appendix H)

Max D=0.085147 < $D_{0.05,192}$ =0.098150

Accept H0: F2 (the Pearson cumulative density function) is fitted with F1 (the empirical distribution function) at 5% level.

OBS	F1	F2	D
1	0.000000	0.000000	0.000000
2	0.005236	0.003608	0.001627
3	0.010471	0.010427	0.000044
4	0.015707	0.012065	0.003642
5	0.020942	0.019891	0.001052
6	0.026178	0.020434	0.005744
7	0.031414	0.020781	0.010633
8	0.036649	0.021355	0.015294
9	0.041885	0.025803	0.016082
10	0.047120	0.026761	0.020359
11	0.052356	0.044392	0.007964
12	0.057592	0.045106	0.012485
13	0.062827	0.052891	0.009937
14	0.068063	0.053494	0.014569
15	0.073298	0.055913	0.017386
16	0.078534	0.060831	0.017703
17	0.083770	0.075447	0.008323
18	0.08901	0.08106	0.007942
19	0.09424	0.08126	0.012985
20	0.09948	0.08644	0.013041
21	0.10471	0.08705	0.017666
22	0.10995	0.10104	0.008910
23	0.11518	0.12832	0.013135
24	0.12042	0.13258	0.012157
25	0.12565	0.13294	0.007283
26	0.13089	0.13524	0.004347
27	0.13613	0.14379	0.007662
28	0.14136	0.16878	0.027416
29	0.14660	0.17287	0.026270
30	0.15183	0.17472	0.022890
31	0.15707	0.19198	0.034916
32	0.16230	0.19848	0.036173
33	0.16754	0.22332	0.055778
34	0.17277	0.23042	0.057643
35	0.17801	0.23551	0.057497
36	0.18325	0.26158	0.078329
37	0.18848	0.27363	0.085147 *** (The Max D-Statistic) ; Prob (D > 0.085147) = 0.123552 .
38	0.19372	0.27652	0.082805
39	0.19895	0.28088	0.081929
40	0.20419	0.28228	0.078093
41	0.20942	0.29158	0.082153
42	0.21466	0.29505	0.080389
43	0.21990	0.30314	0.083243

Kolmogorov-Smirnov Goodness-of-Fit Test of R23 (Continued Appendix H)

44	0.22513	0.30710	0.081966
45	0.23037	0.30803	0.077667
46	0.23560	0.30906	0.073461
47	0.24084	0.31157	0.070734
48	0.24607	0.31333	0.067260
49	0.25131	0.31461	0.063301
50	0.25654	0.32436	0.067814
51	0.26178	0.34611	0.084325
52	0.26702	0.34625	0.079231
53	0.27225	0.34684	0.074586
54	0.27749	0.36062	0.083137
55	0.28272	0.36715	0.084430
56	0.28796	0.37050	0.082542
57	0.29319	0.37466	0.081466
58	0.29843	0.37591	0.077483
59	0.30366	0.38150	0.077833
60	0.30890	0.38506	0.076161
61	0.31414	0.39200	0.077865
62	0.31937	0.39239	0.073015
63	0.32461	0.39560	0.070992
64	0.32984	0.40599	0.076143
65	0.33508	0.40644	0.071366
66	0.34031	0.41669	0.076374
67	0.34555	0.42879	0.083242
68	0.35079	0.43050	0.079711
69	0.35602	0.43115	0.075128
70	0.36126	0.43359	0.072334
71	0.36649	0.43905	0.072554
72	0.37173	0.45136	0.079637
73	0.37696	0.45286	0.075902
74	0.38220	0.45356	0.071359
75	0.38743	0.45429	0.066858
76	0.39267	0.45631	0.063645
77	0.39791	0.45767	0.059769
78	0.40314	0.45938	0.056235
79	0.40838	0.45945	0.051072
80	0.41361	0.46345	0.049832
81	0.41885	0.46424	0.045395
82	0.42408	0.47305	0.048966
83	0.42932	0.47977	0.050448
84	0.43455	0.48991	0.055352
85	0.43979	0.49264	0.052852
86	0.44503	0.49283	0.047806
87	0.45026	0.49612	0.045858
88	0.45550	0.50034	0.044843
89	0.46073	0.50526	0.044524
90	0.46597	0.50917	0.043198
91	0.47120	0.51205	0.040848
92	0.47644	0.51352	0.037082
93	0.48168	0.51502	0.033344

Kolmogorov-Smirnov Goodness-of-Fit Test of R23 (Continued Appendix H)

94	0.48691	0.52181	0.034898
95	0.49215	0.52204	0.029889
96	0.49738	0.52486	0.027477
97	0.50262	0.52538	0.022758
98	0.50785	0.53198	0.024130
99	0.51309	0.53413	0.021045
100	0.51832	0.53465	0.016322
101	0.52356	0.53772	0.014157
102	0.52880	0.53805	0.009254
103	0.53403	0.54030	0.006272
104	0.53927	0.54103	0.001764
105	0.54450	0.54115	0.003357
106	0.54974	0.54554	0.004200
107	0.55497	0.54840	0.006578
108	0.56021	0.54919	0.011018
109	0.56545	0.55413	0.011318
110	0.57068	0.55471	0.015972
111	0.57592	0.55787	0.018049
112	0.58115	0.56922	0.011936
113	0.58639	0.56976	0.016627
114	0.59162	0.58238	0.009242
115	0.59686	0.58636	0.010497
116	0.60209	0.58799	0.014100
117	0.60733	0.59443	0.012896
118	0.61257	0.59721	0.015352
119	0.61780	0.60016	0.017641
120	0.62304	0.60382	0.019219
121	0.62827	0.60944	0.018836
122	0.63351	0.61361	0.019902
123	0.63874	0.61405	0.024692
124	0.64398	0.61675	0.027226
125	0.64921	0.61864	0.030577
126	0.65445	0.61872	0.035729
127	0.65969	0.63221	0.027476
128	0.66492	0.63692	0.028002
129	0.67016	0.63778	0.032381
130	0.67539	0.65224	0.023154
131	0.68063	0.65614	0.024486
132	0.68586	0.65939	0.026472
133	0.69110	0.65973	0.031374
134	0.69634	0.66417	0.032170
135	0.70157	0.66992	0.031651
136	0.70681	0.67138	0.035427
137	0.71204	0.67667	0.035372
138	0.71728	0.67938	0.037902
139	0.72251	0.69508	0.027429
140	0.72775	0.69609	0.031656
141	0.73298	0.70182	0.031169
142	0.73822	0.70560	0.032617
143	0.74346	0.71014	0.033314

Kolmogorov-Smirnov Goodness-of-Fit Test of R23 (Continued Appendix H)

144	0.74869	0.71020	0.038489
145	0.75393	0.71449	0.039440
146	0.75916	0.71642	0.042738
147	0.76440	0.72941	0.034992
148	0.76963	0.73336	0.036272
149	0.77487	0.73872	0.036144
150	0.78010	0.73957	0.040537
151	0.78534	0.74139	0.043947
152	0.79058	0.74751	0.043067
153	0.79581	0.76432	0.031488
154	0.80105	0.76887	0.032182
155	0.80628	0.77088	0.035401
156	0.81152	0.77977	0.031746
157	0.81675	0.78435	0.032402
158	0.82199	0.79116	0.030827
159	0.82723	0.79125	0.035980
160	0.83246	0.81114	0.021325
161	0.83770	0.81518	0.022512
162	0.84293	0.82880	0.014132
163	0.84817	0.83465	0.013522
164	0.85340	0.83651	0.016889
165	0.85864	0.83918	0.019462
166	0.86387	0.84369	0.020188
167	0.86911	0.85483	0.014277
168	0.87435	0.85496	0.019385
169	0.87958	0.85614	0.023439
170	0.88482	0.86146	0.023355
171	0.89005	0.86827	0.021778
172	0.89529	0.87711	0.018179
173	0.90052	0.88034	0.020181
174	0.90576	0.89504	0.010723
175	0.91099	0.89546	0.015531
176	0.91623	0.89798	0.018250
177	0.92147	0.90498	0.016485
178	0.92670	0.90568	0.021022
179	0.93194	0.91013	0.021810
180	0.93717	0.91740	0.019777
181	0.94241	0.92261	0.019793
182	0.94764	0.92320	0.024443
183	0.95288	0.92651	0.026366
184	0.95812	0.93138	0.026738
185	0.96335	0.93998	0.023366
186	0.96859	0.94253	0.026059
187	0.97382	0.95983	0.013990
188	0.97906	0.97857	.0004914
189	0.98429	0.99012	.0058246
190	0.98953	0.99445	.0049191
191	0.99476	0.99683	.0020697
192	1.00000	1.00000	.0000000

Kolmogorov-Smirnov Goodness-of-Fit Test of R36 (Continued Appendix H)

Max D=0.044445 < $D_{0.05,188}$ =0.099188

Accept H0: F2 (the Pearson cumulative density function) is fitted with F1 (the empirical distribution function) at 5% level.

OBS	F1	F2	D
1	0.005319	0.00181	0.003511
2	0.010638	0.00903	0.001607
3	0.015957	0.01480	0.001162
4	0.021277	0.01749	0.003789
5	0.026596	0.02536	0.001231
6	0.031915	0.03780	0.005887
7	0.037234	0.04056	0.003328
8	0.042553	0.05021	0.007659
9	0.047872	0.05166	0.003784
10	0.053191	0.05361	0.000417
11	0.058511	0.06068	0.002166
12	0.063830	0.06491	0.001077
13	0.069149	0.06703	0.002118
14	0.074468	0.07517	0.000706
15	0.079787	0.07939	0.000396
16	0.085106	0.08382	0.001284
17	0.090426	0.10711	0.016682
18	0.09574	0.12335	0.027607
19	0.10106	0.12984	0.028775
20	0.10638	0.13995	0.033564
21	0.11170	0.14373	0.032030
22	0.11702	0.14461	0.027586
23	0.12234	0.15151	0.029171
24	0.12766	0.15554	0.027877
25	0.13298	0.15557	0.022589
26	0.13830	0.16456	0.026262
27	0.14362	0.17052	0.026903
28	0.14894	0.17225	0.023309
29	0.15426	0.17763	0.023374
30	0.15957	0.17962	0.020042
31	0.16489	0.18037	0.015479
32	0.17021	0.18566	0.015444
33	0.17553	0.20067	0.025139
34	0.18085	0.20275	0.021901
35	0.18617	0.20964	0.023472
36	0.19149	0.21546	0.023974
37	0.19681	0.21877	0.021963
38	0.20213	0.22442	0.022295
39	0.20745	0.22504	0.017596
40	0.21277	0.23198	0.019217
41	0.21809	0.23637	0.018284
42	0.22340	0.24401	0.020603
43	0.22872	0.25252	0.023798

Kolmogorov-Smirnov Goodness-of-Fit Test of R36 (Continued Appendix H)

44	0.23404	0.26313	0.029092
45	0.23936	0.27014	0.030779
46	0.24468	0.27222	0.027535
47	0.25000	0.27235	0.022354
48	0.25532	0.27579	0.020474
49	0.26064	0.28153	0.020888
50	0.26596	0.28730	0.021343
51	0.27128	0.30737	0.036088
52	0.27660	0.31337	0.036771
53	0.28191	0.31450	0.032588
54	0.28723	0.31478	0.027545
55	0.29255	0.31728	0.024725
56	0.29787	0.32252	0.024643
57	0.30319	0.32493	0.021741
58	0.30851	0.32841	0.019899
59	0.31383	0.33606	0.022231
60	0.31915	0.35168	0.032533
61	0.32447	0.35501	0.030538
62	0.32979	0.35542	0.025637
63	0.33511	0.37353	0.038420
64	0.34043	0.37360	0.033172
65	0.34574	0.37513	0.029389
66	0.35106	0.38053	0.029467
67	0.35638	0.38239	0.026003
68	0.36170	0.38824	0.026542
69	0.36702	0.38840	0.021376
70	0.37234	0.38965	0.017312
71	0.37766	0.39632	0.018656
72	0.38298	0.39705	0.014076
73	0.38830	0.39772	0.009420
74	0.39362	0.39795	0.004336
75	0.39894	0.39968	0.000747
76	0.40426	0.40397	0.000283
77	0.40957	0.40473	0.004849
78	0.41489	0.40487	0.010024
79	0.42021	0.41007	0.010140
80	0.42553	0.41995	0.005585
81	0.43085	0.42108	0.009775
82	0.43617	0.42292	0.013249
83	0.44149	0.42515	0.016339
84	0.44681	0.42603	0.020783
85	0.45213	0.43983	0.012299
86	0.45745	0.43988	0.017566
87	0.46277	0.45017	0.012594
88	0.46809	0.45588	0.012200
89	0.47340	0.46506	0.008348
90	0.47872	0.47534	0.003386
91	0.48404	0.48415	0.000105
92	0.48936	0.48998	0.000621
93	0.49468	0.49486	0.000181

Kolmogorov-Smirnov Goodness-of-Fit Test of R36 (Continued Appendix H)

94	0.50000	0.49627	0.003731	
95	0.50532	0.49727	0.008052	
96	0.51064	0.50957	0.001071	
97	0.51596	0.51300	0.002955	
98	0.52128	0.52501	0.003736	
99	0.52660	0.53264	0.006049	
100	0.53191	0.54134	0.009427	
101	0.53723	0.54879	0.011559	
102	0.54255	0.55146	0.008906	
103	0.54787	0.56169	0.013817	
104	0.55319	0.56851	0.015317	
105	0.55851	0.58153	0.023023	
106	0.56383	0.59453	0.030701	
107	0.56915	0.60498	0.035828	
108	0.57447	0.61654	0.042071	
109	0.57979	0.62423	0.044445	*** (The Max D-Statistic) ; Prob (D > 0.044445) = 0.851598 .
110	0.58511	0.62830	0.043192	
111	0.59043	0.63419	0.043767	
112	0.59574	0.63746	0.041713	
113	0.60106	0.64268	0.041611	
114	0.60638	0.64445	0.038067	
115	0.61170	0.64479	0.033092	
116	0.61702	0.64527	0.028247	
117	0.62234	0.64824	0.025904	
118	0.62766	0.65009	0.022434	
119	0.63298	0.65198	0.019003	
120	0.63830	0.66324	0.024943	
121	0.64362	0.66701	0.023392	
122	0.64894	0.67082	0.021884	
123	0.65426	0.67553	0.021278	
124	0.65957	0.68335	0.023779	
125	0.66489	0.70250	0.037602	
126	0.67021	0.70305	0.032839	
127	0.67553	0.70543	0.029901	
128	0.68085	0.70960	0.028744	
129	0.68617	0.71110	0.024928	
130	0.69149	0.71502	0.023535	
131	0.69681	0.71845	0.021642	
132	0.70213	0.71865	0.016526	
133	0.70745	0.72315	0.015701	
134	0.71277	0.72365	0.010889	
135	0.71809	0.72679	0.008709	
136	0.72340	0.73590	0.012496	
137	0.72872	0.73650	0.007773	
138	0.73404	0.73763	0.003592	
139	0.73936	0.74170	0.002341	
140	0.74468	0.76004	0.015360	
141	0.75000	0.76295	0.012946	
142	0.75532	0.76394	0.008622	
143	0.76064	0.76527	0.004632	

Kolmogorov-Smirnov Goodness-of-Fit Test of R36 (Continued Appendix H)

144	0.76596	0.76571	0.000251
145	0.77128	0.78322	0.011941
146	0.77660	0.78447	0.007870
147	0.78191	0.78729	0.005377
148	0.78723	0.79240	0.005163
149	0.79255	0.79265	0.000095
150	0.79787	0.79607	0.001802
151	0.80319	0.80725	0.004057
152	0.80851	0.81228	0.003773
153	0.81383	0.81315	0.000675
154	0.81915	0.81586	0.003290
155	0.82447	0.81904	0.005431
156	0.82979	0.82818	0.001610
157	0.83511	0.82871	0.006398
158	0.84043	0.82918	0.011242
159	0.84574	0.83689	0.008856
160	0.85106	0.84448	0.006583
161	0.85638	0.85336	0.003022
162	0.86170	0.85635	0.005355
163	0.86702	0.85895	0.008076
164	0.87234	0.86163	0.010714
165	0.87766	0.87052	0.007143
166	0.88298	0.87704	0.005943
167	0.88830	0.88288	0.005421
168	0.89362	0.88399	0.009625
169	0.89894	0.88838	0.010554
170	0.90426	0.89208	0.012175
171	0.90957	0.89375	0.015819
172	0.91489	0.90842	0.006472
173	0.92021	0.91006	0.010151
174	0.92553	0.91718	0.008355
175	0.93085	0.92471	0.006140
176	0.93617	0.92726	0.008907
177	0.94149	0.93167	0.009824
178	0.94681	0.93458	0.012226
179	0.95213	0.95322	0.001092
180	0.95745	0.95408	0.003367
181	0.96277	0.95898	0.003788
182	0.96809	0.96471	0.003375
183	0.97340	0.97151	0.001894
184	0.97872	0.98084	0.002115
185	0.98404	0.98322	0.000825
186	0.98936	0.99530	0.005943
187	0.99468	0.99541	0.000733
188	1.00000	1.00000	0.000000

Kolmogorov-Smirnov Goodness-of-Fit Test of R39 (Continued Appendix H)

Max D=0.068837 < $D_{0.05, 192}$ =0.098150

Accept H0: F2 (the Pearson cumulative density function) is fitted with F1 (the empirical distribution function) at 5% level.

OBS	F1	F2	D	
1	0.005208	0.01920	0.013993	
2	0.010417	0.03522	0.024802	
3	0.015625	0.04261	0.026983	
4	0.020833	0.04827	0.027436	
5	0.026042	0.05329	0.027248	
6	0.031250	0.06500	0.033750	
7	0.036458	0.07516	0.038702	
8	0.041667	0.07550	0.033833	
9	0.046875	0.07700	0.030125	
10	0.052083	0.08005	0.027967	
11	0.057292	0.09038	0.033088	
12	0.062500	0.10010	0.037600	
13	0.067708	0.10313	0.035422	
14	0.072917	0.10402	0.031103	
15	0.078125	0.11314	0.035015	
16	0.083333	0.12230	0.038967	
17	0.088542	0.12702	0.038478	
18	0.09375	0.12780	0.034050	
19	0.09896	0.13534	0.036382	
20	0.10417	0.13737	0.033203	
21	0.10938	0.14209	0.032715	
22	0.11458	0.14994	0.035357	
23	0.11979	0.15215	0.032358	
24	0.12500	0.15344	0.028440	
25	0.13021	0.16230	0.032092	
26	0.13542	0.18000	0.044583	
27	0.14063	0.19721	0.056585	
28	0.14583	0.21467	0.068837	*** (The Max D-Statistic) ; Prob (D > 0.068837) = 0.322802 .
29	0.15104	0.21467	0.063628	
30	0.15625	0.21645	0.060200	
31	0.16146	0.21651	0.055052	
32	0.16667	0.21875	0.052083	
33	0.17188	0.22082	0.048945	
34	0.17708	0.22458	0.047497	
35	0.18229	0.23976	0.057468	
36	0.18750	0.24886	0.061360	
37	0.19271	0.25229	0.059582	
38	0.19792	0.25238	0.054463	
39	0.20313	0.25292	0.049795	
40	0.20833	0.25379	0.045457	
41	0.21354	0.25624	0.042698	
42	0.21875	0.25702	0.038270	
43	0.22396	0.25748	0.033522	

Kolmogorov-Smirnov Goodness-of-Fit Test of R39 (Continued Appendix H)

44	0.22917	0.26404	0.034873
45	0.23438	0.26805	0.033675
46	0.23958	0.27030	0.030717
47	0.24479	0.27947	0.034678
48	0.25000	0.27994	0.029940
49	0.25521	0.28462	0.029412
50	0.26042	0.29156	0.031143
51	0.26562	0.31409	0.048465
52	0.27083	0.32608	0.055247
53	0.27604	0.32683	0.050788
54	0.28125	0.32706	0.045810
55	0.28646	0.33013	0.043672
56	0.29167	0.33613	0.044463
57	0.29687	0.33770	0.040825
58	0.30208	0.34328	0.041197
59	0.30729	0.34409	0.036798
60	0.31250	0.35141	0.038910
61	0.31771	0.35148	0.033772
62	0.32292	0.35449	0.031573
63	0.32812	0.35564	0.027515
64	0.33333	0.35629	0.022957
65	0.33854	0.35939	0.020848
66	0.34375	0.36313	0.019380
67	0.34896	0.36394	0.014982
68	0.35417	0.37477	0.020603
69	0.35937	0.37479	0.015415
70	0.36458	0.37638	0.011797
71	0.36979	0.37740	0.007608
72	0.37500	0.37969	0.004690
73	0.38021	0.38317	0.002962
74	0.38542	0.38906	0.003643
75	0.39062	0.39994	0.009315
76	0.39583	0.41245	0.016617
77	0.40104	0.41250	0.011458
78	0.40625	0.41713	0.010880
79	0.41146	0.42798	0.016522
80	0.41667	0.43526	0.018593
81	0.42187	0.44138	0.019505
82	0.42708	0.44379	0.016707
83	0.43229	0.44764	0.015348
84	0.43750	0.45445	0.016950
85	0.44271	0.45539	0.012682
86	0.44792	0.45656	0.008643
87	0.45312	0.45826	0.005135
88	0.45833	0.46223	0.003897
89	0.46354	0.46962	0.006078
90	0.46875	0.47091	0.002160
91	0.47396	0.47708	0.003122
92	0.47917	0.47793	0.001237
93	0.48437	0.48345	0.000925

Kolmogorov-Smirnov Goodness-of-Fit Test of R39 (Continued Appendix H)

94	0.48958	0.48512	0.004463
95	0.49479	0.49053	0.004262
96	0.50000	0.49589	0.004110
97	0.50521	0.50041	0.004798
98	0.51042	0.51749	0.007073
99	0.51563	0.51810	0.002475
100	0.52083	0.52016	0.000673
101	0.52604	0.53162	0.005578
102	0.53125	0.54187	0.010620
103	0.53646	0.54741	0.010952
104	0.54167	0.54812	0.006453
105	0.54688	0.54942	0.002545
106	0.55208	0.55411	0.002027
107	0.55729	0.55596	0.001332
108	0.56250	0.56014	0.002360
109	0.56771	0.56059	0.007118
110	0.57292	0.56418	0.008737
111	0.57813	0.56421	0.013915
112	0.58333	0.56997	0.013363
113	0.58854	0.58035	0.008192
114	0.59375	0.58114	0.012610
115	0.59896	0.59093	0.008028
116	0.60417	0.59847	0.005697
117	0.60938	0.60107	0.008305
118	0.61458	0.60218	0.012403
119	0.61979	0.60344	0.016352
120	0.62500	0.60446	0.020540
121	0.63021	0.61265	0.017558
122	0.63542	0.61341	0.022007
123	0.64063	0.62024	0.020385
124	0.64583	0.62056	0.025273
125	0.65104	0.62076	0.030282
126	0.65625	0.62370	0.032550
127	0.66146	0.62562	0.035838
128	0.66667	0.62728	0.039387
129	0.67188	0.63238	0.039495
130	0.67708	0.63771	0.039373
131	0.68229	0.63872	0.043572
132	0.68750	0.64206	0.045440
133	0.69271	0.64723	0.045478
134	0.69792	0.66017	0.037747
135	0.70313	0.67013	0.032995
136	0.70833	0.67697	0.031363
137	0.71354	0.68528	0.028262
138	0.71875	0.69913	0.019620
139	0.72396	0.70410	0.019858
140	0.72917	0.72034	0.008827
141	0.73438	0.72955	0.004825
142	0.73958	0.72992	0.009663
143	0.74479	0.73776	0.007032

Kolmogorov-Smirnov Goodness-of-Fit Test of R39 (Continued Appendix H)

144	0.75000	0.73921	0.010790
145	0.75521	0.74183	0.013378
146	0.76042	0.74556	0.014857
147	0.76563	0.74722	0.018405
148	0.77083	0.74764	0.023193
149	0.77604	0.75393	0.022112
150	0.78125	0.77021	0.011040
151	0.78646	0.77135	0.015108
152	0.79167	0.77222	0.019447
153	0.79688	0.77270	0.024175
154	0.80208	0.77992	0.022163
155	0.80729	0.78242	0.024872
156	0.81250	0.78516	0.027340
157	0.81771	0.78686	0.030848
158	0.82292	0.78737	0.035547
159	0.82813	0.81275	0.015375
160	0.83333	0.81329	0.020043
161	0.83854	0.83560	0.002942
162	0.84375	0.85322	0.009470
163	0.84896	0.85486	0.005902
164	0.85417	0.85742	0.003253
165	0.85938	0.86107	0.001695
166	0.86458	0.86770	0.003117
167	0.86979	0.87532	0.005528
168	0.87500	0.87544	0.000440
169	0.88021	0.87669	0.003518
170	0.88542	0.88529	0.000127
171	0.89063	0.88794	0.002685
172	0.89583	0.90741	0.011577
173	0.90104	0.91109	0.010048
174	0.90625	0.91902	0.012770
175	0.91146	0.92391	0.012452
176	0.91667	0.92943	0.012763
177	0.92188	0.92947	0.007595
178	0.92708	0.93577	0.008687
179	0.93229	0.93788	0.005588
180	0.93750	0.93862	0.001120
181	0.94271	0.94007	0.002638
182	0.94792	0.94681	0.001107
183	0.95313	0.94697	0.006155
184	0.95833	0.94826	0.010073
185	0.96354	0.96089	0.002652
186	0.96875	0.96565	0.003100
187	0.97396	0.96984	0.004118
188	0.97917	0.98163	.0024633
189	0.98438	0.98706	.0026850
190	0.98958	0.99511	.0055267
191	0.99479	0.99809	.0032983
192	1.00000	1.00000	.0000000

Kolmogorov-Smirnov Goodness-of-Fit Test of R48 (Continued Appendix H)

Max D=0.29663 > $D_{0.05, 192}$ =0.098150

Reject H0: F2 (the Pearson cumulative density function) is fitted with F1 (the empirical distribution function) at 5% level.

OBS	F1	F2	D	
1	0.000000	0.00000	0.00000	
2	0.005236	0.08332	0.07808	
3	0.010471	0.09228	0.08181	
4	0.015707	0.10722	0.09151	
5	0.020942	0.15290	0.13196	
6	0.026178	0.17120	0.14502	
7	0.031414	0.22512	0.19370	
8	0.036649	0.23098	0.19433	
9	0.041885	0.25104	0.20916	
10	0.047120	0.27697	0.22985	
11	0.052356	0.28010	0.22774	
12	0.057592	0.28856	0.23097	
13	0.062827	0.29530	0.23247	
14	0.068063	0.30822	0.24016	
15	0.073298	0.32638	0.25308	
16	0.078534	0.33666	0.25813	
17	0.083770	0.34898	0.26521	
18	0.08901	0.37510	0.28609	
19	0.09424	0.37582	0.28158	
20	0.09948	0.37834	0.27886	
21	0.10471	0.38782	0.28311	
22	0.10995	0.39436	0.28441	
23	0.11518	0.39749	0.28231	
24	0.12042	0.40915	0.28873	
25	0.12565	0.42228	0.29663	*** (The Max D-Statistic) ; Prob (D > 0.29663) = 0.000000 .
26	0.13089	0.42731	0.29642	
27	0.13613	0.42849	0.29237	
28	0.14136	0.42986	0.28850	
29	0.14660	0.43275	0.28615	
30	0.15183	0.43632	0.28448	
31	0.15707	0.43822	0.28116	
32	0.16230	0.44016	0.27786	
33	0.16754	0.45143	0.28389	
34	0.17277	0.45261	0.27984	
35	0.17801	0.45740	0.27938	
36	0.18325	0.45858	0.27534	
37	0.18848	0.45918	0.27070	
38	0.19372	0.46394	0.27022	
39	0.19895	0.46678	0.26783	
40	0.20419	0.46826	0.26407	
41	0.20942	0.47115	0.26173	
42	0.21466	0.47631	0.26165	
43	0.21990	0.47924	0.25934	

Kolmogorov-Smirnov Goodness-of-Fit Test of R48 (Continued Appendix H)

44	0.22513	0.47933	0.25420
45	0.23037	0.48086	0.25049
46	0.23560	0.48366	0.24805
47	0.24084	0.49051	0.24967
48	0.24607	0.49705	0.25098
49	0.25131	0.49965	0.24834
50	0.25654	0.49983	0.24328
51	0.26178	0.50066	0.23888
52	0.26702	0.50424	0.23722
53	0.27225	0.50495	0.23270
54	0.27749	0.50504	0.22756
55	0.28272	0.50921	0.22649
56	0.28796	0.50939	0.22144
57	0.29319	0.51192	0.21872
58	0.29843	0.51782	0.21939
59	0.30366	0.51921	0.21554
60	0.30890	0.52374	0.21484
61	0.31414	0.52492	0.21078
62	0.31937	0.52499	0.20562
63	0.32461	0.52665	0.20204
64	0.32984	0.52725	0.19741
65	0.33508	0.53448	0.19940
66	0.34031	0.53494	0.19462
67	0.34555	0.53510	0.18955
68	0.35079	0.53686	0.18607
69	0.35602	0.53962	0.18360
70	0.36126	0.54052	0.17926
71	0.36649	0.54332	0.17683
72	0.37173	0.54899	0.17726
73	0.37696	0.55180	0.17484
74	0.38220	0.55266	0.17046
75	0.38743	0.55333	0.16589
76	0.39267	0.55966	0.16699
77	0.39791	0.56002	0.16212
78	0.40314	0.56460	0.16146
79	0.40838	0.56990	0.16152
80	0.41361	0.57021	0.15660
81	0.41885	0.57131	0.15246
82	0.42408	0.57131	0.14723
83	0.42932	0.57182	0.14250
84	0.43455	0.57275	0.13819
85	0.43979	0.57510	0.13531
86	0.44503	0.57547	0.13045
87	0.45026	0.57792	0.12766
88	0.45550	0.58196	0.12646
89	0.46073	0.58197	0.12124
90	0.46597	0.58257	0.11661
91	0.47120	0.58312	0.11191
92	0.47644	0.58820	0.11176
93	0.48168	0.58998	0.10830

Kolmogorov-Smirnov Goodness-of-Fit Test of R48 (Continued Appendix H)

94	0.48691	0.59078	0.10387
95	0.49215	0.59345	0.10130
96	0.49738	0.59384	0.09645
97	0.50262	0.59543	0.09281
98	0.50785	0.59663	0.08878
99	0.51309	0.60086	0.08777
100	0.51832	0.60090	0.08257
101	0.52356	0.60098	0.07742
102	0.52880	0.60269	0.07390
103	0.53403	0.60318	0.069151
104	0.53927	0.60320	0.063928
105	0.54450	0.60544	0.060938
106	0.54974	0.60642	0.056680
107	0.55497	0.61192	0.056941
108	0.56021	0.61389	0.053684
109	0.56545	0.61616	0.050712
110	0.57068	0.61849	0.047810
111	0.57592	0.62176	0.045841
112	0.58115	0.62250	0.041346
113	0.58639	0.62284	0.036449
114	0.59162	0.62712	0.035494
115	0.59686	0.62922	0.032360
116	0.60209	0.63276	0.030665
117	0.60733	0.63360	0.026274
118	0.61257	0.64020	0.027639
119	0.61780	0.64029	0.022489
120	0.62304	0.64133	0.018297
121	0.62827	0.64730	0.019023
122	0.63351	0.65337	0.019866
123	0.63874	0.65555	0.016803
124	0.64398	0.65738	0.013397
125	0.64921	0.65779	0.008574
126	0.65445	0.66489	0.010436
127	0.65969	0.67148	0.011791
128	0.66492	0.67579	0.010864
129	0.67016	0.68004	0.009879
130	0.67539	0.68166	0.006268
131	0.68063	0.68171	0.001080
132	0.68586	0.68824	0.002372
133	0.69110	0.68954	0.001563
134	0.69634	0.69249	0.003849
135	0.70157	0.69273	0.008840
136	0.70681	0.69833	0.008478
137	0.71204	0.70087	0.011169
138	0.71728	0.70313	0.014151
139	0.72251	0.71434	0.008175
140	0.72775	0.72035	0.007400
141	0.73298	0.72289	0.010090
142	0.73822	0.72457	0.013650
143	0.74346	0.72644	0.017015

Kolmogorov-Smirnov Goodness-of-Fit Test of R48 (Continued Appendix H)

144	0.74869	0.72727	0.021417
145	0.75393	0.73448	0.019446
146	0.75916	0.74098	0.018187
147	0.76440	0.74178	0.022615
148	0.76963	0.74204	0.027595
149	0.77487	0.75208	0.022786
150	0.78010	0.75262	0.027483
151	0.78534	0.75742	0.027916
152	0.79058	0.75746	0.033116
153	0.79581	0.75935	0.036458
154	0.80105	0.76017	0.040882
155	0.80628	0.76413	0.042148
156	0.81152	0.76522	0.046300
157	0.81675	0.76917	0.047588
158	0.82199	0.76991	0.052077
159	0.82723	0.77081	0.056415
160	0.83246	0.77267	0.059786
161	0.83770	0.77298	0.064715
162	0.84293	0.77746	0.065470
163	0.84817	0.77826	0.069913
164	0.85340	0.78070	0.072700
165	0.85864	0.78965	0.068992
166	0.86387	0.80678	0.057097
167	0.86911	0.80989	0.059221
168	0.87435	0.81467	0.059671
169	0.87958	0.81747	0.062111
170	0.88482	0.82169	0.063128
171	0.89005	0.82850	0.061551
172	0.89529	0.83552	0.059766
173	0.90052	0.83851	0.062014
174	0.90576	0.83953	0.066233
175	0.91099	0.84509	0.065900
176	0.91623	0.84854	0.067686
177	0.92147	0.85840	0.063065
178	0.92670	0.86368	0.063017
179	0.93194	0.86398	0.067957
180	0.93717	0.86837	0.068807
181	0.94241	0.88135	0.061061
182	0.94764	0.88982	0.057827
183	0.95288	0.89715	0.055725
184	0.95812	0.90418	0.053937
185	0.96335	0.90883	0.054520
186	0.96859	0.92000	0.048582
187	0.97382	0.93239	0.041429
188	0.97906	0.94373	0.035330
189	0.98429	0.94374	0.040551
190	0.98953	0.95360	0.035927
191	0.99476	0.97070	0.024066
192	1.00000	1.00000	0.000000

Appendix I: The Results of Kolmogorov-Smirnov Test for the Distribution Estimated by Polynomials of R19 and R48 During 1978-1993

Kolmogorov-Smirnov Goodness-of-Fit Test of R19

Max D=0.044686 < $D_{0.05,192}$=0.098150

Accept H0: F2 (the Polynomial cumulative function) is fitted with F1 (the empirical distribution function) at 5% level.

OBS	F1	F2	D
1	0.000000	0.00000	0.000000
2	0.005236	0.03848	0.033248
3	0.010471	0.04417	0.033700
4	0.015707	0.04861	0.032902
5	0.020942	0.05054	0.029599
6	0.026178	0.05234	0.026158
7	0.031414	0.05601	0.024598
8	0.036649	0.05984	0.023189
9	0.041885	0.06748	0.025594
10	0.047120	0.07378	0.026662
11	0.052356	0.08042	0.028064
12	0.057592	0.08214	0.024547
13	0.062827	0.08601	0.023187
14	0.068063	0.08732	0.019261
15	0.073298	0.08931	0.016013
16	0.078534	0.09373	0.015195
17	0.083770	0.10460	0.020831
18	0.08901	0.10500	0.015992
19	0.09424	0.11111	0.016865
20	0.09948	0.11119	0.011715
21	0.10471	0.11511	0.010401
22	0.10995	0.11674	0.006793
23	0.11518	0.12214	0.006961
24	0.12042	0.12244	0.002018
25	0.12565	0.12353	0.002126
26	0.13089	0.13092	0.000030
27	0.13613	0.14045	0.004320
28	0.14136	0.14120	0.000165
29	0.14660	0.15166	0.005060
30	0.15183	0.15245	0.000620
31	0.15707	0.15974	0.002675
32	0.16230	0.16785	0.005545
33	0.16754	0.16835	0.000807
34	0.17277	0.16971	0.003061
35	0.17801	0.17224	0.005770
36	0.18325	0.17838	0.004863
37	0.18848	0.17886	0.009626
38	0.19372	0.18074	0.012976
39	0.19895	0.18078	0.018170
40	0.20419	0.18445	0.019735
41	0.20942	0.18472	0.024701
42	0.21466	0.18481	0.029850

Kolmogorov-Smirnov Goodness-of-Fit Test of R19 (Continued Appendix I)

43	0.21990	0.18642	0.033475	
44	0.22513	0.18940	0.035726	
45	0.23037	0.20584	0.024526	
46	0.23560	0.20607	0.029530	
47	0.24084	0.21165	0.029186	
48	0.24607	0.21601	0.030066	
49	0.25131	0.21759	0.033720	
50	0.25654	0.21914	0.037408	
51	0.26178	0.22647	0.035315	
52	0.26702	0.22712	0.039900	
53	0.27225	0.22756	0.044686	*** (The Max D-Statistic) ; Prob (D > 0.044686) = 0.837903 .
54	0.27749	0.23535	0.042133	
55	0.28272	0.23900	0.043718	
56	0.28796	0.26270	0.025257	
57	0.29319	0.26968	0.023510	
58	0.29843	0.29145	0.006976	
59	0.30366	0.29846	0.005209	
60	0.30890	0.29999	0.008913	
61	0.31414	0.30524	0.008901	
62	0.31937	0.31001	0.009366	
63	0.32461	0.31008	0.014522	
64	0.32984	0.31755	0.012289	
65	0.33508	0.32924	0.005840	
66	0.34031	0.33874	0.001573	
67	0.34555	0.34213	0.003421	
68	0.35079	0.34250	0.008288	
69	0.35602	0.34342	0.012601	
70	0.36126	0.34650	0.014757	
71	0.36649	0.34673	0.019759	
72	0.37173	0.36115	0.010576	
73	0.37696	0.36297	0.013998	
74	0.38220	0.37022	0.011980	
75	0.38743	0.37538	0.012053	
76	0.39267	0.37916	0.013511	
77	0.39791	0.38692	0.010983	
78	0.40314	0.40249	0.000656	
79	0.40838	0.40667	0.001702	
80	0.41361	0.41021	0.003403	
81	0.41885	0.41455	0.004301	
82	0.42408	0.41956	0.004527	
83	0.42932	0.44182	0.012505	
84	0.43455	0.44849	0.013935	
85	0.43979	0.45143	0.011641	
86	0.44503	0.45314	0.008117	
87	0.45026	0.45415	0.003887	
88	0.45550	0.45459	0.000910	
89	0.46073	0.45501	0.005726	
90	0.46597	0.45531	0.010659	
91	0.47120	0.47509	0.003886	
92	0.47644	0.47783	0.001387	

Kolmogorov-Smirnov Goodness-of-Fit Test of R19 (Continued Appendix I)

93	0.48168	0.47849	0.003185
94	0.48691	0.47917	0.007741
95	0.49215	0.49148	0.000670
96	0.49738	0.49839	0.001008
97	0.50262	0.50094	0.001681
98	0.50785	0.50231	0.005547
99	0.51309	0.50617	0.006915
100	0.51832	0.50818	0.010144
101	0.52356	0.51587	0.007692
102	0.52880	0.51874	0.010052
103	0.53403	0.53170	0.002327
104	0.53927	0.53838	0.000882
105	0.54450	0.53850	0.006002
106	0.54974	0.54570	0.004042
107	0.55497	0.55237	0.002603
108	0.56021	0.56178	0.001573
109	0.56545	0.57309	0.007642
110	0.57068	0.57333	0.002648
111	0.57592	0.57379	0.002131
112	0.58115	0.58063	0.000524
113	0.58639	0.58289	0.003498
114	0.59162	0.58743	0.004198
115	0.59686	0.59248	0.004378
116	0.60209	0.60054	0.001557
117	0.60733	0.62222	0.014892
118	0.61257	0.62330	0.010732
119	0.61780	0.62368	0.005874
120	0.62304	0.62615	.0031085
121	0.62827	0.63082	.0025518
122	0.63351	0.63222	.0012909
123	0.63874	0.63369	.0050513
124	0.64398	0.63871	.0052674
125	0.64921	0.65848	.0092623
126	0.65445	0.66126	.0068138
127	0.65969	0.66631	.0066278
128	0.66492	0.67154	.0066206
129	0.67016	0.67932	.0091602
130	0.67539	0.68127	.0058795
131	0.68063	0.68369	.0030615
132	0.68586	0.68693	.0010710
133	0.69110	0.68927	.0018340
134	0.69634	0.68934	.0069923
135	0.70157	0.69914	.0024353
136	0.70681	0.70328	.0035305
137	0.71204	0.70838	0.003660
138	0.71728	0.71006	0.007215
139	0.72251	0.71101	0.011501
140	0.72775	0.71172	0.016026
141	0.73298	0.72324	0.009744
142	0.73822	0.73218	0.006044

Kolmogorov-Smirnov Goodness-of-Fit Test of R19 (Continued Appendix I)

143	0.74346	0.73224	0.011211
144	0.74869	0.73359	0.015103
145	0.75393	0.74071	0.013220
146	0.75916	0.75727	0.001888
147	0.76440	0.76790	0.003500
148	0.76963	0.77817	0.008539
149	0.77487	0.79418	0.019308
150	0.78010	0.79931	0.019206
151	0.78534	0.80738	0.022038
152	0.79058	0.81076	0.020180
153	0.79581	0.81390	0.018084
154	0.80105	0.82041	0.019366
155	0.80628	0.82287	0.016584
156	0.81152	0.82362	0.012099
157	0.81675	0.82720	0.010442
158	0.82199	0.83730	0.015314
159	0.82723	0.84436	0.017138
160	0.83246	0.84848	0.016015
161	0.83770	0.85109	0.013391
162	0.84293	0.85145	0.008522
163	0.84817	0.85996	0.011796
164	0.85340	0.86096	0.007554
165	0.85864	0.86618	0.007537
166	0.86387	0.87770	0.013822
167	0.86911	0.87775	0.008645
168	0.87435	0.88212	0.007778
169	0.87958	0.88276	0.003175
170	0.88482	0.88929	0.004470
171	0.89005	0.89115	0.001097
172	0.89529	0.89201	0.003279
173	0.90052	0.89256	0.007959
174	0.90576	0.89569	0.010069
175	0.91099	0.89833	0.012661
176	0.91623	0.90409	0.012140
177	0.92147	0.90807	0.013398
178	0.92670	0.91420	0.012497
179	0.93194	0.92662	0.005317
180	0.93717	0.93097	0.006201
181	0.94241	0.93117	0.011241
182	0.94764	0.93298	0.014660
183	0.95288	0.94096	0.011917
184	0.95812	0.94493	0.013189
185	0.96335	0.95070	0.012651
186	0.96859	0.96483	0.003761
187	0.97382	0.97621	0.002383
188	0.97906	0.97799	.0010627
189	0.98429	0.98345	.0008451
190	0.98953	0.98904	.0004919
191	0.99476	0.99655	.0017886
192	1.00000	1.00000	.0000000

Kolmogorov-Smirnov Goodness-of-Fit Test of R48 (Continued Appendix I)

Max D=0.074435 < $D_{0.05,187}$=0.099453

Accept H0: F2 (the Polynomial cumulative function) is fitted with F1 (the empirical distribution function) at 5% level.

OBS	F1	F2	D
1	0.000000	0.00000	0.000000
2	0.005376	0.00107	0.004311
3	0.010753	0.00265	0.008101
4	0.016129	0.00655	0.009582
5	0.021505	0.01015	0.011354
6	0.026882	0.02614	0.000742
7	0.032258	0.02840	0.003854
8	0.037634	0.03700	0.000635
9	0.043011	0.05016	0.007146
10	0.048387	0.05191	0.003519
11	0.053763	0.05682	0.003061
12	0.059140	0.06094	0.001797
13	0.064516	0.06932	0.004799
14	0.069892	0.08223	0.012334
15	0.075269	0.09015	0.014879
16	0.080645	0.10024	0.019596
17	0.086022	0.12389	0.037864
18	0.09140	0.12459	0.033188
19	0.09677	0.12704	0.030266
20	0.10215	0.13656	0.034405
21	0.10753	0.14337	0.035847
22	0.11290	0.14671	0.033809
23	0.11828	0.15956	0.041282
24	0.12366	0.17486	0.051202
25	0.12903	0.18094	0.051911
26	0.13441	0.18240	0.047988
27	0.13978	0.18408	0.044298
28	0.14516	0.18768	0.042520
29	0.15054	0.19218	0.041645
30	0.15591	0.19462	0.038703
31	0.16129	0.19711	0.035819
32	0.16667	0.21200	0.045329
33	0.17204	0.21360	0.041558
34	0.17742	0.22015	0.042733
35	0.18280	0.22180	0.039001
36	0.18817	0.22263	0.034461
37	0.19355	0.22932	0.035772
38	0.19892	0.23337	0.034449
39	0.20430	0.23550	0.031204
40	0.20968	0.23970	0.030019
41	0.21505	0.24729	0.032237
42	0.22043	0.25166	0.031233
43	0.22581	0.25180	0.025993

Kolmogorov-Smirnov Goodness-of-Fit Test of R48 (Continued Appendix I)

44	0.23118	0.25410	0.022922
45	0.23656	0.25835	0.021790
46	0.24194	0.26894	0.027002
47	0.24731	0.27929	0.031976
48	0.25269	0.28347	0.030779
49	0.25806	0.28375	0.025690
50	0.26344	0.28511	0.021665
51	0.26882	0.29093	0.022111
52	0.27419	0.29211	0.017914
53	0.27957	0.29226	0.012686
54	0.28495	0.29915	0.014208
55	0.29032	0.29946	0.009139
56	0.29570	0.30369	0.007991
57	0.30108	0.31372	0.012645
58	0.30645	0.31610	0.009651
59	0.31183	0.32397	0.012141
60	0.31720	0.32603	0.008824
61	0.32258	0.32616	0.003579
62	0.32796	0.32907	0.001115
63	0.33333	0.33013	0.003203
64	0.33871	0.34304	0.004328
65	0.34409	0.34387	0.000213
66	0.34946	0.34417	0.005290
67	0.35484	0.34735	0.007487
68	0.36022	0.35241	0.007807
69	0.36559	0.35405	0.011542
70	0.37097	0.35923	0.011741
71	0.37634	0.36981	0.006531
72	0.38172	0.37514	0.006585
73	0.38710	0.37677	0.010332
74	0.39247	0.37804	0.014434
75	0.39785	0.39022	0.007629
76	0.40323	0.39093	0.012295
77	0.40860	0.39987	0.008737
78	0.41398	0.41035	0.003625
79	0.41935	0.41098	0.008379
80	0.42473	0.41317	0.011561
81	0.43011	0.41317	0.016937
82	0.43548	0.41418	0.021301
83	0.44086	0.41605	0.024810
84	0.44624	0.42079	0.025445
85	0.45161	0.42154	0.030071
86	0.45699	0.42651	0.030483
87	0.46237	0.43475	0.027619
88	0.46774	0.43477	0.032968
89	0.47312	0.43601	0.037109
90	0.47849	0.43712	0.041370
91	0.48387	0.44765	0.036220
92	0.48925	0.45135	0.037894
93	0.49462	0.45304	0.041586

Kolmogorov-Smirnov Goodness-of-Fit Test of R48 (Continued Appendix I)

94	0.50000	0.45863	0.041371	
95	0.50538	0.45945	0.045927	
96	0.51075	0.46281	0.047941	
97	0.51613	0.46536	0.050771	
98	0.52151	0.47436	0.047143	
99	0.52688	0.47443	0.052447	
100	0.53226	0.47462	0.057643	
101	0.53763	0.47828	0.059352	
102	0.54301	0.47934	0.063673	
103	0.54839	0.47937	0.069022	
104	0.55376	0.48420	0.069564	
105	0.55914	0.48631	0.072829	
106	0.56452	0.49826	0.066260	
107	0.56989	0.50259	0.067306	
108	0.57527	0.50756	0.067712	
109	0.58065	0.51270	0.067942	
110	0.58602	0.51994	0.066080	
111	0.59140	0.52159	0.069810	
112	0.59677	0.52234	0.074435	*** (The Max D-Statistic) ; Prob (D > 0.074435) = 0.251321 .
113	0.60215	0.53190	0.070252	
114	0.60753	0.53661	0.070912	
115	0.61290	0.54459	0.068314	
116	0.61828	0.54650	0.071781	
117	0.62366	0.56149	0.062169	
118	0.62903	0.56168	0.067351	
119	0.63441	0.56406	0.070346	
120	0.63978	0.57772	0.062065	
121	0.64516	0.59173	0.053432	
122	0.65054	0.59675	0.053783	
123	0.65591	0.60099	0.054922	
124	0.66129	0.60195	0.059341	
125	0.66667	0.61845	0.048219	
126	0.67204	0.63382	0.038225	
127	0.67742	0.64388	0.033535	
128	0.68280	0.65382	0.028976	
129	0.68817	0.65762	0.030554	
130	0.69355	0.65773	0.035819	
131	0.69892	0.67298	0.025945	
132	0.70430	0.67601	0.028288	
133	0.70968	0.68289	0.026787	
134	0.71505	0.68346	0.031592	
135	0.72043	0.69648	0.023954	
136	0.72581	0.70238	0.023431	
137	0.73118	0.70759	0.023593	
138	0.73656	0.73332	0.003242	
139	0.74194	0.74693	0.004993	
140	0.74731	0.75265	0.005334	
141	0.75269	0.75639	0.003704	
142	0.75806	0.76056	0.002492	
143	0.76344	0.76241	0.001033	

Kolmogorov-Smirnov Goodness-of-Fit Test of R48 (Continued Appendix I)

144	0.76882	0.77823	0.009416
145	0.77419	0.79221	0.018012
146	0.77957	0.79392	0.014350
147	0.78495	0.79446	0.009517
148	0.79032	0.81534	0.025013
149	0.79570	0.81643	0.020729
150	0.80108	0.82606	0.024982
151	0.80645	0.82613	0.019677
152	0.81183	0.82986	0.018030
153	0.81720	0.83145	0.014241
154	0.82258	0.83910	0.016523
155	0.82796	0.84116	0.013206
156	0.83333	0.84855	0.015213
157	0.83871	0.84992	0.011211
158	0.84409	0.85156	0.007479
159	0.84946	0.85494	0.005482
160	0.85484	0.85550	0.000659
161	0.86022	0.86341	0.003195
162	0.86559	0.86478	0.000809
163	0.87097	0.86896	0.002007
164	0.87634	0.88345	0.007103
165	0.88172	0.90741	0.025690
166	0.88710	0.91118	0.024079
167	0.89247	0.91659	0.024113
168	0.89785	0.91953	0.021681
169	0.90323	0.92366	0.020437
170	0.90860	0.92954	0.020934
171	0.91398	0.93454	0.020563
172	0.91935	0.93635	0.016995
173	0.92473	0.93692	0.012190
174	0.93011	0.93967	0.009563
175	0.93548	0.94106	0.005573
176	0.94086	0.94380	0.002939
177	0.94624	0.94463	0.001608
178	0.95161	0.94466	0.006949
179	0.95699	0.94508	0.011911
180	0.96237	0.94570	0.016667
181	0.96774	0.94657	0.021176
182	0.97312	0.94851	0.024606
183	0.97849	0.95218	0.026312
184	0.98387	0.95595	0.027918
185	0.98925	0.97045	0.018793
186	0.99462	0.99362	0.001000
187	1.00000	1.00000	0.000000

VITA

Yu-Chen Tu

13 Duh Drive, Apt. 213

Bethlehem, Pennsylvania 18015

Telephone: (610) 758-1773

Birthdate January 8, 1954

Birthplace Tainan, Taiwan, Republic of China

Parents Lu Tu & Yen-Shuai Wu

Education Ph.D. 10/94

College of Business and Economics, Lehigh University

Bethlehem, PA, U.S.A.

Certificate, 09/90 - 12/90

English Language Skill Center, Golden Gate University

San Francisco, CA, U.S.A.

M.B.A. 06/90

Institute of Management Science, National Chiao-Tung University

Hsin-Chu, Taiwan, R.O.C.

B.A. 06/78

Department of Economics, Soochow University

Taipei, Taiwan, R.O.C.

Work Experience

Founder and Member of the Board of Directors, 10/89 - 05/92
Wei-Cheng Security Co., Ltd.
Kaohsiung, Taiwan, R.O.C.

Founder and Member of the Board of Directors, 01/83 - 08/90
Wei-Cheng Construction Co., Ltd.
Kaohsiung, Taiwan, R.O.C.

Personnel Supervisor, 05/82 - 08/90
Taiwan Power Co., Ltd.
Taipei, Taiwan, R.O.C.

Financial Analyst, 08/80 - 12/81
Taiwan Transportation and Terminal Co., Ltd
Taipei, Taiwan, R.O.C.

Honors

"Academic Excellent Award" of National Chiao-Tung University in 1988

Passed "The Special Examination of the Section of Personnel Administration of the National Services, R.O.C. in 1982"

"Outstanding Performance in Extra-Curricular Activity Award" of Soochow University in 1975

"Academic Excellence Scholarship" of Soochow University in 1975

Extra-Curricular Activities

President , 06/77 - 06/78
Association of Graduating Students, Soochow University